FLORIDA INTERNATIONAL UNIVERSITY

Miami, Florida

PUBLIC-PRIVATE PARTNERSHIPS IN THE UNITED STATES: THE RELEVANCE OF PUBLIC POLICY AND FINANCE

A dissertation submitted in partial fulfillment of

the requirements for the degree of

DOCTOR OF PHILOSOPHY

in

PUBLIC AFFAIRS

by

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We have read this dissertation and recommend that it be approved.

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Date of Defense: June 25, 2021

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ACKNOWLEDGMENTS

This dissertation is supported by FIU Graduate School's Doctoral Evidence Acquisition and Dissertation Year Fellowships.

ABSTRACT OF THE DISSERTATION

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The infrastructure deficit is among the most significant challenges facing the United States. The Trump and Biden administrations called for using public-private partnerships (PPPs) to rebuild the nation's crumbling infrastructure. As distinct arrangements that are part of both the public and private sectors, PPPs pose critical questions to public policy and administration. They have also gained popularity as a result of the New Public Management and Collaborative Governance movements.

By synthesizing the theories of the economics of hybrid organizations, public choice, and public value, my research suggests that PPP formation, management, and performance evaluation require the strategic interactions of both sectors, without one dominating the other. Moreover, it addresses the gap in the literature on public-private financial interactions by examining private capital engagement and its interactions with the government's motivations, strategies, and performances.

My dissertation makes three main contributions. First, my analysis of state-level data between 2000 and 2019 demonstrates that governments propose and use PPPs, with

or without private capital engagement, for different reasons. Second, through a fuzzy-set qualitative comparative analysis of 33 PPPs, I show that the effectiveness of governmental strategies for leveraging private capital is mixed, and the configuration of strategies matters. Third, I suggest a public value framework to evaluate PPP performance and use a comparative case study to examine the effects of private capital engagement on PPP accountability, manageability, and substantive outcomes. Using those results, I explain how private capital engagement can threaten and strengthen PPP public value delivery depending on the public value dimensions and the project's characteristics.

Given the state of its infrastructure, the U.S. has the potential to be the world's largest PPP market. However, governments at all levels still struggle with complex PPP structures and practices. My research provides important policy recommendations on how to structure and govern private investment, and how to ensure the public value of PPPs.

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1.1. The Infrastructure Challenge

The infrastructure investment gap in the United States will exceed $2 trillion between 2016 and 2025 (American Society of Civil Engineers, 2017). Public infrastructure investment as a percentage of GDP has declined since the late 1930s (Stupak, 2018). Although the idea of rebuilding the nation's public facilities is one of the few issues with bipartisan support (Hanke, 2018), legislators disagree on how to fund and finance infrastructure (LIU Hornstein Center, 2018; Thompson & Heyd, 2018).

The infrastructure gap has encountered major budget shortfalls at all levels of government in the U.S. (Chapman, 2008). The nation's debt grows much faster than its Gross Domestic Product (GDP). Even with low interest rates, debt service payments will begin to exceed defense expenditures by 2022 and will become the largest category of spending by 2049 (U.S. Government Accountability Office, 2020). Healthcare and social security programs are also a large portion of the federal budget, but they will be depleted in a few decades. At the state and local levels, governments are on track to break their promises to honor pension and other post-employment guarantees. Absent major policy changes, this path is unsustainable (Chapman, 2008; National Academy of Public Administration, 2020). These unfunded liabilities and entitlements could easily crowd out public investment in future infrastructure.

What is lacking is the political leadership to make major government revenue reforms. After two rounds of tax resistance campaigns in the 1970s and 1990s, lawmakers are unwilling to pay the political costs, no matter how important the change might be for the survival of the administrative state (Mikesell, 2005). If major tax reforms

are unlikely, then how will the U.S. close its enormous infrastructure investment gap? Policymakers across the country are actively looking for alternatives (C. Chen & Bartle, 2017).

Public-private partnerships (PPPs) are often introduced as one of the solutions to the nation's infrastructure problem. Engaging the private sector elicits political support in a traditionally conservative nation that values a strong private-sector and limited government (Sclar, 2000). The U.S. has the potential to develop into the world's largest PPP market.

However, the development of U.S. PPP is reaching a plateau. It has been applied to a very small portion of U.S. infrastructure projects (Reinhardt, 2011; Roman, 2015), even though globally, more than 134 countries have used infrastructure PPP, accounting for about 15-20% of total infrastructure investment between 2002 and 2012 (World Bank Group, 2015). Across the U.S., governments at all levels continue to face poor-performing or bankrupted PPP projects, which cost millions of taxpayers' dollars. This mixed performance not only calls into question PPP practices in the U.S. but also calls for the reexamination of the basic theories of PPP.

1.2. The Scope of PPP

Despite the great scholarly and practical interest in PPPs, there is no agreed-upon meaning for the term. By its loose definition, PPP can be referred to as any arrangement between public and private sectors (Savas, 2000). The term *public-private partnership* is flexible and assumes numerous meanings depending on context (Ghere, 2001). As Hodge & Greve (2007) found, the PPP concept encompasses many arrangements, such as

institutional cooperation for joint production, infrastructure contracts, and policy networks, as well as community and urban development.

My work only focuses on its most coherent and developed application—*infrastructure PPP.* It is defined as an institutional arrangement in which governments contract private entities to design, build, finance, operate, or maintain infrastructure assets. The government shares certain risks with its private partners during the contract period, but it owns the assets.

In the U.S. infrastructure context, PPP is usually operationalized based on contract types. Delivery method and financial arrangement are the two dimensions used to differentiate between them (Miller, 2000). Project delivery method refers to how a PPP bundles its different project phases into one contract. The project phases include *design*, *build*, *operation,* and *maintenance*. Conventionally, governments build infrastructure through design-bid-build contracts, which involve separate design and build procurement, followed by government-led operation and maintenance. For PPP, bundling multiple phases into one contract is a key feature (Engel et al., 2013; Iossa & Martimort, 2015).

The second dimension, the financial arrangement, refers to the source of financing. Historically, state and local governments in the U.S. have financed infrastructure through municipal bond markets and repaid the debts through fees or taxes. In contrast, private firms can finance infrastructure directly through debt financing and equity investment under PPP arrangements. Private capital is a viable financing option with plentiful capital and investors.

In this work, I discuss the following project delivery types as PPP: DB (Design-Build), DBF (Design-Build-Finance), DBO(M) (Design-Build-Operate[-Maintain]),

DBFO(M) (Design-Build-Finance-Operate[-Maintain]), and Long-term Lease. Although there is still no agreement in the literature on which types are true PPP, my specifications are consistent with the common working definitions in the U.S. infrastructure finance context (Governmental Accounting Standards Board, 2018; Roman, 2015; U.S. Federal Highway Administration, 2016; Zhao et al., 2011). *Figure 1* diagrams the PPP contract types based on delivery method and financial arrangement. *Figure 2* shows the number of PPP achieving financial close in the U.S. by contract type between 2000 and 2019.

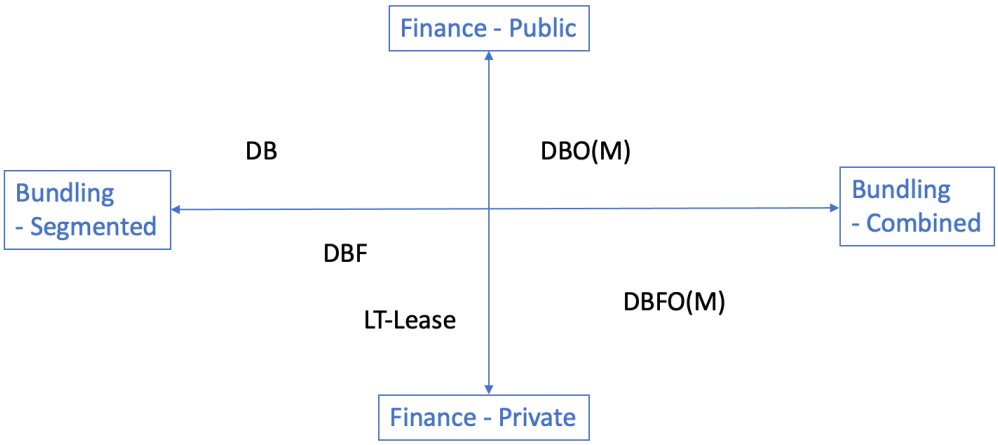


Figure 1: A Quadrant Framework of PPP

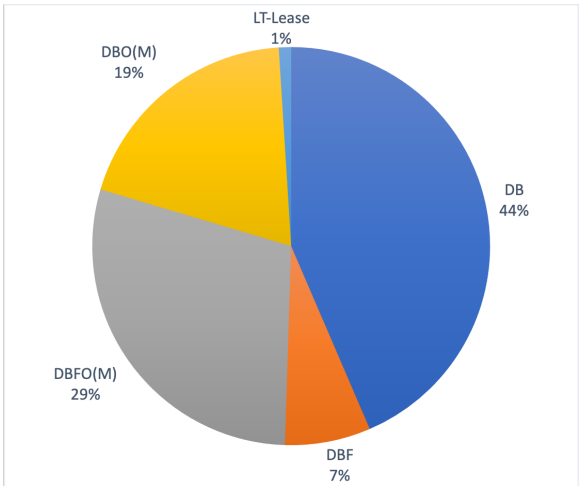


Figure 2: PPP Achieving Financial Close by Contract Type in the U.S. (2000-2019)

1.3. The Puzzles

Often for different reasons, policymakers and scholars have frequently cited PPP as an innovative and effective model of infrastructure delivery (e.g., Brown, 2007; Little, 2011). However, many such projects have failed in recent years, wasting millions of taxpayers' dollars and subjecting the PPP model to justifiable criticism. "There's nothing magical about PPPs" (Roman, 2015, p. 7) and "there are no free lunches" (Vining et al., 2005, p. 199). These controversial outcomes call for a deeper understanding of PPP's theories and practices.

With its mixed performance, PPP is not a silver bullet for the challenge of infrastructure deficiency (Hodge & Greve, 2007). When successfully implemented, PPP provides access to private capital, enhances project delivery efficiency by using private expertise, shares risks, and improves political acceptance. However, the long-term nature of PPP and the complex relationships it often requires, create enormous difficulties to ensure the project's efficiency, effectiveness, and accountability as well as the broader public interests (Forrer et al., 2010).

The research on PPP has surged during the past several years, but it is still in its infancy. Many scholars have argued that PPP practices are ahead of their academic research (Engel et al., 2013). Few empirical studies have examined PPP dynamics in the U.S. context due to poor data availability (Z. Chen et al., 2016). Since countries have distinctive social and economic backgrounds, the experiences of other countries may not be applicable to the U.S. Indeed, "different countries already had quite different versions of what constituted a PPP" (Hodge & Greve, 2018, p. 8). Yet, without fully understanding the politics and economics of PPP, many state and local governments have

still used it in their infrastructure projects. Therefore, after more than 30-years of development of modern PPP in the U.S., a comprehensive examination of the American experience is urgently needed.

1.4. A Research Framework and Three Questions

Much of the PPP literature is fragmented and inconclusive (H. Wang, Xiong, et al., 2018; Zhao et al., 2011). By synthesizing various research findings and putting forward a general theoretical framework, my research covers three major aspects of PPP: formation, management, and performance. They represent the three stages of PPP development: the emergence and adoption of PPP, the strategies to manage and sustain PPP, and the value outcomes of PPP.

The previous public budgeting and finance literature on PPP ignores important perspectives from the private sector. Similarly, the literature of organizational economics neglects its public nature. By bridging the theories and perspectives of public choice, economics of hybrid organizations, and public value, I submit there is a new paradigm: "public-private financial management". This paradigm highlights that PPP formation, management, and performance evaluation are the strategic decisions of the two sectors taken together rather than the public sector dominating the private sector.

To address the literature gaps, my work focuses on private capital engagement in PPP and examines its interactions with public motivations, strategies, and value delivery. To that end, I ask three empirical questions.

1.4.1. Are the States with Weaker Financial Conditions Associated with More Private-financed PPPs?

The first purpose of my research is to address a previously inconclusive proposition regarding the relationship between a state's fiscal conditions and PPP formation. Variations in PPP use exist among the states, but it is unclear why some governments choose to adopt such a tool while others don't. Public policy scholars have inquired extensively into the drivers of policy adoptions in various areas (Berry & Berry, 2018; Weible, 2018).

Based on the theories of public choice and transaction cost, it is hypothesized that states with weaker financial conditions will initiate more private-financed PPPs but will adopt fewer PPPs with bundled contracts. After analyzing a panel dataset of state PPP utilization between 2000 and 2019, I demonstrate that governments with weaker long-term solvency have stronger motivation to utilize private-financed PPPs. But, to mitigate pre-contract costs, states with strong financial conditions are associated with larger numbers of PPP adoptions rather than initiations.

My analysis resolves the previous inconsistent results regrading state financial conditions and PPP formation. It decomposes governments' motivations for two types of PPPs: the private-financed and the bundled. This analysis also enhances our understanding of the PPP formation process in which project initiation and final adoption are two different stages.

1.4.2. Which government support strategies, and in which combinations, are necessary and sufficient to attract high levels of private investment in PPPs?

Forming a PPP is not the end. Understanding how to use PPPs wisely to attract more private capital requires a project-level analysis. The ability to leverage private investment is a key selling point of infrastructure PPPs. Prior research has shown that government support is needed to attract private capital to infrastructure projects. PPPs may initiate financial platforms, but private capital will not flow in by itself: "[t]he private firm does not participate out of a will for the common good, but out of a desire for profit" (Mikesell, 2018, p. 322). As a type of market failure, few infrastructure projects are economically viable for private investment (World Bank Group, 2019) due to their nature as public goods. Thus, governmental support may be a necessary factor for attracting private capital.

Theoretically, my research establishes a link between government support and private investment in PPPs by adapting theories from organizational economics on hybrids and from rational choice institutionalism. I consider a PPP to be a modified hybrid in which one of the partners is a government agency. This theoretical borrowing advances the current discussion in the field of public administration by bringing in the literature from management and organizational economics. This new framework also highlights the importance of the government's financial, institutional, and risk-mitigation strategies when leveraging private capital in a PPP.

In practice, various governmental strategies have been used to support PPPs, such as offering direct cash aid, providing low-cost financing programs, creating supportive legal frameworks, and offering other contractual and relational benefits. Private investors

calculate the risks and benefits of those government support approaches differently. With multiple support strategies available, it is important to understand whether those strategies should be used together. As Verhoest et al. (2015) and H. Wang et al. (2019) suggested, future research should discuss the effectiveness of specific combinations of government support programs. My research explores the configurational effects of government support strategies on private capital.

The importance of those governmental support strategies and their configurational effects raise an important set-theoretic research question: Which government support strategies, and in which combinations, are necessary and sufficient to attract high levels of private investment in PPPs?

To address this question, I performed a fuzzy-set qualitative comparative analysis (fsQCA) of 33 state-sponsored motorway PPP projects in the U.S. This was the first attempt to examine the effects of multiple government support approaches on private capital engagement in the U.S. context. It is meant to help policymakers provide support more wisely when seeking private capital through PPPs. My findings also urge policymakers to rethink the mixture of policy tools when used together to pursue the same policy goal.

1.4.3. How does private capital engagement affect public value delivery?

More private capital does not necessarily lead to better outcomes of PPPs. It's necessary to assess whether different levels of private capital lead to different performances. Private capital motivates the private sector to deliver the project effectively and efficiently (Warsen et al., 2019). However, extensive private capital engagement may also raises financing costs and risks losing public control over

infrastructure, which threatens public values (Bunch, 2012; Forrer et al., 2010; Haque, 2001; Reynaers, 2014; Sclar, 2015). Thus, the third purpose of my research is to examine the impact of private capital engagement on PPP performance.

Using the public value framework, I constructed a normative framework for infrastructure PPP performance. It focuses on three criteria: accountability, manageability, and substantive outcomes. I then used a deductive comparative study of two cases to test the propositions between private capital and public value delivery. The two cases have contrasting private financing components but are comparable in terms of other project features. As my results show, whether public values are created or eroded by private capital's engagement in PPP cannot be answered with a simple yes or no. These case studies disentangle the complex relationships and provide several insights on the practices used to safeguard public values. They also demonstrate how this public value framework can assist in a comprehensive performance review of PPP.

1.5. The Outline

In the next chapter, I review the literature of PPP research in the field of public administration (PA). This provides a general framework for PPP's three major aspects: formation, management, and performance. In Chapter 3, I provide important background information for my empirical setting and explain why I focus on U.S. PPPs. I lay out this study's theoretical framework and related propositions in Chapter 4. Next, I report my empirical findings on my three research questions in Chapters 5, 6, and 7. In Chapter 8, I present my conclusions.

2. Literature Review

PPP has attracted researchers from many fields, including management, economics, sociology and PA (Z. Chen et al., 2016; Cui et al., 2018; Roehrich et al., 2014; H. Wang, Xiong, et al., 2018; S. Zhang et al., 2016). Different disciplines have taken different perspectives to explore it (Cui et al., 2018). For example, project management focuses on the micro-interactions within PPP projects, such as contract design, property rights, and quality control. Economists investigate risk allocation, revenue sharing, and project efficiency. Different disciplines also use different terms to frame "partnership". In the management literature, it is framed as a type of "alliance". In the economics literature, it is referred to as a "hybrid." In sociology journals, it is more often called a form of "network". The diverse terminology reflects the richness of PPP literature but also creates difficulties for discussions across disciplines.

My review focuses on the literature in public administration. Research in management, economics, sociology, and other fields are also considered if they are related to this study's themes. To synthesize various findings in the literature regarding PPPs, I will review the literature covering four major aspects of PPPs: concept, formation, management, and performance. The concept of PPP section will distinguish similar terms and confine the scope of this literature review. The other three aspects collectively address the lifecycle issues of PPPs. The literature gaps are summarized at the end of this chapter.

2.1. The Concept of PPP

Governments have been working with the private sector for centuries to deliver goods and services but not all those arrangements are PPPs. As an umbrella term, PPP

perhaps does not need a precise definition (Reynaers, 2014). The broadness of the concept may be a sign of its strength, and a certain amount of neologism may fuel its popularity (Greve & Hodge, 2005). Yet, such a malleable term also creates difficulties for intellectual discussion. Previous reviews indicate PPP research suffers from conceptual imprecision (Cui et al., 2018; H. Wang, Xiong, et al., 2018; S. Zhang et al., 2016). No matter how each research defines PPP in its own way, it is still necessary to reexamine how PPP has been defined elsewhere and search for the common ground that can be used to better clarify the concept (Martin, 2016).

A few articles have dedicated sections to display the various definitions of PPP. Roman (2015, p. 2) listed fourteen different definitions from academic journal articles, books, and professional reports. However, while the author admitted there is no agreement on a precise definition for PPP, the mutual long-term commitment beyond contractual bonding is the key feature that distinguishes a PPP from a mere contract. Martin (2016) reviewed how various governmental agencies and NGOs define PPP in practice, including the National Center for Public-Private Partnerships (NCPPP), the US Department of Transportation (USDOT), the states of Florida, Maryland and Virginia, and even other countries. Martin (2016) also pointed out some areas of convergence in terms of PPP definitions. PPP involves infrastructure, including both new and existing facilities, and it is concerned with the design, construction, financing, operations, and maintenance of infrastructure. Hodge & Greve (2007) regarded PPP as both financial and organizational arrangements. They formulated four additional families of PPP usage besides infrastructure contracts: institutional cooperation for joint production and risk sharing, public policy networks, civil society and community development, and urban

renewal and downtown economic development. Forrer et al. (2010) focused on the PPP that have three conditions: a long-term relationship, private sector cooperation in both the decision-making and production of services, and a negotiated allocation of risks.

Although these scholars investigated the concept of PPP, a number of other researchers have questioned the legitimacy of PPP research itself, arguing that PPP might just be a "language game" (Teisman & Klijn, 2002). PPP is merely a new term used to describe a previously existing and heavily discussed phenomena.

The Reinventing Government Movement in the 1990s highlighted the importance of the market approach and private efficiency (Kettl, 2000). The phenomenon was commonly referred to as contracting-out or privatization at that time. But, those terms generated ideological opposition because they conjure images of shirking public control and responsibility (Savas, 2000). An alternative expression—*public-private partnership*—was believed to be more welcome in the public discourse because it has the positive connotation of cooperative partnership.

PPP is always used interchangeably with similar terms such as *contracting out* and *privatization*. But, if there is no qualitative jump from those concepts, then PPP may lose its identity and the value of the discussion will also be lost. Indeed, PPP has emerged as a response to contracting out's limitations but the outcomes of contracting out form the foundation of PPP. They are closely related but the conceptual, qualitative jump from privatization and contracting out does exist.

2.1.1. Privatization vs. PPP

The major difference between *privatization* and PPP relates to the ownership of the infrastructure asset. "Privatization refers to the transfer of ownership of assets from

public to private ownership" (Domberger & Jensen, 1997, p. 68). In privatization, day-to-day operations, production of goods, delivery of services, and ownership of assets are left to the private sector (Forrer et al., 2010; Reynaers, 2014). It assumes all the risks and benefits associated with the project. In PPP, the public sector holds the "eventual ownership" of assets (Savas, 2000). Typically, both sectors collectively hold and manage the project during the contract years. When a contract ends, the full ownership will transfer back to the public sector in PPP. The difference between PPP and privatization is evident. The ownership transfer in privatization indicates a *seller-buyer relation* between the public and private sectors, but in PPP, the assets will never be sold to the private sector.

2.1.2. Contracting out vs. PPP

The differences between PPP and contracting out are more intricate. PPP has emerged as a response to contracting's limitations, but the outcome of contracting out forms the foundation of PPP. They are closely related but the conceptual, qualitative jump from contracting out exists in PPP's functions of accountability, project bundling, and trust.

First, in contracting out, the principal-agent relationship between the public and private sectors provides the foundation for accountability (Acar et al., 2008). Contracting out usually refers to "a temporary and singular *principal-agent* relation" between the public and private sectors (Reynaers, 2014, p. 42). The public partner defines what, how, and by whom public goods and services should be delivered in the contract. Then, the private sector is delegated to deliver public goods and services based on the input-output specifications imposed by the public sector (Savas, 2000). The public sector retains major

control in contract design and project oversight in the contracting-out arrangement. In contrast, PPP emphasizes a mutual partner relationship where both sectors "partner during pre- and post-award negotiations to determine how the good or service might be provided" (Forrer et al., 2010, p. 477). There is no obvious principal-agent relation between the public and private sectors in PPP. Instead, it requires an accountability approach where one party has no hierarchical control over its partner and no full oversight power over its partner's performance. Acar et al.(2008) suggested that PPP focuses more on a dialogue-based mutual accountability setting rather than project control and oversight.

Second, bundling of different project phases is also a distinctive feature of PPP (Engel et al., 2013; Iossa & Martimort, 2015), whereas traditional contracting out usually separates provisions or contracts. A typical PPP involves bundling at least two parts of the *design, building, finance, operation,* and *maintenan*ce of a project into one contract. The simplest PPP contract form for a greenfield project is the DB model, which bundles *design* and *build* into one contract. Bundling is critical because it can reduce a project's life-cycle costs. Bundling internalizes the positive externalities in which investments in the design or construction phase reduce the costs of the management phase (Bennett & Iossa, 2006).

Third, contracting out usually relies on a complete contractual relationship where a well-written contract can specify the input-output indicators, sanctions, and risk allocations. However, PPP can rarely be a complete contract because the exchange between partners is far more complex. It is impossible to write down all specifications in a contract, given the considerable transaction costs (Sclar, 2015). Transaction costs are

incurred because PPP involves multiple actors with divergent goals, high levels of uncertainty as well as high levels of complexity in contract negotiations, specifications, and enforcement (Dudkin & Välilä, 2006; Vining et al., 2005; Williamson, 1979). PPP usually has an incomplete contractual relationship where an informal trust relationship is important (Warsen et al., 2019). The role of public managers in PPP is to proactively guide long-term vendor involvement rather than reactively guard against abuse (Ghere, 2001). From this perspective, PPP is viewed as a cooperative institution, establishing mutual trust between the two sectors (Edelenbos & Klijn, 2007; Smyth & Edkins, 2007). PPP not only relies on a formal contract but also an informal trust relationship to ensure project efficiency and accountability.

2.1.3. Four Features of PPP

The upshot is that PPP is different from privatization and contracting out. Even though all these terms entail some level of private sector involvement, their conceptual logics differ substantially (Forrer et al., 2010; Reynaers, 2014). By reviewing the different interpretations of PPP and comparing them with similar concepts, four critical characteristics shape our conception of PPP: 1) eventual public ownership, 2) mutual accountability and risk-sharing, 3) project bundling, and 4) a long-term trust relationship, rather than a one-time relationship. Within this definition and research context, this literature review focuses on the infrastructure PPP that meets those criteria.

2.2. PPP Formation

To account for the emergence and proliferation of PPP across different jurisdictions, a number of studies have explored the factors of PPP formation (Tan & Zhao, 2021; Y. Wang & Zhao, 2014; Warner & Hefetz, 2008; Yang et al., 2013).

At the international level of analysis, Yang et al. (2013) developed a theoretical framework of PPP adoption and classified its drivers into three categories: market, government, and operating environment. Through binary logit regressions on survey data from four transition countries and eight developed countries, they found that market potential, institutional guarantee, government credibility, financial accessibility, government capacity, consolidated management, and corruption control are the positive factors. Using the World Bank's Private Participation in Infrastructure (PPI), Bertelli (2019) found that government stability and revenue-generating capability are important factors for the adoption of BOT (build-operate-transfer), which is a typical form of infrastructure PPP in many developing countries. These results suggest a country with political stability and government revenue above its historic average is more attracted to BOT. However, BOT is less used when a country's tax revenues are increasing.

For the empirical studies focusing on the other countries and regions, Tejada-Ibanez (2013) used a panel data of European Union member countries from 1996 to 2010 and found that the existence and strength of fiscal rules are positively related to the utilization of PPPs. Verhoest et al. (2015) developed an index of national level governmental support for PPP which includes aspects of the political commitment, the legal framework, and the dedicated supporting arrangements. The authors further indicated that the government support index has a positive link with PPP take-up activities based on an exploration of project results from 20 European countries. Based on the World Bank's PPP 2018 database, Rosell & Saz-Carranza (2020) explored the determinants of PPP policy quality which indirectly shed light on PPP formation. They found that legal tradition, isomorphic pressure, the quality of government, and GDP per

capita are important factors. By focusing on the PPP diffusion processes among Chinese cities between 1992 and 2008, Y. Zhang (2015) found that the city's probability of PPP use was influenced by the decisions of their neighboring or peer cities, the policy recommendations offered by policy research professionals, and higher-level governments. By differentiating between intentions and actual adoption, Tan & Zhao (2021) found that government fiscal transparency and capacity, market conditions, institutional environments, and project variables are related to PPP adoption rate among Chinese provinces. Based on a fsQCA of 48 countries in less developed regions, Casady (2020) showed that political will, regulatory regime, and market reliability are necessary conditions for mature PPP market performance.

At the U.S. state level, by adopting political business cycle theory, Daito (2015) found that the size of the economy, growth in vehicle miles traveled, and growth in gas tax revenues are positively related to the number of PPP projects (and the aggregated project cost of PPPs) in states. The author used Poisson and negative binomial regressions to examine a panel dataset of U.S. PPP projects from 1997 to 2013. The author also found that a state with higher debt growth rate adopted fewer PPPs. However, by analyzing the same dataset from 1998 to 2010, Z. Chen, Daito, & Gifford (2014) found there was "not enough empirical evidence to claim" how state fiscal constraints affect states' decisions on PPP. Through analyzing U.S. transportation PPP projects data from 2000 to 2016, Boyer & Scheller (2018) found "state debt, urban travel demand, and state laws allowing unsolicited PPP proposals" are positively associated with the likelihood of PPP adoption. As moderated by legislative professionalism, state government ideology has a mixed impact on PPP adoption. Y. Wang & Zhao (2018)

constructed PPP adoption based on Mohr (1969)'s organizational innovation and diffusion model. Through analyzing the data on toll road development activities in the U.S. from 1985 to 2010, they found the probability of using PPP in toll road development by state governments was related to "fiscal pressure", "traffic demand", "liberal political ideology", "state PPP legislation", and "earlier experiences of PPP" (p. 679).

Through a systematic literature review of PPP research in the PA discipline, H. Wang, Xiong et al. (2018) found a few repeated drivers of PPP adoption in developed countries, including government's fiscal conditions and the political environment. But, for developing countries, PPP utilization is mainly associated with higher-level government directions or national strategies and peer pressures. In sum, the previous literature focused on the large forces such as the political and economic conditions of jurisdictions that drive their governments to use PPP.

2.3. PPP Management

The bulk of the previous research informs policymakers about their initial PPP decisions, and primarily about the conditions under which PPP is formed. However, it does not offer sufficient guidance to public managers about how to manage and sustain such projects beyond the initiation stage. According to a survey of experts involved in Dutch PPP projects, Steijn et al. (2011) found managerial efforts have the most impact on PPP outcomes.

Successfully implementing such hybrid relationships has received much attention in the field of project management and PA. Based on a systematic review of the journal articles in project management between 1990 and 2013, Osei-Kyei & Chan (2015) found that appropriate risk management, strong private partners, sufficient political and

community support, and transparent procurement are the common factors. In the field of PA, the focus has shifted from project managers to government officials. Researchers pay great attention to the strategies public managers can use to achieve certain goals within the PPP setting. Broadly speaking, there are two strategies: 1) managing through formal contracts and institutions, and 2) managing through informal relations (Warsen et al., 2019).

A well-written contract that specifies input-output indicators, sanctions, allocation of risks, and role divisions is the key to PPP implementation. The transaction cost theory (Dudkin & Välilä, 2006; Williamson, 1979) and principal–agent theory (Moe, 1984) highlight the importance of contract design. Based on a case study of PPP projects in Virginia, Y. Wang & Zhao (2018) identified five critical contract arrangements for PPP performance: private partner selection, financial arrangements, role division, risk allocation, and project characteristics.

As this research focuses on the relevance of public finance, I review the literature of PPP financing in greater detail. PPP financial arrangements refer to "how public and private actors engaged financially in PPPs" (Hodge & Greve, 2007, p. 547). It is one of the most fundamental dimensions of PPP (Grimsey & Lewis, 2004; Hodge & Greve, 2007, 2018; Iossa & Martimort, 2015; Miller, 2000; Solheim-Kile et al., 2019; Yescombe, 2007). PPP financial arrangements are critical because they provide "mechanisms for private incentives and protection of the public interest" (Sharma et al., 2010, p. 60).

Many pieces of literature about PPP financial arrangements are practice orientated. Government manuals highlight the important elements of various PPP

financial arrangements, and the roles multiple partners should play from a technical, project management perspective. They are published around the world by state finance or infrastructure departments (World Bank Group, 2017).

To provide guidance on related policy and financing issues in PPP, Yescombe (2007)'s book is regarded as the most widely cited book on infrastructure PPP. From both public-sector and private-sector perspectives, the author listed the major financing issues, such as sources of investment, debt payback methods, the role of insurance, public budgeting and reporting, the traditional cooperation finance model, and the special purpose vehicle (SPV) project finance model. In the U.S., the Federal Highway Administration (FHWA) published a guidebook of financing PPP highways (2016). This book presents the major components of a typical PPP highway financial arrangement, including the various types of private debts and equity investments, and public subsidies and guarantees.

As a key selling point of PPP, attracting private capital is a frequently discussed topic. A group of empirical studies examined the factors of attracting private capital using non-U.S. PPP cases (Osei-Kyei & Chan, 2017; H. Wang et al., 2019; H. Wang, Chen, et al., 2018; Ye et al., 2018). Through a survey of individuals involved in PPPs in developing countries, Osei-Kyei & Chan (2017) found the important factors to be political support and acceptability, political stability, and the government's positive attitude towards private sector investment. By analyzing infrastructure PPP projects in developing countries, Wang et al. (2019) confirmed the positive impact of direct financial support on private investment but did not find any significant effects for indirect support, such as loan guarantees or tax deductions.

However, there have been few empirical studies examining such cases in developed countries. Geddes and Reeves (2017, p. 157) found that "the existence of enabling legislation is a helpful but not necessarily sufficient condition for PPP investment" with U.S. case studies. They also indicated the ultimate level of private investment is shaped by many other important factors, which they left for future studies.

The other vein of PPP management focuses on informal relations among partners. Studies on collaborative governance and relational contracting emphasize the importance of trust and other informal relationships that enable PPP success. For example, based on survey data of Dutch PPP managers, Warsen et al. (2018) found trust is correlated with the cooperation process and the perceived performance of PPP. Other studies suggest public managers play an important role but so do the communities served by the project. For example, even though public involvement does not affect project delivery effectiveness, it can improve the political support for PPP and the tailoring of facility design to meet local demands (Boyer et al., 2016). By characterizing PPP as a gaming situation, Ghere (2001) suggested that public partners should build their own capacity to act on the partnership with effectiveness and accountability. The role of public managers in PPP is more about recruiting eligible firms, making deals, and mentoring vendor involvement over time rather than simply buying low-cost services and monitoring for abuse. Based on fsQCA of 25 PPP projects in the Netherlands and Belgium, Warsen et al (2019) found the mixed use of contractual and relational strategies jointly influence the implementation of PPP. They further demonstrated that formal contracts and informal relationships may complement each other.

2.4. PPP Performance

The third group of PPP literature addresses the issues of PPP performance. For project level performance, the literature presents both the normative and descriptive discussions of PPP outputs and outcomes. This cluster of literature mostly began with a normative proposal and identified a set of evaluation criteria that should be used to assess and compare PPP performance. Without a commonly accepted evaluation framework, many scholars have tried to assess PPP performance in specific contexts with their own evaluation criteria.

The assessment of project-level PPP performance begins logically with the project's goals as set by the partners initiating the partnership (Hodge & Greve, 2007). The effectiveness in achieving those self-identified goals is the cornerstone of PPP performance evaluation. Most contract specific outputs and outcomes are related to time and financial terms. Finishing the project under budget and on time are usually the key standards. Y. Wang & Zhao (2018) took this approach when examining the performance of five transportation PPP projects in Virginia. They found the projects were effective in accessing extra financing sources but were unable to decrease construction risk or to transfer revenue risk.

Recently, the view of PPP performance has expanded to include the impacts outside a project's boundaries and to supersede pure economization. It encompasses evaluation criteria including social value creation for communities (Caldwell et al., 2017), social welfare (Boardman & Vining, 2012), substantiality (Hueskes et al., 2017), intergenerational justice (Gilmour, 2012), accountability (Forrer et al., 2010), public interest and control (Bunch, 2012), and other public values (Reynaers, 2014). The

common threat to these evaluation criteria is that it is difficult to formulate comparative measurements for PPP performance. Therefore, much of the literature uses "small-N" case designs. For example, based on a documentary analysis of 25 Flemish PPP infrastructure projects, Hueskes et al. (2017) found those projects gave very limited attention to sustainability because measurable substitutability criteria are very difficult to formulate. Based on case studies of two long-term PPP projects in the UK healthcare sector, Caldwell et al. (2017) developed a social value creation framework for PPP which explains how relational coordination affects task performance and social value. They briefly defined social value as the benefits for the community or society at large without disentangling what constitutes social values specifically.

With the spread of public value discourse in network governance (Bryson et al., 2014; Wallmeier et al., 2019), PA scholars have shown a growing interest in the effects of PPP on public value delivery (Reynaers, 2014). From many possible values, Reynaers (2014) selected five dimensions—accountability, transparency, responsiveness, responsibility, and quality—"based on the prominence of these values in the public values literature and their application in the context of infrastructure DBFOM" (p.43). The author then applied this framework to examine a case in the Netherlands and revealed the circumstances that might affect public values in PPP. Page et al. (2015) proposed a public value framework which includes three sets of public values—"democratic accountability, procedural legitimacy, and substantiative outcomes" (p.715). They used a single transportation PPP case in Minnesota to illustrate how this framework can be applicable.

From a macro level perspective, the literature has evaluated how PPP policy affects the fiscal conditions and governing capacities in a jurisdiction. PPP enables the public sector to access private financial or technical resources (Cui et al., 2018; Vining et al., 2005), to transfer risks (Hussain & Siemiatycki, 2018), and to achieve a higher level of value for money (Kweun et al., 2018), as well as political convenience (Guo & Ho, 2019).

However, whether the public sector can realize those promised benefits depends on many factors. Mixed results were found around the world. For example, based on the experience of the UK's private finance initiative (PFI) , Hodge & Greve (2007) found mixed results of PPP in easing the fiscal stress on government and in achieving value for money. Drawing insights from the rapid proliferation of PPP across China between 2012 and 2017, Tan & Zhao (2019) suggested that PPP "might not be as effective a financing tool for infrastructure as expected" (p.516). They found PPP did not attract enough private investment but did accumulate significant financial risk.

PPP also incurs the risk of losing public control over infrastructure assets and decision making. By reviewing several international PPP cases, Hodge & Greve (2007) found that with a long-term PPP contract, governments are locked in an arrangement that may reduce their flexibility to make future decisions in favor of public interests. Sclar (2015) cited the case of the Indiana Toll Road, where the State of Indiana had to pay private partners half-a-million dollars to waive the tolls of travelers during a flood emergency. Many PPP projects are subject to 30-year contracts, and it is difficult to predict what contingencies will arise within those years. Moreover, some PPPs use noncompete clauses or other compensation provisions to attract private investors. Such

provisions may ensure a steady stream of toll revenues, but they limit the government's power to provide alternative public facilities in order to address public needs (Bunch, 2012).

With multiple organizations and complex formal and informal organizational relationships, PPP challenges the traditional public accountability system. Focusing on the disclosure systems of the UK's PFI, Hood et al. (2006) raised concerns about PFI's poor transparency and its accountability deficit. Based on a PPP case study, Forrer et al. (2010) indicated that a traditional public accountability framework was unable to serve that purpose in the PPP context. They further set up a six-dimensional public accountability framework for PPP, including "risk, costs and benefits, social and political impact, expertise, collaboration, and performance measurement" (p.482). Haque (2001) argued that PPP increases the possibility of kickbacks due to the hybrid organization model. People may be unable to find "who is responsible for what" when multiple equity partners, contractors, public sponsors, and operators are bundled together. The blurred accountability increases the possibility of corruption and loss of public values (Reynaers, 2014).

Even though financial benefits are still the cornerstone of performance review, various public values have been brought into the discussion. This expansion is in line with PA's paradigm shift from NPM to network governance (Kim, 2020). Challenges of PPP performance review remain significant (Warsen et al., 2019). I will discuss those challenges in the following section.

2.5. A Summary of Literature Gaps

Previous literature in PA has focused on three aspects of PPP study. First, the formation aspect addresses why a PPP was formed. It focuses on the macro-level forces that drive PPP use. Second, the management aspect tackles the project-level managerial issues of PPP. It speaks to the operational strategies which government can use to incentivize constructive behaviors to deliver certain operational objects. It discusses the financial, contractual, and relational management of PPP. Third, the performance aspect is related to the normative theory of what values should a PPP produce and evaluating if the project achieved them. Literature gaps are identified for each aspect.

Previous research on PPP formation provides significant insights on how political, economic, and social factors influence a government's decision to use PPP. However, the discussion is still at the initial stage. First, inconsistent results have been found. For U.S. state-level research, the intriguing relationship is whether state financial conditions, measured in various ways, affect PPP adoption. Boyer & Scheller (2018), Daito (2015), and Y. Wang & Zhao (2014) indicate that states with tight financial conditions are significantly more likely to use PPP. However, Z. Chen et al. (2014) and Geddes & Wagner (2013) found there is no significant relationship between state financial conditions and PPP adoption. PPP's relationship with a state's financial conditions is particularly relevant because it is primarily viewed as a vehicle to deal with infrastructure needs during times of public fiscal stress. Second, most of the extant research used a binary variable (adopted vs not adopted) as the outcome variable. Using a binary variable to measure adoption cannot capture the variations in volume of PPP usage. Third, PPP can vary substantially in terms of project delivery methods and financial arrangements

(See *Figure 1*). The rationales for forming PPP with private finance are different from the purposes for forming PPP with bundling project phases[1]. However, previous results rest on the assumption that private-financed PPP and bundled PPP are undertaken for similar reasons. It is necessary for future research to disentangle those differences. Thus, the first empirical research question is: *Are the states with weaker financial conditions associated with more private-financed PPP?*

The financial arrangements of PPPs are believed to be an important and fundamental issue, but there is relatively little literature on the subject (Cui et al., 2018). Previous studies have examined the drivers of private investment with non-U.S. PPP cases (Osei-Kyei & Chan, 2017; H. Wang et al., 2019; H. Wang, Chen, et al., 2018; Ye et al., 2018). However, given the differences in public procurement legal frameworks and unique municipal bond markets, the U.S. pursues a different set of strategies to leverage private capital (Casady et al., 2020). Little research has investigated the effects of those government strategies on attracting private capital in U.S. contexts.

Furthermore, with different government support strategies in place (Verhoest et al., 2015), it is interesting to diagnose whether or not these strategies can and should be used together to leverage private investment. It is possible that some approaches may complement each other, while some others may counteract each other. For example, a private-friendly institutional framework may amplify the effect of public funding grants on private investment. Previous literature has demonstrated the moderating role of institutional quality on the relationship between public financial support and private

[1] The theoretical discussion about why they are different is presented in Chapter 4.

investment using interaction terms in a regression analysis (H. Wang et al., 2019). Regression analysis is valuable, but it is incapable of diagnosing the impact of specific combinations of governmental support approaches on private investment. In particular, based on a clustering analysis of 20 European countries' national supporting strategies, Verhoest et al. (2015) suggested that "governmental support may be a necessary but not sufficient factor to explain PPP activity in a country" (p. 134). H. Wang et al. (2019) suggested that future research should discuss the effectiveness of specific combinations of government support programs. Therefore, the second research question is: *Which government support strategies, and in which combinations, are necessary and sufficient to attract high levels of private investment in PPPs?*

Along with the public value governance movement, much progress has been made on the research of PPP performance in terms of the expansion of evaluation criteria superseding economization. Cost-efficiency (or Value for Money) and other financial benefits are still the cornerstone of performance review, but various public values have been brought into the discussion, such as accountability and equity. However, the literature is inconsistent on value selection. Different authors proposed different sets of public values based on popularity (Bunch, 2012; Reynaers, 2014). Those value frameworks based on empiricism often lack theoretical foundations. And, the values were scattered without explaining the theoretical rationale behind the selection.

Moreover, few studies have examined the effects of private capital engagement on PPP public value delivery. Hussain & Siemiatycki (2018) tried to examine the effects of private capital with the experience of Ontario's PPP but only focused on its effects on financial cost and effectiveness in risk transfer. Higher private investment in PPPs is not

always the desired option for public value delivery. Indeed, some scholars have raised concerns that private firms that make large investments will have more leverage in project decision-making, which creates difficulties for safeguarding public values. Thus, the third question is: *How does private capital engagement affect public value delivery?*

3. The Development of PPP in the U.S.

This chapter introduces important background information about the empirical studies and explains why this research focuses on the U.S. context.

3.1. An Overview

Both the Trump and Biden administrations campaigned for leveraging private capital through PPP (Likosky, 2020; The White House, 2018). The quest for innovative infrastructure finance and better PPP projects to replace aging infrastructure is also urgent among many state and local governments (C. Chen & Bartle, 2017; Martin, 2017). *Figure 3* shows the number of PPP projects in the U.S. over the past two decades[2]. Between 2000 and 2019, 740 PPP projects were proposed, and 42% of them had a private finance component. Of the 320 PPP projects that achieved financial close during that period, 36% used private capital. On average, 11.5 such projects were financially closed annually between 2000 and 2005. There was steady growth from 2005 to 2014 in the number of PPP attempts, with a sharp increase starting in 2015. However, the number of projects reaching financial close was still limited. However, this does not indicate that PPP is trivial in the U.S. Most PPPs are mega projects in terms of the dollar amounts of

[2] The data was compiled and cross-verified using multiple infrastructure finance databases. The details of data sources and how they were collected are explained in Chapter 5: Data and Methods.

the transactions. *Figure 4* shows the total amount of PPP transactions by year of financial close. The total amount of PPP deals between 2000 and 2019 was worth $168 billion.

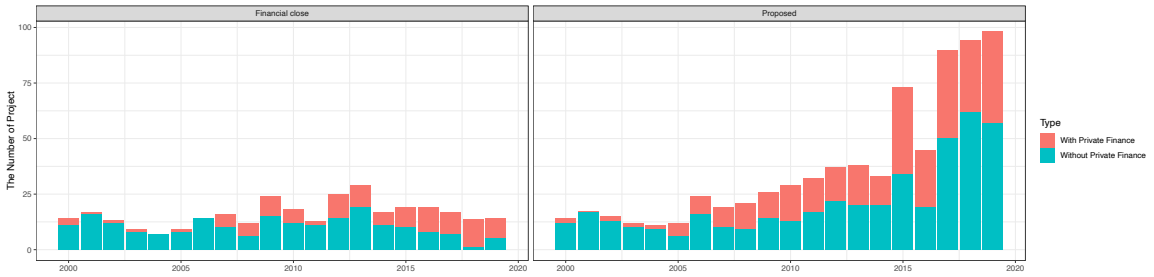


Figure 3: The Number of PPP by Year

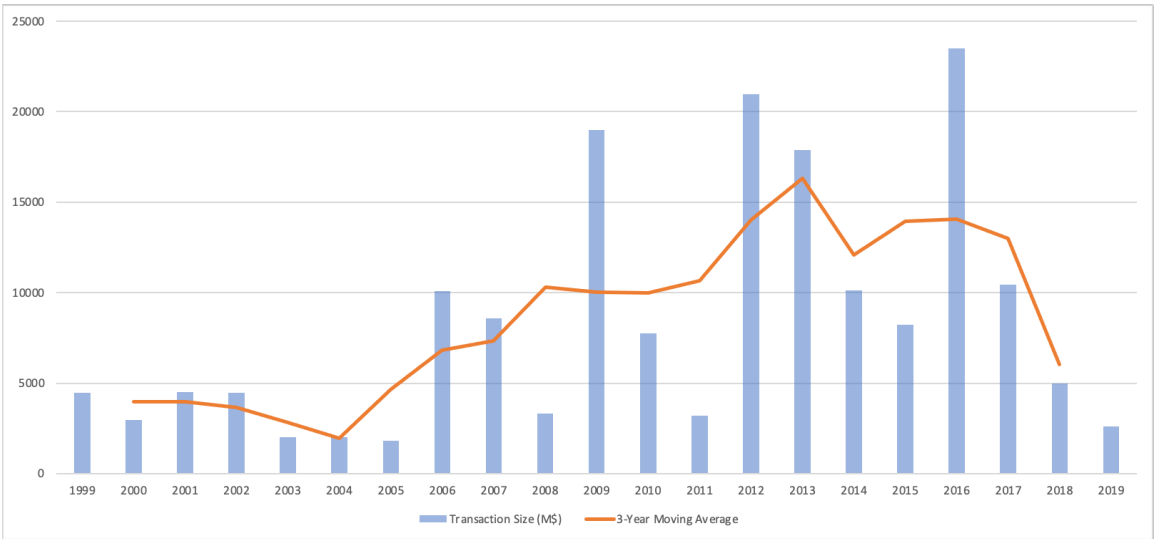


Figure 4: The Total Amount of PPP Transactions by Year of Financial Close

U.S. infrastructure PPP has been used for transportation projects, including motorways (46%) and rails (13%), followed by utility projects, such as water and wastewater projects (20%). It has also been used to develop social infrastructure buildings, including civic (9%) and education (7%) spaces. *Figure 5* shows the percentages of PPP projects achieving financial close by sector.

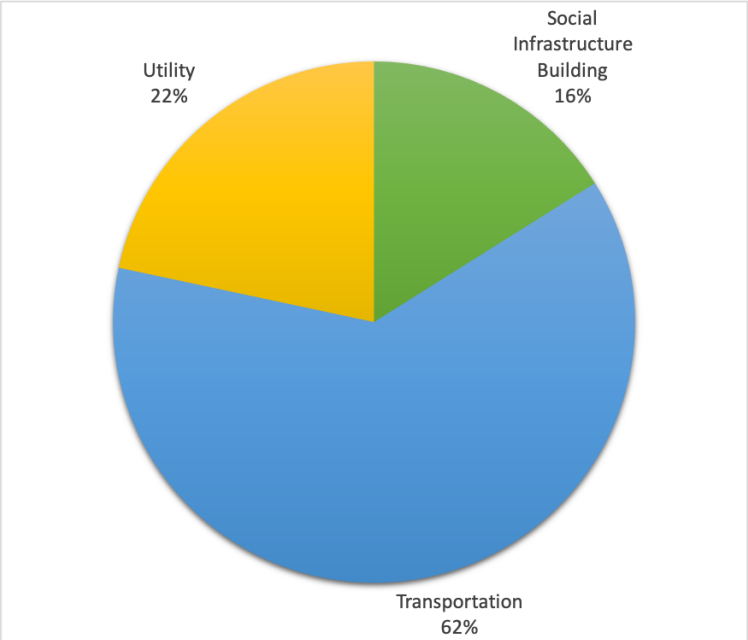


Figure 5: PPP by Sector

3.2. Government Institutions and Strategies

Even though the development of PPP capacity in the U.S. remains in its infancy compared to other developed economies, progress has been made (Casady et al., 2020). There are two important capacities: institutional support and financial support. A solid legal framework enables "the government to enter into PPP and set the rules and boundaries for how P3 projects are implemented" (World Bank Group, 2017, p. 58). An effective legal framework also ensures consistency and clarity which reduces the uncertainty for investors (Farquharson et al., 2011).

3.2.1. Institutional Support

Under the federal government system, these is no uniform statute for PPP (Mirchandani & Jacobo, 2020). State legislatures play a vital role in enabling PPP adoption and creating boundaries and guidance for PPP administration (Martin, 2017). The federal government plays a significant role in providing PPP knowledge, training,

and procurement guidelines. The Build America Bureau and FHWA Center for Innovative Finance Support offers various trainings and handbooks to guide state and local governments to use PPP. The Build America Transportation Investment Center (BATIC) Institute offers specific trainings for PPP financing issues.

According to the National Conference of State Legislatures (NCSL)'s Transportation Funding and Finance State Bill Tracking Database, on average, 46 PPP-related bills were either proposed or passed on the floor annually between 2009 and 2017 across all 50 state legislatures (National Conference of State Legislatures, 2020). The first modern PPP law was California's *Cal. Streets & Highways Code §143* in 1989. Since then, 37 states have passed legislation that enables state or local agencies to participate in PPP projects[3]

NCSL (2015, 2017) has dedicated much effort to documenting and categorizing state PPP laws. Geddes & Wagner (2013) examined what causes a state to adopt such laws. They found the public's need for infrastructure and political disposition, rather than the state's fiscal constraints, are the primary drivers. They also developed an index reflecting the favorability of private participation based on the states' PPP laws.

3.2.2. Financial Support

The theory of market failure justifies the need for public financial support for infrastructure (Mikesell, 2011; Weimer & Vining, 2017). As a classic type of quasi-public goods, much infrastructure would be insufficiently supplied without government provisions. Indeed, infrastructure PPPs are usually not economically viable for private

[3] The FHWA Center for Innovative Finance Support listed the PPP enabling statutes by state at https://www.fhwa.dot.gov/ipd/p3/legislation/

investors without government input (World Bank Group, 2019). The lump-sum dollar amounts and the longer-than-usual return periods drive away most private investors. Thus, a certain level of government support is required to attract private investment to infrastructure projects.

Governments usually have various tools to support PPP development. In the U.S., the frequently used tools include 1) offering direct financial support through grant-based aids for construction and operation; or, 2) providing indirect capital support through low-cost financing programs (U.S. Federal Highway Administration, 2016).

Although one of the major purposes of PPP is to stimulate private capital investment in infrastructure, the public sector still plays a major role in funding PPP projects. The U.S. federal, state, and local governments can provide direct in-cash support through capital or operational subsidies. Those amounts are usually from their capital or operating budgets.

Private investors expect to be paid back. That is why payment structure is so critical. In the U.S., there are two common mechanisms for public agencies to compensate private entities for their investments: availability payments and user fees. For user-fee PPPs, the agency delegates authority to the private entity to collect fees from infrastructure users. For example, PPP agreements will typically state toll collections in detail. The private investor's return depends on those toll revenues and is at risk when demand falls short. However, if the demand is higher than anticipated, the private investor can keep the extra profits.

For availability payment PPPs, the agency makes periodic payments to the private entity if certain project delivery standards are satisfied. And, the private entity does not

collect tolls or revenues from users (Poole, 2017). In this case, private investors are not subject to revenue risk when demand falls short. Governments use the availability payment mechanism to mitigate the revenue risks that private investors typically worry about. In this way, availability payment PPPs attract conservative investors who seek to protect their investment portfolio's value by investing in lower risk assets.

Indirect financial support includes various debt programs. The government can provide indirect financial support through exempting tax payments on interest earnings from municipal bonds and some private activity bonds, or by providing improved access to capital markets through credit assistance tools. The indirect financial support examples listed here are not exhaustive, but they do reflect the major types for motorway PPPs in the U.S.

Tax-exempt Municipal Bonds. State and local governments can issue tax-exempt municipal bonds to finance infrastructure projects, including certain PPP projects. Because the interest earnings on municipal bonds are exempted from federal income tax, public agencies can borrow at “artificially low interest rates” (Mikesell, 2018, p. 638). However, the tax-exemption does not apply to projects where private investors are the main beneficiaries. For motorway PPP projects, generally, “no more than 10 percent of issuance of tax-exempt bonds can benefit any private business” (U.S. Federal Highway Administration, 2016, p. 3_6). Thus, those approaches are less utilized in PPP projects.

Tax-exempt Private Activity Bonds. The Tax Reform Act of 1986 permits certain private activity bonds (PABs) to be tax-exempt. This allows a “private project sponsor to benefit from the lower financing costs of tax-exempt municipal bonds” (FHWA, n.d.). This bond program highlights the federal government’s support for

increasing private investment in infrastructure. The total amount of PABs is capped at $15 billion by law, and the U.S. Department of Transportation (USDOT) allocates this amount among qualified facilities (U.S. Department of Transportation, 2020).

Credit Assistance Tools. PPP projects can also access loans from various credit assistance programs provided by federal and state governments. Those programs often allow more flexible repayment terms, larger credit amounts, and more favorable interest rates than those offered by private capital markets. The most widely used credit assistance tool for PPP motorway projects is the Transportation Infrastructure Finance and Innovation Act (TIFIA) program (U.S. Federal Highway Administration, 2016). The program particularly encourages private participation, and private firms are eligible borrowers (U.S. Department of Transportation, n.d.).

Private investment needs to be paid back, but PPPs may create extra values. How much of that excess value can be captured by the private partners in a public-private relationship depends on the rent-sharing negotiation (Kivleniece & Quelin, 2012). Rent-sharing rules are essential in any PPP agreement. They are important devices for attracting private investment and preventing free-rider opportunism (Ménard, 2012).

3.3. Private Capital Engagement

In general, the private sector can financially participate in PPP by making an equity investment, issuing corporate bonds in the capital market, or borrowing money from commercial banks and other financial institutions (Hussain & Siemiatycki, 2018). Equity investment has the highest level of risk among the private sources of financing for two reasons: any return is directly related to the project's revenue, and the return on equity is at the bottom of the cash flow waterfall (DeCorla-Souza & Ham, 2016). Put

another way, if the project generates more revenue than anticipated, the equity investors will receive higher returns. However, if the project fails to do so, the equity investors will lose their return payments or even their principal investment. In addition, the return on equity is at the bottom of the cash flow waterfall. Usually, after all the operating costs, tax payments, and debt services are paid down, the surplus or the net income can be divided among equity investors. In other words, equity investors are at the first loss position if their project is unable to generate sufficient revenues or unable to meet the requirements for government payments.

Higher risk investments must offer higher compensation. The return for an equity investment is the highest among the sources of financing, and it comes with upside potential (the actual return is higher than the pre-determined targeted return rate). For example, the targeted net internal rate of return (IRR) for the PPP infrastructure fund Meridiam Infrastructure North America II is 11-12%, but its achieved IRR was about 16% as of June 2019 (Inframation, n.d.). Equity investors can maximize their risk-adjusted return by minimizing costs and risks. With the upside potential, equity plays an important role, strengthening the incentives for the private sector to perform efficiently and effectively. In many cases, design-build and O&M subcontractors are required to make a certain amount of equity investment in their projects to ensure efficiency and accountability (U.S. Federal Highway Administration, 2016). Thus, PPP projects can benefit from additional financing sources as well as incentive frameworks that manage how equity investors are compensated.

The major equity investors in the U.S. transportation PPP market include asset manager corporations, infrastructure funds, general partner (GP) equity firms, and

institutional investors. Based on a search of the Global Transaction Database that traces every major investor in infrastructure (Inframation, n.d.), about 70 investors have directly made an equity investment in a U.S. transportation PPP from 2003 to 2019. Many investors originate outside the U.S. *Table 1* shows the investors who have directedly financed more than three transportation projects in the U.S.

Table 1: Major Equity Investors of U.S. Transportation PPPs

Investor Name	Type	Origin
Meridiam Infrastructure Managers	GP	France
Ferrovial	Corporate	Spain
John Laing	Corporate	UK
Grupo ACS	Corporate	Spain
Transurban Group	Corporate	Australia
Macquarie Infrastructure and Real Assets (MIRA)	GP	Australia
Plenary (North America)	Corporate	USA
APG Group (APG)	Institutional	Netherlands
Skanska	Corporate	Sweden
Star America Infrastructure Fund	Fund	USA
Fluor Corporation	Corporate	USA
Star America Infrastructure Partners	GP	USA
Dallas Police and Fire Pension System	Institutional	USA

Source: Global Transaction Database (Inframation, n.d.)

Bonds and loans are both debt financing tools. Together with municipal bonds and government loan programs, debt financing plays a critical role because most PPP projects are highly leveraged (more than half of the financing amount is from bonds and loans) (U.S. Federal Highway Administration, 2013). In this section, I focus on the bonds and loans issued by private entities.

The private sector can issue corporate bonds and sell them to investors in the capital market to raise funds for PPP projects. Bond investors usually receive fixed coupon earnings twice a year until the bond matures, and the bond issuers will also pay

back the bond face value (the principal investment) at the maturity year. Bonds are tradable in the capital market, which gives great liquidity for bondholders. The bond price depends on market interest rates and the risk assessments made by bond rating agencies, such as Moody's, Standard & Poor's, and Fitch. When a bond is issued, the rating agencies assess whether the bond carries a default risk and whether the issuer is financially stable enough to pay back the debt services. Bond issuers can use credit enhancement tools, such as bond insurance and guarantees, to improve their credit rating. However, those instruments also require fees and premiums. Issuing and selling bonds often requires underwriters who also charge fees.

The private sector can also borrow money (loans) from commercial banks or other lenders to fund PPP projects. Loans are easier to construct and are more flexible in terms of repayment schedules, but they cannot be traded in the capital market. The limited liquidity of loans increases the interest rate required by the loan lenders. Thus, loans usually have higher interest costs and shorter terms than private bonds (U.S. Federal Highway Administration, 2013).

Private bonds and loans generally have lower risks than an equity investment. Bondholders and lenders are ahead of equity investors in the cash flow waterfall. They can be paid in full and on time even if the project may not have sufficient cash to pay its equity investors. Bondholders and lenders usually receive fixed (or contract specified) interest without upside potential. With less risk, bond and loan investors accept lower returns.

In the U.S., PPP lenders and bond underwriters are usually investment and commercial banks. Based on the Global Transaction Database (Inframation, n.d.), there

are about 70 private entities that have lent funds or arranged bonds for U.S. transportation PPP projects. About 27% of them are originated in the U.S. *Table 2* shows the lenders involved in more than three transportation projects in the U.S.

Table 2: Major Lenders of U.S. Transportation PPPs

Name	Origin
Bank of America Merrill Lynch (BAML)	USA
JP Morgan	USA
Santander	Spain
Goldman Sachs	USA
Barclays	UK
Royal Bank of Canada (RBC)	Canada
Credit Agricole CIB	France
Citigroup	USA
ING Group (ING)	Netherlands
Societe Generale (SocGen)	France
Banco Bilbao Vizcaya Argentaria (BBVA)	Spain
Sumitomo Mitsui Banking Corporation (SMBC)	Japan
Mitsubishi UFJ Financial Group (MUFG & BTMU)	Japan
Canadian Imperial Bank of Commerce (CIBC)	Canada
Wells Fargo	USA

Source: Global Transaction Database (Inframation, n.d.)

3.4. Hitting a Plateau

The development of U.S. PPP is hitting a plateau. Globally, more than 134 countries have used infrastructure PPP, and those projects account for about 15-20% of all infrastructure investment between 2002 and 2012 (World Bank Group, 2015). It has been a popular alternative for infrastructure development in many countries including China, Germany, U.K., Australia, and Canada. But, PPP has only been applied to a very small portion of U.S. infrastructure projects (Reinhardt, 2011; Roman, 2015).

Recent PPP failures have cost millions of tax dollars. Examples include the 2011 bankruptcy of the South Bay Expressway concession company in California (U.S.

Department of Transportation, 2014), the 2014 bankruptcy of the Indiana Toll Road concession company (FHWA Center for Innovative Finance, n.d.-b), the extensive budget and schedule overruns on the I-69 Section 5 project in Indiana (Degood, 2018), and the 2016 bankruptcy of SH 130 Concession Co. in Texas (Blunt, 2016). Some states, such as Texas, have tapped the brakes, rejecting several transportation PPP projects in 2017 (Shelton, 2017). As shown in *Figure 3,* even though the number of proposed PPP increased, the number of projects that reached financial close decreased starting in 2015.

Although the U.S. has the potential to be the world's largest PPP market, its current size remains very small (Casady et al., 2020). If it can be successfully delivered, PPP is one of many tools that can be used to close the infrastructure investment gap. Perhaps, PPP is appealing to U.S. governments. However, its limited institutional maturity may be stifling its further development. Casady et al. (2020) summarizes three institutional barriers to U.S. PPP: the outdated public procurement legal framework, the fragmented distribution of infrastructure provision, and the low-interest municipal bond market.

Across the country, governments at all levels continue to struggle with poor PPP practices. This not only calls into question current U.S. PPP practices and their associated institutions, but also calls for reexamination of the basic theories of PPP.

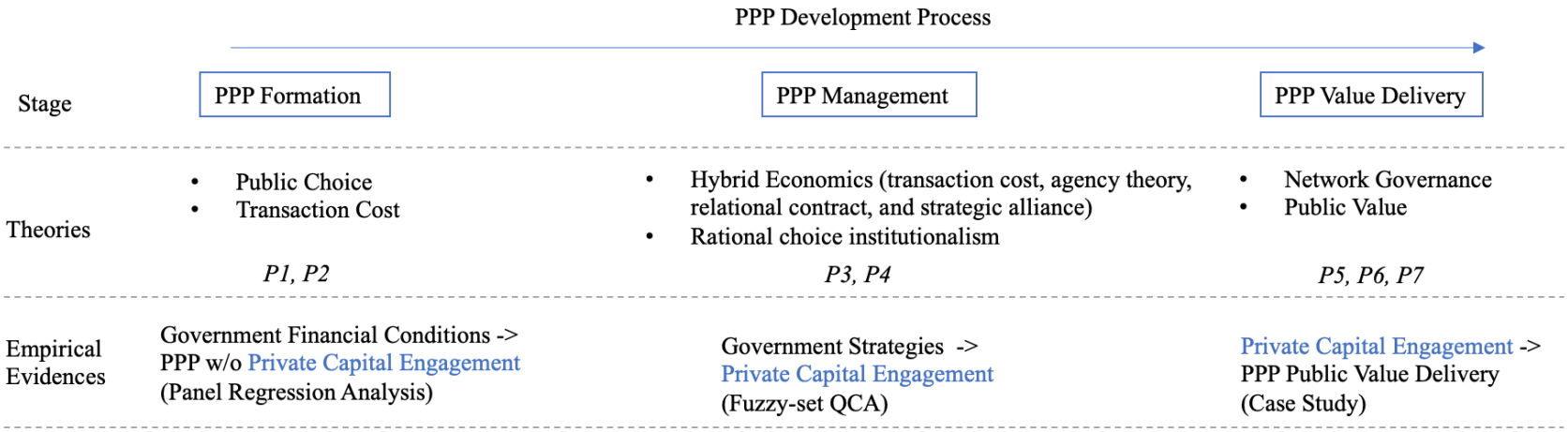
4. Theoretical Frameworks and Propositions

In order to understand the complexities of PPP, a general theoretical framework that covers the lifecycle issues of PPP has to be put forward. Based on my review of the literature, it should account for three aspects of PPP: formation, management, and

performance. They represent PPP's three stages: the emergence and adoption of the project, the strategies to manage and sustain it, and its value outcomes.

I investigated this process by extracting and incorporating theories and perspectives from organizational economics on hybrids[4], public choice, institutionalism, and public value. These perspectives were selected because they have received substantial attention in the relevant literature. More importantly, they are related to the literature gaps that are identified in this research. This chapter outlines these theories and describes how they contribute to the understandings of PPP formation, management, and performance. *Figure 6* shows the overview of the framework and lists the propositions derived from those theories.

[4] The organizational economics on hybrids includes a set of economic theories that are used to explan hybrid organizational dynamics. Those theories include transaction cost economics, agency theory, relational contract theory, and the resource-based view of organization alliances (Ménard, 2004, 2012).



*P1: Governments with **weaker** financial conditions are associated with more **private-financed** PPP **initiations**.*
*P2: Governments with **sounder** financial conditions are associated with more **bundled** PPP **adoptions**.*

P3: Governments' financial and institutional supporting strategies affect the level of private capital engagement in PPPs.
*P4: The **mix and match** of different government supporting strategies matter for attracting private capital in PPPs.*

*P5: A higher level of private capital is associated with poorer **accountability**.*
*P6: A higher level of private capital is associated with better **procedural rationality** but poorer **procedural justice**.*
*P7: A higher level of private capital is associated with better **outcome effectiveness** and **efficiency** but poorer **outcome equity**.*

Figure 6: Theoretical Framework Overview

4.1. Theories of PPP Formation

As an organizational form, PPP is formed voluntarily between the two sectors. Why would governments and private firms want to form PPP? And, given their different value preferences, under what conditions do they form such partnerships? The following two perspectives make significant contributions to these questions.

4.1.1. Public Choice Perspective

Public choice theories are widely used to examine nonmarket decisions through economic reasoning (Mueller, 1976). People are assumed to be "egoistic, rational, utility maximizers" in economics (Mueller, 1976, p. 395). Similarly, public choice theorists assume that politicians and public bureaucrats are self-interested. Although they may have concern for others or may serve for the greater social welfare, their dominant motivation is still themselves.

In analyzing politicians' actions, public choice theorists claim that politicians make decisions based on reelection calculations. PPP brings important political benefits for politicians under fiscal pressure. Building new infrastructure is usually a winning political choice as it can concentrate benefits across certain constituencies while spreading costs broadly (Wilson, 1980). However, if a state faces weak financial conditions, politicians may look for private capital to meet the infrastructure deficiency, because the other options to fund and finance the lump-sum, upfront payments are politically painful, such as raising taxes, increasing fees, cutting spending elsewhere, or issuing municipal bonds (Posner et al., 2009). Some governments use the PPP model mainly because of its off balance-sheet accounting and political convenience (Engel et al., 2013; Posner et al., 2009; Tejada-Ibanez, 2013). Guo & Ho (2019) argued, "fiscal

stress incentivizes contracting-out and PPP because policymakers must identify ways to do more with less and identify ways to cut costs".

Public choice also provides insights on the behaviors of public bureaucrats. It assumes bureaucrats are able to shape the budget process to maximize their budgets in order to increase the power of their own agencies. Doing so leads to fatter budgets and overstaffing (Niskanen, 1971). Merging the benefits of private expertise and market competition is a logical solution to excessive bureaucracy, converting certain government functions to private hands (Savas, 2000). Although public bureaucrats will always try to preserve their benefits, "fiscal stress serves as a blunt instrument that weakens the overstaffed bureaucratic arrangements and enforces frugality" (Zullo, 2009, p. 461). In theorizing the effects of fiscal stress on private contracting, Zullo (2009) used the public choice framework and argued the tight fiscal condition of a public bureaucracy should lead to more private contracting. PPP inherits some features of contracting in terms of transferring certain functions of infrastructure development to the private sector. Thus, it is assumed a public bureaucracy confronting narrow fiscal straits should also turn towards more PPP formation.

Under such conditions, a government's need to obtain financial resources is much greater than the need to gain advantages from knowledge-based resources. Indeed, public choice theories suggest politicians and bureaucrats may care less about the cost-savings of using private knowledge-based resources because the savings are not their own (Mueller, 1976). Thus, the primary goal of PPP is to use private capital in order to escape current fiscal pressures.

Proposition 1: Governments with weaker financial conditions are associated with more private-financed PPP initiations.

4.1.2. Transaction Cost Theory

Transaction costs have been widely discussed as the major barrier of PPP formation (Garg & Garg, 2017; Vining et al., 2005). Transaction costs can rise when contract negotiations and specifications are complex (Sclar, 2000; Tan & Zhao, 2021). For example, PPP usually has longer bargaining times compared to traditional contracts. The average time from transaction launch to financial close is 2.4 years among PPP projects between 2006 and 2017 in the U.S. (Buckberg et al., 2018). A U.S. Government Accountability Office (GAO) Report (2008) reviewed the trade-offs of highway PPPs. Those PPPs usually employed professional financial and legal advisors because of the project's complex contractual and accounting issues. Hiring third parties incurs significant costs. And, PPP may incur higher public costs than conventional infrastructure delivery (Martin, 2017).

By reviewing several international PPP cases, Hodge & Greve (2007) found that with a long-term PPP contract, governments are locked in an arrangement that may reduce their flexibility to make future decisions in favor of public interests. Sclar (2015) cited the case of the Indiana Toll Road, where the State of Indiana had to pay private partners half-a-million dollars to waive tolls for travelers during a flood emergency. Many PPP contract terms extend over 30-years; unforeseen contingencies will arise. Moreover, some PPPs use noncompete clauses or other compensation provisions to attract private investors. Such provisions may ensure a steady stream of toll revenues, but they limit government power to provide alternative public facilities in order to address

public needs (Bunch, 2012). Thus, PPP with sophisticated bundling or long-term contracts are associated with higher transaction costs compared with the traditional method.

To overcome the transaction cost barrier, certain investments are needed. The adoption of PPP can be obstructed by the lack of government financial support for pre-contract negotiations. The pre-contract negotiation costs are often paid by the government. Thus, my next proposition is:

Proposition 2: Governments with sounder financial conditions are associated with more bundled PPP adoptions.

4.2. PPP Financial Interactions

The previous section theoretically examined the relationship between government's financial condition and PPP formation. It primarily focused on the macro-level forces that drive government to use different types of PPP. PPP initiate financial platforms, but private capital does not flow in by itself: "[t]he private firm does not participate out of a will for the common good, but out of a desire for profit" (Mikesell, 2018, p. 322). As a type of market failure, few infrastructure projects are economically viable for private investment (World Bank Group, 2019) due to their nature as public goods. Therefore, government incentives must be developed to attract private investors.

The ability to leverage private investment is a key selling point of PPP. This section focuses on the theories that bridge private investment with government support within the PPP setting. I analyze the driving factors of private investors in PPPs. In particular, organizational economics regarding hybrids and rational choice institutionalism shed light on this examination. Then, based on the driving factors of

private investors, I explore the important strategies governments can use to leverage private capital in PPP.

4.2.1. Hybrid Economics Perspectives

In organizational economics, hybrids refer to the relationships "where two or more partners pool strategic decision rights as well as some property rights while simultaneously keeping distinct ownership over key assets" (Ménard, 2012, p. 1066). I contend that PPPs generally fit within the scope of hybrid arrangements because of the characteristics of typical PPP property and decision rights. Their only significant difference from a hybrid is the "publicness" of the public partner, which introduces a different set of political and social value preferences for PPPs [5] (Boardman & Vining, 2012; Caldwell et al., 2017).

The abundant organizational economics literature on hybrids suggests three important factors encouraging private firms to invest in hybrids: 1) above-normal value creation from bundled resources, 2) improved capacity to face uncertainty, and 3) expected rent spillovers if adequate sharing rules are implemented (Ménard, 2012). These factors are grounded in multiple economic theories, including transaction cost economics, agency theory, relational contract theory, and the resource-based view of organization alliance[6]. As a complement, rational choice institutionalism emphasizes the role of external institutions in altering private capital engagement (Campbell, 2004).

[5] As this section examines the motivations of private investors, I will not elaborate any further on how public involvement changes the dynamics of the hybrids. For private investors who consider PPPs as capital investment projects, most of the motivations remain valid.

[6] See the detailed discussions in Ménard (2012, 1078-1082).

In the next sections, I will discuss each factor and its connection with government support strategies.

4.2.1.1. Value Creation and the Effect of Government Financial Support.

The private sector also expects added value from their joint investment (Borys & Jemison, 1989). The net benefits from bundled financial resources and the spillovers through resource complementarity may exceed the net benefits produced by the parties working alone. The expected ex post surplus provides incentives for the private sector to invest in PPPs ex ante (Ménard, 2012).

The resource-based view of strategic alliances suggests that by forming an alliance, each participant can access the other's valuable resources while simultaneously keeping distinct ownership of key assets (Barney, 1991; Das & Teng, 2000). In this sense, PPPs can be considered strategic alliances between the public and private sectors (Xiong et al., 2021). The synergy argument—one plus one is greater than two—prevails among advocates for partnerships (Mackintosh, 1992). This argument indicates that the synergistic interactions among PPP participants create extra value that would be unattainable if the participants worked individually (Brinkerhoff & Brinkerhoff, 2011). Those potential extra benefits are attractive to both the public and private entities.

The two sectors hold heterogeneous resources that can create competitive advantages over their partners. From the public perspective, PPPs enable the public sector to access private financial resources. This is one of the fundamental rationales for these partnerships (Cui et al., 2018; Kivleniece & Quelin, 2012). In the U.S., government financial resources are usually scarce, but private entities such as pension and life

insurance funds actively seek long-term and stable infrastructure assets to complete their portfolios (Burke & Lipshitz, 2018).

In addition, PPPs also offer platforms for the use of private knowledge-based resources in project management and risk control, as well as the advantages of scale economy (Domberger & Jensen, 1997; Hirsch, 1995). For an infrastructure project, risk occurs if construction is delayed, costs overrun, infrastructure use falls short, capital service supply becomes discontinuous, or natural or man-made disasters strike (Posner et al., 2009). Some are better managed by the private sector, such as construction and operation risks. By identifying and allocating risks to the partners who are best at managing them, PPP can benefit from this cost-effective way to control uncertainty (Cui et al., 2018; FHWA Center for Innovative Finance, n.d.-a). Roumboutsos and Chiara (2010) argue that PPPs are strategic alliances that can amplify each partner's competitive advantages, ultimately producing extra value and mutual benefits.

In a PPP project, the size and structure of bundled financial resources in part depend on the government's financial inputs. Government financial support directly and indirectly affects the extent of project value creation, which in turn influences private capital engagement. For example, government can provide direct subsidies that increase the net value of a project's cash flows. Government can also provide incentives by offering low-cost debt programs. The financing costs of those government loan programs are lower than regular commercial capital market financing, indirectly increasing the project's net valuation.

In particular, the resource-based view of strategic alliances explains the resource structure between partners and its impact on project value creation. This theory asserts

that for similar resources, the resource alignment between partners can be both supplementary and redundant (Das & Teng, 2000). In the supplementary arrangement, one partner's investment will leverage the other's investment because it increases the project's net valuation. In the redundant arrangement, one partner's investment will crowd out the other's, because any additional investment will only become excessive "slack" which cannot produce marginal benefits (Das & Teng, 2000). This difference in resource alignments implies that government financial support can be both positively and negatively correlated with private investment.

4.2.1.2. Rent-Sharing and the Effect of Government Payback Support.

PPPs may create extra values, but how much of that value can be captured by the private partners in a public-private relationship depends on the rent-sharing negotiation (Kivleniece & Quelin, 2012). Rent-sharing rules are essential in any PPP agreement. They are important devices for attracting private investment and preventing free-rider opportunism (Ménard, 2012).

Much literature on hybrid economics focuses on the design of rent-sharing rules according to the allocation of asset inputs and project risks (Ménard, 2012). In the U.S., there are two broad mechanisms by which public agencies can compensate private entities for their investments: the revenue-at-risk payment and the availability payment (U.S. Federal Highway Administration, 2016). In revenue-at-risk PPPs, the public sector delegates to the private partner the right to collect revenue from users. PPP agreements of this type will describe both the timing and the toll amounts to be collected and shared. The private investor's return depends on toll revenues, and is therefore at risk when demand falls short. In availability payment PPPs, the public sector makes periodic

payments to the private sector if certain project delivery standards are satisfied. Private partners do not collect tolls or revenues from users directly (Poole, 2017). In this case, private partners do not have to worry about revenue risk when demand falls short, but their public partner does.

Governments can use the availability payment mechanism to absorb the revenue risk that typically worries private investors (Chauhan & Marisetty, 2019). In this way, availability payment PPPs can attract conservative investors who seek to protect the value of their investment portfolios by investing in lower-risk assets. However, the risk-return tradeoff in capital finance usually dictates that availability payment PPPs offer lower rewards, which diminishes their attractiveness for private firms. In the literature, despite frequent discussions of the differences between these two payback mechanisms, little empirical research has examined their impact on private investment.

4.2.1.3. An Instrument for Uncertainty and the Effect of Government Institutional Support.

Improved capacity to face uncertainty is another important motivation for private firms to invest in hybrids (Ménard, 2012). By allocating the risks to the partners who can best handle them, PPPs benefit from finding a cost-effective way to control uncertainty (Cui et al., 2018; FHWA Center for Innovative Finance, n.d.-a; Savas, 2000). For an infrastructure PPP project, uncertainties include both elemental and global risks (Grimsey & Lewis, 2002; Zhao et al., 2011). Elemental risks occur when a specific project encounters cost overruns, delays in construction, or shortfalls in demand. They are often project-specific and are allocated based on complex negotiations between the project partners. Global risks are related to the external environment, such as financial market

crashes and political turnover. Global risks are largely managed through external institutions.

4.2.2. Rational Choice Institutionalism

Rational choice institutionalism complements hybrid economics. It largely contributes to understanding how external rules and norms, rather than internal motivations, influence the behavior of individuals or organizations (Campbell, 1998). It assumes private firms are institutionally constrained, and their behaviors are responsive to the institutions (Campbell, 2004). Institutions can range from formal to informal frameworks, such as a legal and procedural framework or a normative, shared social understanding. In this research, I focus on formal institutions[7]. A solid legal framework is critical to attracting private investment (Geddes & Wagner, 2013; Verhoest et al., 2015; World Bank Group, 2017). It ensures PPP legitimacy and policy consistency over time and signals a government's commitment to engaging PPPs (Verhoest et al., 2015). An effective institutional environment also reduces uncertainty for investors (Farquharson et al., 2011).

Viewed through the above theoretical lens, I identified three types of government support strategies: financial support, revenue payback support, and institutional support.

Proposition 3: *Governments' financial, payback, and institutional supporting strategies affect the level of private capital engagement in PPPs.*

With different government support strategies in place, it is interesting to ascertain whether these strategies can and should be used together to leverage private investment.

[7] Even though informal norms are important and they do influence the behavior of private investors, such frameworks are very hard to measure systematically in a multi-project study.

Some approaches may complement each other, while others may counteract each other. For example, a private-friendly institutional framework may amplify the effect of public funding grants on private investment. Based on a clustering analysis of 20 European countries' national supporting strategies, Verhoest et al. (2015) suggested that "governmental support may be a necessary but not sufficient factor to explain PPP activity in a country" (p. 134). H. Wang et al. (2019) suggested that future research should discuss the effectiveness of specific combinations of government support programs.

Proposition 4: The mix and match of various government supporting strategies matter for attracting private capital.

4.3. A Public Value Framework of PPP Performance Assessment

The quest for a comprehensive assessment tool of PPP performance has intensified in recent years. However, evaluating the performance of PPP is always a challenging task (Warsen et al., 2019). Scholars have debated the scope of, and the standards that should be included in, such an assessment. Building upon public value theory (Wallmeier et al., 2019) and drawing upon the literature from its application on network governance (Bryson et al., 2014), I propose a public value framework of PPP performance assessment in this research. It addresses the gaps in the previous literature that result from a lack of a theoretical foundation of value selection.

This section briefly describes public value theory and how it can be applied to assess PPP performance. The term *public value* has been used broadly among PA scholars and administrators. Much confusion exists in the PA literature regarding what constitutes *public values* (van der Wal & Huberts, 2008) and what is the *public value*

(Wallmeier et al., 2019). Rutgers (2015) contended there are two independent discourses around public value: Moore's public value management (PVM) and Bozeman's public value failure (PVF). Initiated by Moore (1995), PVM is often viewed as "the next step after New Public Management, moving away from a state-versus-market perspective" (Rutgers, 2015, p. 30). It has taken up instead the strategic management perspective. PVF, in comparison, is more policy oriented. PVF's roots are in the 1990s New Public Administration movement. It often refers to a set of values and interests that feature the public sector in comparison to its counterpart—the private sector (Bozeman, 2007; Rutgers, 2015).

Our approach is related to Moore's PVM, and its subsequent development of public value governance (PVG) (Bryson et al., 2014). Moore charted a strategic triangle with three points: value or purpose, legitimacy, and operational capacity (Moore, 2000). For a strategy to be a good, it has to be publicly valuable, politically and legally supported, and administratively feasible (Moore, 2000; Wallmeier et al., 2019). In recognition of the public value challenges created by cross-sector collaborations and related network governance, Page et al. (2015) proposed a public value creation framework that includes three dimensions: "democratic accountability, procedural legitimacy, and substantive outcomes" (p. 715). The author also used Minnesota's Urban Partnership Agreement as a case to illustrate how ten attributes of public values are assessed, including "vertical democratic accountability", "horizontal democratic accountability", "procedural rationality", "procedural justice", "operational control", "effective performance", "efficient performance", "equity of benefits", "equity of payment", and "problem-solving capacity" (p.772).

My framework is built upon Page et al. (2015)'s work, with modifications to the attributes (See *Table 3*). These modifications reflect Moore's strategic triangle, but include the political and administrative system characteristics that it lacks (Wallmeier et al., 2019). I propose three dimensions of public value, including accountability, manageability, and outcome. These three address the issues of PPP purpose validity, procedural legitimacy, and impact soundness, respectively.

Table 3: Public Value Dimensions

Public Value Dimensions	Attributes of Public Value	Definitions
Accountability (purpose validity)	Accountability as answerability	The extent to which **public authorizers or elected officials** are able to determine, influence, and adjust project delivery
	Accountability as managing expectations	The extent to which project decisions and implementation respond to the diverse expectations generated by **stakeholders and the public community.**
Manageability (procedural legitimacy)	Operational rationality	The extent to which PPP decisions are based on technically and administratively sound data, analysis, and plans
	Operational justice	The extent to which the partners and the public perceive PPP decisions and activities to be fair
Outcome (impact soundness)	Effectiveness	The extent to which PPP achieves its initial goals
	Efficiency	The extent to which PPP achieves its goals at reasonable costs
	Equity	The extent to which costs and benefits of PPP are spread appropriately among partners and the public

(Adapted from Page et al. (2015, p.722))

I adjusted the definitions of accountability by borrowing insights from Acar et al. (2008)'s typology on accountability. Accountability as answerability refers to the extent to which public authorizers or elected officials are able to determine, influence, and adjust project delivery. Reynaers (2014)'s discussion of PPP's responsiveness and Bunch

(2012)'s concern for public control speak to its answerability. Accountability as managing expectations refers to how PPP respond to stakeholders and the public community. It relates to Reynaers (2014)'s discussion of PPP's responsibility and transparency.

Many PA scholars have expressed concern that extensive private engagement in PPP might create difficulties for ensuring accountability (Bunch, 2012; Forrer et al., 2010; Haque, 2001; Reynaers, 2014; Sclar, 2015). It assumes that a private sector with more investment will have more leverage on project decision-making, thereby creating difficulties for public sponsors to control the project. Moreover, ensuring PPP transparency is also challenging because of the different financial accounting rules (Engel et al., 2013; Posner et al., 2009; Tejada-Ibanez, 2013) and confidentiality issues (such as the intellectual property of a private business) (Hood et al., 2006; Siemiatycki & Farooqi, 2012). Thus, it assumes that a higher level of private capital will make it more difficult to ensure accountability.

Proposition 5: A higher level of private capital is associated with poorer accountability.

The second dimension is manageability which encompasses procedural rationality and justice. Procedural rationality refers to the extent to which PPP decisions "are based on technically and administratively sound data, analysis, and plans" (Page et al., 2015, p. 722). Procedural justice refers to the extent to which the partners and the public perceive PPP decisions and activities to be fair.

Discussions about the effect of private capital engagement on PPP manageability can be featured with two foci. By involving private capital investment, the private

partners demand returns from their investment. Private equity investors, lenders, underwriters, credit rating agencies, and bondholders usually conduct extensive reviews of the project's contract models. Those review and oversight processes ensure the project's rationality and its alignment with the goals of the public sector. In this sense, the private capital engagement offers an additional layer of procedural rationality. However, a higher level of private capital engagement may incur a higher risk of losing inclusive decision making and harm citizen engagement in the process. Capital structure often defines control power (Holmstrom & Tirole, 1989). A higher level of private capital engagement means the private sector has higher leverage over project decision-making. As the private sector's goal is to maximize the firm's value, activities that require additional costs, such as citizen outreach, may be eliminated. Moreover, collaborative meetings with many stakeholders incurs significant transaction costs and information flow costs. Thus, it assumes that a higher level of private capital will make it more difficult to ensure procedural justice.

Proposition 6: A higher level of private capital is associated with better procedural rationality but poorer procedural justice.

Outcome effectiveness refers to whether a partnership has delivered the objectives required by its initial PPP agreement on time and on budget. Outcome efficiency refers to the extent to which PPP achieves those goals at reasonable costs. When a private entity invests in a project, it also bears the risk of losing returns if it cannot deliver the project on time and on budget. Such adjustment in risk allocation creates strong incentives for the private partner to perform (Bing et al., 2005; Hussain & Siemiatycki, 2018).

The level of private capital, especially equity investments in which return is directly related to the project's performance, motivates the private sector to deliver the project in an efficient way (Warsen et al., 2019). Efficiency is "defined as the cost of producing a given outcome"(Andrews & Entwistle, 2010, p. 683). The private sector can enhance project efficiency by bringing more private expertise and innovation to reduce costs. Andrews & Entwistle (2010) also argued, "the benefits of PPP will be most apparent in the efficiency dimension of performance" (p.679). PPP can use private expertise and the advantages of scale economy to achieve efficiency (Domberger & Jensen, 1997; Hirsch, 1995). Thus, I assume that a higher level of private capital will improve PPP performance in terms of outcome effectiveness and efficiency.

The outcome equity dimension refers to the extent to which costs and benefits of PPP are spread appropriately among partners and the public, "depending on the goals of the collaboration and the assessors' judgement" (Page et al., 2015, p. 725). It is assumed that private firms pursue financial optimization and are only concerned at the minimum level of social equity (Andrews & Entwistle, 2010; Holmstrom & Tirole, 1989). The public sector rather than the private firms usually takes care of disadvantaged or underrepresented groups. Focusing on inclusive and equitable outcomes often reflects the sector's publicness (Pesch, 2008). Using data from 46 UK local government service departments, Andrews & Entwistle (2010) indicated that PPP is negatively associated with equity.

Proposition 7: A higher level of private capital is associated with better outcome effectiveness and efficiency but poorer outcome equity.

This chapter laid out seven propositions, drawing upon theories from public choice, transaction cost, hybrid economics, rational choice institutionalism, and public value. I will test these propositions in the following three chapters using different methodologies.

5. Identifying the Causes of Action: A Panel Regression Analysis

This chapter illustrates the empirical strategies I used to address the first research question: are the states with weaker financial conditions associated with more private-financed PPPs? The first two propositions are investigated through state-level panel data regression analyses.

5.1. Data and Variables

5.1.1. Constructing a U.S. PPP Database

Previous literature has demonstrated the poor data availability of U.S. PPP projects (Z. Chen et al., 2016). The World Bank maintains data for more than 6,400 infrastructure PPP projects in developing countries from 1990 to 2019 (World Bank Group, n.d.). The European PPP Expertise Centre (EPEC) collects European PPP practices dating back to 1990 (European Investment Bank, n.d.). China's Ministry of Finance (MOF) created a PPP database in 2015 to track PPP development in China. However, no database comprehensively surveys PPP projects in the U.S.

Several data collection efforts have been made by the Federal Highway Administration (FHWA) Center for Innovative Finance, the Inframation Group, and the Public Works Financing Newsletter. The FHWA Center for Innovative Finance's Project Profile database (FHWA Center for Innovative Finance, n.d.-b) contains detailed project financing and delivery information, but it only captures those projects with federal

support, such as TIFIA, PAB, and other tools. A few peer-reviewed articles (Y. Wang & Zhao, 2014) have used this dataset in the context of PPP.

The Global Transactions Database is constructed and maintained by the Inframation Group, a private firm dedicated to providing information on the global infrastructure finance market. The database currently covers about 25,000 infrastructure transactions globally (including 4,000 U.S. transactions), and lists 615 PPP transactions in the U.S.(Inframation, n.d.). The number also includes pre-launching, live-bid, and canceled projects. Several peer-reviewed articles (Casady et al., 2018, 2020; Loxley & Hajer, 2019) have used this dataset in the context of PPP. Another commercial dataset, Public Works Financing Newsletter's P3 Database, has been tracking PPP projects for 26 years (Public Works Financing Newsletter, n.d.). It has also been used for empirical studies (Albalate et al., 2017; Boyer & Scheller, 2018). These commercial datasets require subscriptions, and each has certain limitations. For example, the Public Works Financing Newsletter includes DB as a type of PPP, but it does not offer sufficient information about project details. The Inframation database uses a narrower definition of PPP that does not include DB and DBF, but it does provide detailed financing data.

Based on the confined definition of PPP in this research, my PPP database includes the following project delivery types: DB (Design-Build), DBF (Design-Build-Finance), DBO(M) (Design-Build-Operate[-Maintain]), DBFO(M) (Design-Build-Finance-Operate[-Maintain]), and Long-term Lease. I constructed a unique U.S. PPP project-level database through collecting, cleaning, and combining secondary data sources from the above three datasets as well as announcements from state agencies across the U.S. I used *Python* web-scraping tools to obtain project profiles from relevant

websites, and then manually coded the data into an Excel file. The merged list contains data from 740 PPP projects (excluding military contracts) between 2000 and 2019. Among them, 320 have achieved financial close as of December 2019. *Figure 7* shows the total number of PPP in the continental United States.

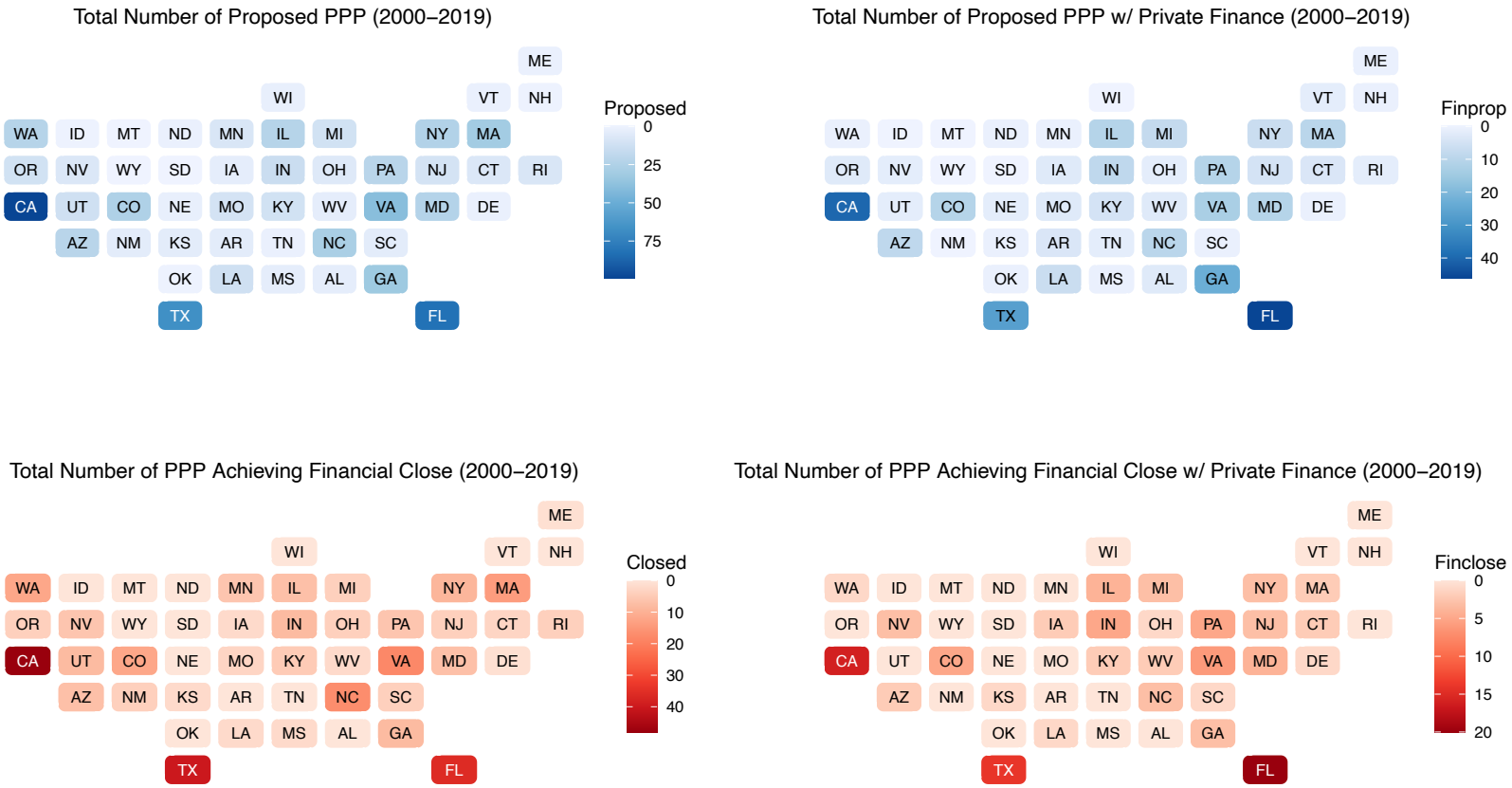


Figure 7: The Total Number of PPP in the Continental U.S. States

5.1.2. Measuring PPP Formation

5.1.2.1. PPP Initiation vs. PPP Final Adoption.

PPP formation is a process that involves project initiation, negotiation, adjustment, and final adoption (Tan & Zhao, 2021; van Ham & Koppenjan, 2001). Initiation is just the first step of PPP formation. As *Figure 2* shows, between 2000 and 2019, 740 PPP projects were proposed, but only 320 (43%) achieved financial close. Some projects were canceled after launching and some are still in progress. "Financial close occurs when all the project and financing agreements have been signed, all conditions on those agreements have been met, and contractors can start drawing down the financing to start work on the project" (World Bank Group, 2017; Yescombe, 2007). In the U.S. infrastructure finance context, financial close indicates the final stage of PPP formation.

Previous research on PPP formation only focused on the projects reaching financial close but ignored the impetus behind project initiation. Based on the public choice and transaction cost theories, I argue the initiation of PPP only reflects the government's motivation to use PPP; the final adoption of the project involves additional inputs to overcome the transaction's cost barriers. These costs arise after the project is proposed during the formation process. For state governments with weak financial conditions, therein lies the dilemma. PPP may help them circumvent fiscal stress but, to get a deal done, they must allocate financial inputs in the short-term.

5.1.2.2. PPP with Private Finance vs. PPP with Bundled Contracts

The previously inconsistent findings in the literature can also be attributed to theoretical differences in the driving mechanisms for different *types* of PPPs. In this section, I will review the differences between PPP with private finance components and PPP with bundled contracts. As *Figure 1* shows, private-financed PPP include the DBF, LT-lease, and DBFO(M) contracts (under the horizontal line). As I discussed in Chapter 4, I hypothesize that governments with weaker financial conditions are associated with more private-financed PPP initiations.

Moreover, the transaction cost associated with the bundled PPP is much higher than the nonbundled PPP. I hypothesize that governments with sounder financial conditions are associated with more bundled PPP adoptions. To test this, I counted the PPP with bundled contracts, including DBO(M) and DBFO(M) (on the right side of the vertical line in *Figure 1*). I distinguished the forms of PPP in order to test and clarify the different governments' motivations behind PPP formation. Thus, I counted both the number of PPP with private finance and PPP without private finance in each year for each state. *Figures 8* and *9* show the numbers by state panels. In total, I measured six dependent variables in my analysis (See *Table 4*).

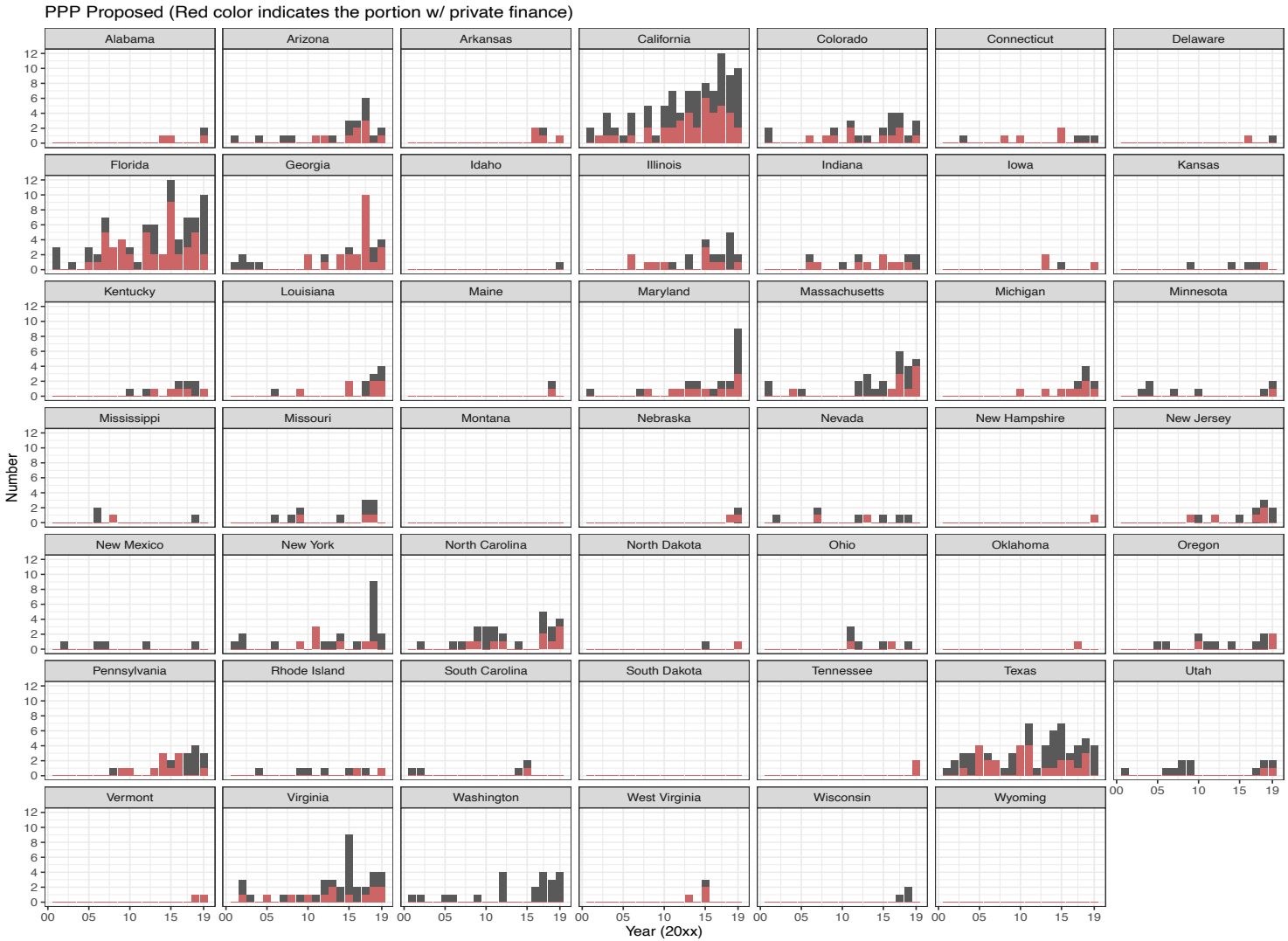


Figure 8: PPP Initiation by State by Year

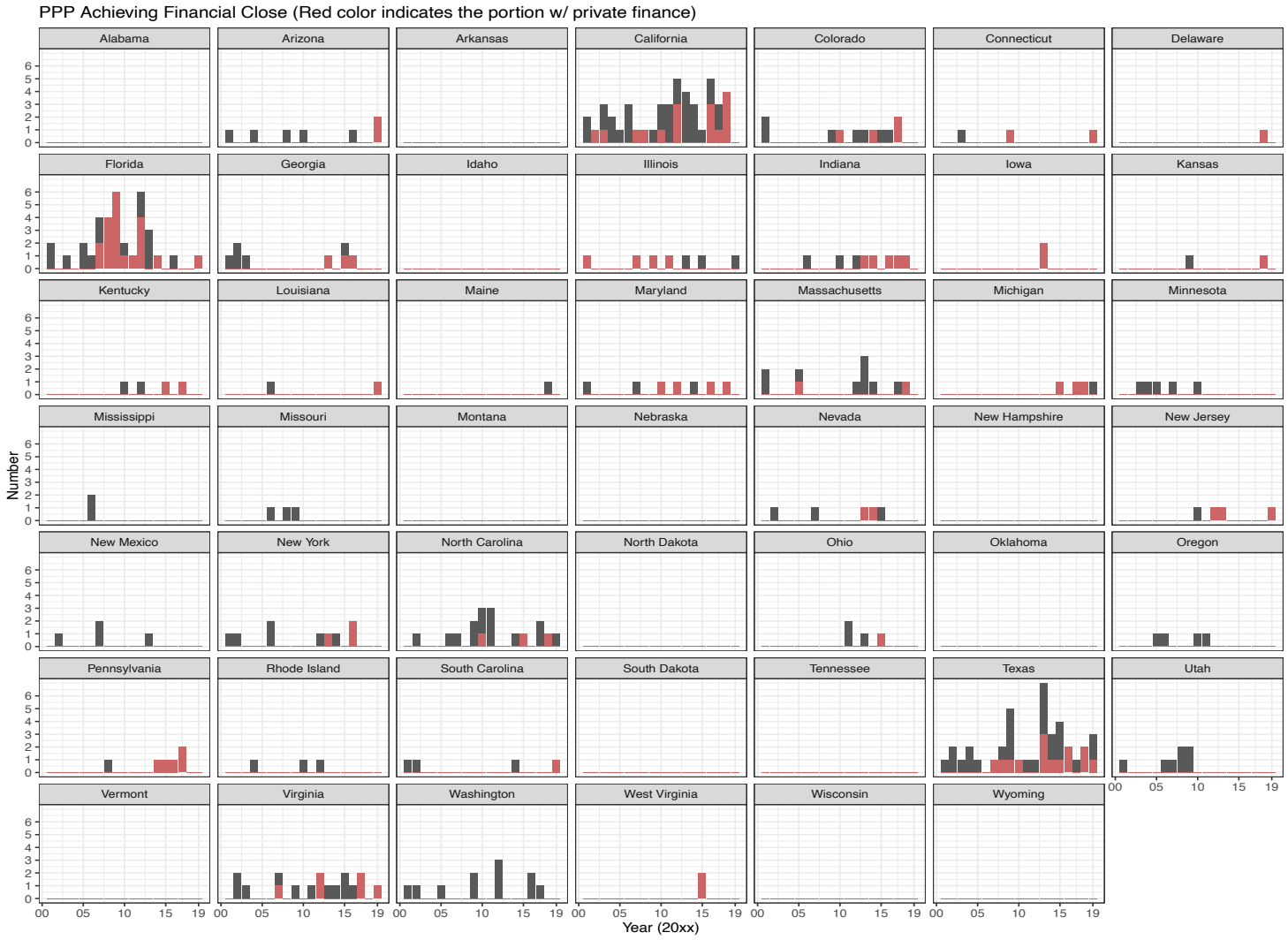


Figure 9: PPP Adoption by State and Year

5.1.3. Measuring State Government Financial Conditions

A number of definitions of state government financial condition have been proposed in the state budgeting literature. Previous literature often select and define their own terms to accommodate specific research purposes (X. Wang et al., 2007). In particular, the literature in examining the effect of state financial condition on PPP formation also use different measurements. For example, Z. Chen et al. (2014) used four state financial condition variables to indicate state fiscal constraints: "state's highway net balance, state debt per capita, highway indebtedness, and the 'cannot carry over deficit' law dummy" (p.125). They found there was "not enough empirical evidence to claim that a state's fiscal constraints affect the implementation of highway P3 projects" (Z. Chen et al., 2014, p. 125). In examining the adoption of toll road PPP among states, Y. Wang & Zhao (2014) used five variables: state revenue per capita, highway expenditure, debt as percentage of total revenue, debt limit dummy, and road fund debt limit dummy. They found significant negative relationships for all the variables except the existence of the state debt limit requirement. They explained that if a state has strong fiscal conditions, it is less likely to use PPP. PPP might be just a substitute for public funding.

Although there is no consensus on the best measurements, recent studies have used four solvency indicators to comprehensively measure state financial conditions; they are cash solvency, budgetary solvency, long-run solvency, and service-level solvency (X. Wang et al., 2007; Yu & Jennings, 2020).

First, cash solvency indicates liquidity (X. Wang et al., 2007). The ratio of total reserve balance in general fund expenditures is considered as an indicator of cash solvency (Gorina et al., 2018; Yu & Jennings, 2020). A larger ratio indicates more

liquidity and a stronger financial condition. Total reserve balance includes the end-of-year balances in the general fund and in the budget stabilization funds. I obtained the data from *Fiscal Survey of States* report of National Association of State Budget Officers (NASBO, n.d.) and Pew's *Fiscal 50* report (Pew Charitable Trusts, 2020). Because all the states' Comprehensive Annual Financial Reports (CAFRs) are not accessible for the years before 2000 and given the 1999 changes to GASB 34 (Yu & Jennings, 2020), I only included data from 2000 to 2019. I expected those states with larger ratios to initiate fewer private-financed PPPs and to adopt more bundled PPPs.

Second, budgetary solvency measures the ability of a state to generate revenues to meet its expenditure demand (Jimenez, 2020). It is often measured by the total budget balance per capita. A higher level of budget balance indicates a stronger financial condition. The data comes from the U.S. Census Bureau's *Annual Survey of State and Local Government Finances*. I obtained it from a secondary source made available by Pierson et al. (2015). I expected those states with higher budget balances per capita to initiate fewer private-financed PPPs and to adopt more bundled PPPs.

Third, state government debt outstanding per capita is a common measure for state long-run solvency (Gorina et al., 2018). A higher level of debt outstanding indicates the state has to pay more long-term obligations with future resources and usually implies a poor financial condition (Kloha et al., 2005). The data is from Pierson et al. (2015). I expected those states with higher debt outstanding per capita to initiate more private-financed PPPs and to adopt fewer bundled PPPs.

Fourth, the state service-level solvency measures the state's "ability to provide and sustain a service level that citizens require and desire"(X. Wang et al., 2007, p. 4). It

is measured by total government expenditure per capita because "higher expenses per capita indicate a more expensive government and lower service-level solvency to sustain that expense level" (X. Wang et al., 2007, p. 9). The data was also obtained from Pierson et al. (2015). I expected those states with higher total government expenditures per capita to initiate more private-financed PPPs and to adopt fewer bundled PPPs.

5.1.4. Control Variables

As suggested by previous literature on PPP formation, I controlled for four groups of variables. First, I controlled for political factors, including the party affiliation of the state's governor and party competition, if any, between the legislative and administrative branches. As Democrats generally favor "big government" compared to Republicans, and their left-wing ideology is commonly associated with more confidence in in-house public service delivery, I hypothesized that states with Democratic governors are associated with fewer PPP. When political power is unified in one party among the state's Senate, House, and Governor, then the state's budget and programs are more easily passed. Such states may have less demand for fiscal circumvention including using private capital through PPP. However, when power is divided, I expected incumbent administrators might find alternate ways to finance infrastructure if the public budget is not sufficient. Thus, I hypothesized that states with divided governments are associated with more PPP.

Second, I controlled for the state's institutional capacity, including the state's PPP legal framework, human resource capacity, and financial management capacity. In the U.S., a state-level PPP enabling law ensures PPP legitimacy and policy consistency over time and signals a government's commitment to engaging PPPs (Casady et al., 2020; Verhoest et al., 2015). As I discussed in Chapter 3, the 50 states vary widely in how they

enable and limit state and local agencies' participation in PPP (National Conference of State Legislatures, 2015, 2017). I coded each state's laws based on three features: statute comprehensiveness, the level of government being enabled, and the service sectors (transportation vs. multi-sector) being enabled. The higher the score for the PPP enabling law, the more open the state's legal framework is to using PPP. I hypothesized that the states with higher PPP enabling law scores are associated with more PPP.

State human resource is measured through the number of state public employees (natural log transformed). When states have more human capital, they are more likely to overcome the transaction cost barriers to develop PPP deals. Thus, I expected those states with more state public employees to be associated with more PPP.

In addition, a state 's credit rating shows an overall evaluation of its fiscal policy and management capacity as perceived by the capital market (Krueger & Walker, 2010; Yu & Jennings, 2020). I used the rating scores given by S&P Global Ratings (2020). The ratings range from BBB- to AAA. All the states' ratings are covered by the ten levels between 2000 and 2019. I coded AAA, AA+, AA, AA−, A+, A, A−, BBB+, BBB, and BBB− as 10, 9, 8, … and 1 respectively. A larger number means a better rating. I expected those states with better ratings to initiate less private-financed PPPs and to adopt more bundled PPPs.

Third, I controlled for infrastructure demand, including median household income (natural log transformed), GSP growth rate, and unemployment rate. According to the median voter theory, median household income is highly related to the residents' demands for public goods and services (C. Chen, 2016; C. Chen et al., 2019). GSP growth rate and unemployment rate are common measures of a state's overall economic

performance. I expected those states with faster economic growth or lower unemployment rates to be associated with higher infrastructure demand, which creates an economic inducement for PPP formation.

Fourth, I also controlled for the effect of interest groups on PPP formation. Literature from political science, economics, and public administration attempt to explain the influence of interest groups on policy agenda setting (Bonafont, 2016). Political scientists[8] claim the political process is primarily determined by those groups which seek to advance their interests through politics. Economists, particularly public choice theorists such as Mancur Olson, argue that interest groups are rent-seeking political actors who influence policymaking based on their calculation of benefits and costs. As the transportation and warehousing sectors highly depend on the quantality and quality of infrastructure, those industries may advocate for more capital projects including PPP in the agenda setting stage.

An alternative line of literature is from public administration's governance theory where interests groups are viewed as stakeholders in the governance network (Ansell & Gash, 2008). In seeking to advance their own interests, those groups collaborate with other stakeholders (e.g., legislators, public managers, and citizens) to govern public problems. In this context, the finance and construction industries are important participants of the PPP market. I expected those states with strong finance and construction industries to be associated with more PPP adoptions.

[8] Political scientists here primarily refer to the earlier "group theorists" such as Arthur Bentley and David Truman and the later "pluralistic theorists" such as Robert Dahl and Charles Lindblom.

Table 4 shows the variables and descriptive statistics. All the independent variables are lagged one year except for the controls for political variables and PPP law scores, where the effects are considered immediate within the year. Lagging one year serves two purposes: 1) to capture the delayed effects on PPP formation, and 2) to deal with the fiscal-calendar year mismatch of the fiscal stress variables.

Table 4: Variable Names and Descriptive Statistics

Variable Name	Variable Description	Obs	Mean	Min	Max
Dependent Variables:					
Initiation	Number of proposed PPP	912	0.796	0	12
Private-financed Initiation	Number of proposed PPP w/ private finance	912	0.338	0	10
Bundled Initiation	Number of proposed PPP w/ bundled contracts	912	0.338	0	6
Adoption	Number of PPP achieving financial close	912	0.336	0	7
Private-financed Adoption	Number of PPP achieving financial close w/ private finance	912	0.123	0	6
Bundled Adoption	Number of PPP achieving financial close w/ bundled contracts	912	0.141	0	4
Financial Condition Variables:					
Cash Solvency	Total Fund Balances / General Fund Expenditures	912	0.098	-0.185	1.097
Budgetary Solvency	(Total Revenues - Total Expenditures) / Population, in 2019$, lag one year	912	0.155	-5.873	9.611
Debt Per Capita (Long-run solvency)	Debt Outstanding / Population, in 2019$, lag one year	912	3.256	0.579	12.354
Service-level Solvency	ln (Total Expenditures / Population), in 2019$, lag one year	912	1.933	1.438	2.593
Political Variables:					
Democratic Governor	Dummy: coded as 1 if the state has a Democratic governor, otherwise 0	912	0.435	0	1
Divided Government	Dummy: coded as 1 if all three institutions of state government (the two chambers of the legislature and the governor's office) are not controlled by the same party, otherwise 0	893[1]	0.445	0	1
Institutional Capacity:					
PPP Law	PPP enabling law score (openness) (1-10 larger value means more open to PPP, see Chapter 3 for details)	912	4.252	0	10
State Public Employment	ln (Number of state public employees), lag one year	912	11.266	9.534	13.218

Credit Rating	SP State Credit Rating (10 = AAA, 9 = AA+, 8 = AA, ..., 1=BBB-), lag one year	900[2]	8.454	1	10
Infrastructure Demand:					
Median Household Income	ln (Median household income), in 2019$, lag one year	912	10.994	10.479	11.384
Unemployment	Unemployment rate, lag one year	912	5.586	2.30	13.70
GSP Growth	GSP growth rate, lag one year	912	0.018	-0.149	0.220
Interest-groups Variables					
Finance Industry Power	Finance and Insurance Employment (NAICS-52) / Total Employment, lag one year	912	0.049	0.029	0.105
Construction Industry Power	Construction Employment (NAICS-23) / Total Employment, lag one year	908[3]	0.059	0.041	0.102
Transportation Industry Power	Transportation and Warehousing Employment (NAICS-48) / Total Employment, lag one year	908[4]	0.033	0.019	0.058

Year: 2001-2019; States: 48 (excluding Hawaii and Alaska)
1. The Nebraska legislature is unicameral and officially recognizes no party affiliation.
2. Observations Missing: South Dakota (2001-2006); Nebraska (2001), Iowa (2001), Idaho (2001), Colorado (2001), Arizona (2001-2002)
3. Observations Missing: Delaware (2006), Rhode Island (2003, 2018), Wyoming (2003).
4. Observations Missing: Rhode Island (2002-03), Wyoming (2002-03).

5.2. Regression Model Specifications

For the count models for the panel data, the starting point was the Poisson regression models with conditional fixed-effects or random effects (Cameron & Trivedi, 2014). To control for the over-dispersion issues, I also estimated negative binomial models. Results obtained from the negative binomial and Poisson models are mostly similar in terms of statistical and substantive significance. I ran Hausman specification texts to help me choose between the fixed effects versus random effects models. For the models of PPP initiation, the results suggest using fixed effects. Whereas for the PPP adoption models, the results suggest using random effects.

5.3. Regression Results

5.3.1. The Effects on PPP Initiation vs. PPP Adoption

Table 5 shows the results of the Negative Binominal Regression (NBR) estimations and Poisson Regression estimations. Most of the results are consistent between the two estimation methods. Models (1) and (2) estimate the effects on PPP Initiation (the number of proposed PPP in a state). Models (3) and (4) estimate the effects on PPP Adoption (the number of PPP reaching financial close in a state). The fixed-effects estimators were calculated for the PPP initiation models, whereas random-effects estimators were calculated for the PPP adoption models. The choice between fixed and random effects was informed by the Hausman tests.

Table 5: The Effects of State Financial Conditions on PPP Initiation and Adoption

	(1)	(2)	(3)	(4)
VARIABLES	PPP Initiation	PPP Initiation	PPP Adoption	PPP Adoption
State Financial Conditions:				
Cash Solvency	-0.0271	0.0534	0.678	0.604
	(0.909)	(1.007)	(1.059)	(1.047)
Budgetary Solvency	0.0156	0.0118	0.0332	0.0289
	(0.0427)	(0.0504)	(0.0690)	(0.0600)
Debt per capita	0.468***	0.467***	0.0939***	0.0942*
	(0.121)	(0.105)	(0.0362)	(0.0497)
Service-level Solvency	0.922	0.685	-0.708	-0.782*
	(0.680)	(0.675)	(0.470)	(0.475)
Political Controls:				
Democratic Governor	0.0117	-0.0142	0.111	0.110
	(0.182)	(0.126)	(0.179)	(0.138)
Divided Government	0.208	0.216*	0.143	0.151
	(0.141)	(0.112)	(0.161)	(0.140)
Institutional Capacity Controls:				
PPP Law	0.0735**	0.0748***	0.0905***	0.0928***
	(0.0333)	(0.0282)	(0.0215)	(0.0219)
State Public Employment	-0.476	0.0445	1.407***	1.396***
	(1.080)	(0.676)	(0.128)	(0.111)
Credit Rating	-0.0263	-0.0242	0.0925**	0.0894*
	(0.0511)	(0.0556)	(0.0384)	(0.0460)
Infrastructure Demand Controls:				
Median Household Income	-1.589	-1.484	0.448	0.559
	(1.027)	(1.102)	(0.613)	(0.618)

Unemployment	-0.134**	-0.138***	0.105**	0.108**
	(0.0534)	(0.0480)	(0.0451)	(0.0425)
GSP Growth	-0.508	-0.583	-0.890	-0.718
	(1.843)	(2.018)	(4.369)	(2.595)
Interest-groups Controls:				
Finance Industry Power	17.99	25.36	13.15**	13.49*
	(26.04)	(21.49)	(6.275)	(7.122)
Construction Industry Power	-26.72**	-23.59**	24.46**	24.02**
	(12.94)	(11.22)	(11.88)	(9.404)
Transportation Industry Power	52.44***	51.16***	-18.41	-17.39
	(15.80)	(15.25)	(11.55)	(11.98)
Observations	827	827	876	876
Number of States	44[1]	44[1]	47[2]	47[2]
Model Specification	FE-Poisson	FE-NBR	RE-Poisson	RE-NBR

Robust standard errors in parentheses for Model (1) (3); Standard errors in parentheses for Model (2) (4)
*** p<0.01, ** p<0.05, * p<0.1
1. Three states (Montana, South Dakota, Wyoming) were dropped as their outcomes are all zeros (See Figure 7). In non-linear models, the fixed effects estimate the conditional likelihood estimator which can be only used for the observations where the outcome varies within groups. Nebraska is dropped due to missing data in Divided Government.
2. Nebraska was dropped due to missing data in Divided Government.

I found state cash solvency and budgetary solvency have no effect on the counts of either the initiation or the adoption of PPP. This shows that short-term solvency measures may not relate to long-term PPP decisions. However, states with higher levels of debt outstanding per capita are associated with proposing and adopting more PPP. It indicates those states facing severe debt stress may choose to use PPP as a circumvention alternative to preserve long-term solvency (Buso et al., 2017; Tan & Zhao, 2019). As the public choice theory suggests, debt hiding may be a key motivation for public officials to use PPP.

I also found the state's total expenditures per capita is negatively related to the number of PPP adoptions, even though it is only significant in the NBR model. As higher expenditures per capita means lower service-level solvency and a more expensive

government, this result indicates an expensive government is associated with adopting fewer PPP. When governments can spend by themselves, there is less motivation for them to use PPP.

In terms of the control variables, the results are also important. The openness score of the state's PPP enabling law is positively related to its number of PPP initiations and adoptions, reinforcing the criticality of a favorable legal environment for PPP formation in both stages. Moreover, states with more state public employees and better credit ratings are associated with more PPP that can reach financial close but not related to the number of PPP initiation. Again, this reflects the transaction cost perspective; governments with stronger human capacity are more capable of landing PPP deals.

The controls for infrastructure demand perform differently in the PPP initiation models versus the PPP adoption models. This further highlights the difference between the motivating factors behind PPP initiation and the capacity to actually adopt PPP. For example, states with higher unemployment rates adopted more PPP but proposed fewer. Economic pressure from the private sector may limit the launch of PPP as fewer private firms participate in the market, but PPP adoption may increase because these governments may construct more infrastructure projects to spur their economies and increase hiring.

For interest group controls, I found those states with stronger finance and construction industry power are associated with more PPP that can reach financial close, even though construction industry power is negatively associated with PPP initiation. Whereas the transportation industry power is associated with more PPP initiation, it is not statistically related to PPP adoption. The transportation industry depends on the quality of

infrastructure. Thus, trucking, shipping, and logistics firms are highly likely to advocate for more infrastructure projects including PPP. However, whether a large amount of PPP can achieve financial close depends on private markets. If a state's finance and construction markets are relatively small, the number of PPP adoptions will also be relatively small. Thus, my results indicate those industries that highly depend on the quality and quantality of infrastructure may act as interest-group rent seekers (Berg et al., 2018) and advocate for PPP agenda setting. But, those industries that participate in the construction and finance of PPP may act as "productive interest groups" or interest-group stakeholders (Bingham et al., 2005).

5.3.2. Comparing the Factors of PPP with Private Finance and PPP with Bundled Contracts

Table 6 shows the results of the NBR estimations. I also ran panel Poisson regression models as robustness checks. The results are consistent. To control for the possible over-dispersion issue, I ran NBR as well. Models (5) and (7) estimate the effects on PPP initiation and adoption with private finance. Models (6) and (8) estimate the effects on PPP initiation and adoption with bundled contracts. The fixed-effects estimators were calculated for the PPP initiation models, whereas the random-effects estimators were calculated for the PPP adoption models. The choice between fixed and random effects was informed by the Hausman tests and data limitations (See Chapter 5).

Table 6: Comparing the Factors of PPP with Private Finance and PPP with Bundled Contracts

VARIABLES	(5) PPP Initiation w/ Private Finance	(6) PPP Initiation w/ Bundled Contracts	(7) PPP Adoption w/ Private Finance	(8) PPP Adoption w/ Bundled Contracts
State Financial Conditions:				
Cash Solvency	-1.227	-0.322	0.138	0.972
	(1.631)	(1.425)	(1.875)	(1.589)
Budgetary Solvency	0.0551	0.00768	0.119	-0.0362
	(0.0800)	(0.0735)	(0.118)	(0.0894)
Debt per capita	0.672***	0.190	0.147*	0.0689
	(0.189)	(0.147)	(0.0815)	(0.0705)
Service-level Solvency	2.058*	1.538	-0.324	-0.598
	(1.074)	(0.987)	(0.778)	(0.694)
Political Controls:				
Democratic Governor	-0.0522	0.00433	-0.147	-0.0861
	(0.191)	(0.177)	(0.252)	(0.208)
Divided Government	0.114	0.107	-0.0576	0.0628
	(0.177)	(0.166)	(0.260)	(0.216)
Institutional Capacity Controls:				
PPP Law	0.0905**	0.108***	0.184***	0.116***
	(0.0442)	(0.0408)	(0.0431)	(0.0342)
State Public Employment	0.120	-1.076	1.457***	1.441***
	(1.034)	(1.181)	(0.204)	(0.166)
Credit Rating	0.0550	0.0263	0.165**	0.0329
	(0.0821)	(0.0779)	(0.0807)	(0.0657)
Infrastructure Demand Controls:				
Median Household Income	-0.145	-0.885	0.128	0.983
	(1.766)	(1.617)	(1.148)	(0.977)
Unemployment	-0.211***	-0.136**	0.0109	-0.0264
	(0.0742)	(0.0679)	(0.0744)	(0.0659)
GSP Growth	0.487	3.327	-11.84**	-4.915
	(3.153)	(2.872)	(4.686)	(3.967)
Interest-groups Controls:				
Finance Industry Power	40.02	18.14	27.81**	23.61**
	(32.24)	(30.80)	(11.76)	(10.41)
Construction Industry Power	-43.63**	-40.90**	-1.177	-7.940
	(18.10)	(16.66)	(18.39)	(15.10)
Transportation Industry Power	-4.428	14.28	31.15	-9.135
	(23.34)	(22.47)	(19.02)	(16.74)
Observations	752	752	876	876
Number of States	40	40	47	47
Model Specification	FE-NBR	FE-NBR	RE-NBR	RE-NBR

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

In this subsection, I highlight the variables' effects on PPP with Private Finance and PPP with Bundled Contracts. As my findings show, those states facing higher debt had more proposed and adopted private-financed PPP projects. However, debt stress does not affect PPP with bundled contracts. State total expenditure per capita also affects the number of proposed PPP with private finance but not bundled PPP. State credit rating affects the number of adopted PPP with private finance but not bundled PPP. These results show that state fiscal stress measurements, including long-run and service-level solvency, are significantly related to the initiation or adoption of private-financed PPP but are not significantly related to the PPP with bundled contracts. I also found GSP growth rate is negatively related to the adoption of private-financed PPP but not associated with bundled PPP.

6. Choosing Among Action Strategies: A fuzzy-set QCA

This chapter reports the empirical analysis for the second question regarding PPP management. I also examine the configurational effects of governments' supporting strategies on private capital engagement in PPP.

6.1. Method: Fuzzy-set QCA

Qualitative Comparative Analysis (QCA) is a set-theoretic method for data analysis (Schneider & Wagemann, 2012). Introduced by Ragin in 1987, its initial purpose was to deal with small- or intermediate-N research designs in sociology studies (Ragin, 2014). In recent years, an increasing number of public administration (PA) studies have opted to use this strategy (Kitchener et al., 2002; Rihoux et al., 2011), with several applying it to studies of PPPs (Casady, 2020; Soecipto & Verhoest, 2018; Warsen et al., 2019). QCA applies to PA research because many PA hypotheses or statements entail set-

theoretic relationships, and many relevant units of analysis are "naturally limited in number," such as countries, states, or governments (Rihoux et al., 2011). The strengths and weaknesses of this methodology have been well discussed in previous PA literature; therefore, we will not elaborate on the method's background.

I chose to use QCA for three major reasons. First, my research questions are set-theoretic. I am examining the necessary and sufficient conditions for private investment in PPPs. Second, my research aim is to test how different configurations of public support strategies affect private capital investment. QCA is well suited to exploring combinations of conditions (Schneider & Wagemann, 2012). Third, I have an intermediate sample size (33), which fits within the appropriate range for QCA. In the following section, I introduce the empirical setting, with a focus on how those cases are identified. I also present the calibration process and the QCA findings.

6.1.1. Empirical Setting and Case Selection

I first obtained a full list of U.S. PPP projects from my U.S. PPP database. For QCA analysis, the sample cases should be homogeneous in relation to background characteristics (Schneider & Wagemann, 2012). Thus, I only selected motorway greenfield projects sponsored by state-level agencies. Airports, water and sewer facilities, and public building projects were not included. Projects sponsored by local governments or regional transportation authorities were also excluded because they have a different set of tools for PPPs. Since my research focuses on the impact of governmental support on private investment in PPPs, I also excluded any projects without a private finance component. This process resulted in a sample of 33 projects. *Appendix I* lists the projects. The project-level financial data were collected by manually coding project profiles from

the data sources. When project profile data were missing, I obtained them from the website of the relevant state transportation agency.

6.1.2. Calibrating the Outcome

In QCA, calibration is a process assigning set membership scores to cases. In Fuzzy-set QCA (fsQCA), each case is given a score between zero and one for each of the conditions and the outcome. It is therefore important to define the three qualitative anchors of the membership score: "the complete presence of a concept (1), its complete absence (0), and the point of indifference (0.5)" (Schneider & Wagemann, 2012). Those anchor values should be determined based on case knowledge and empirical distribution (Schneider & Wagemann, 2012). When the three anchors are properly defined, the difference in set-membership scores using different calibration methods (simple recoding, direct calibration using a logistic function, and indirect calibration using regression-predicted values) "will not be of major substantive importance" (Schneider & Wagemann, 2012). In this research, I used both simple recoding and direct calibration methods where interval or scale variables were in hand. The QCA findings are consistent for both methods. Thus, I only report the findings with direct calibration using a logistic function.

I calibrated the "PCP" (private capital) outcome based on the total private capital amount: the sum of private equity investment, private bonds, and loans borrowed from commercial banks and other financial institutions. Typically, the private sector invests in PPPs via these three financing vehicles (DeCorla-Souza & Ham, 2016). The total dollar amount directly reflects the level of private capital involvement. I defined the three anchors as: total private capital amount = $1 million (complete absence anchor, no

significant private investment present if the amount is smaller than $1 million); total private capital amount = $300 million (indifference anchor); and total private capital amount = $500 million (complete presence anchor, a very high level of private capital). These anchor values were determined based on case knowledge and empirical distribution (Schneider & Wagemann, 2012). I considered a project with more than $300 million of private capital to be included in the set of high private investment cases. 15 of the 33 projects are above this point. The membership score was assigned using a direct calibration method with a logistic function using R packages *QCA 3.7* (Duşa, 2019). The set membership score with the actual total private capital amount is plotted in *Figure 10*.

6.1.3. Calibrating the Conditions

I have identified three broad types of government support: financial support, revenue payback support, and institutional support. To fit my empirical setting, I found that financial support can be represented by three supporting programs: direct government support, indirect support through the Transportation Infrastructure Finance and Innovation Act (TIFIA) credit assistance, and indirect support through private activity bonds (PABs).

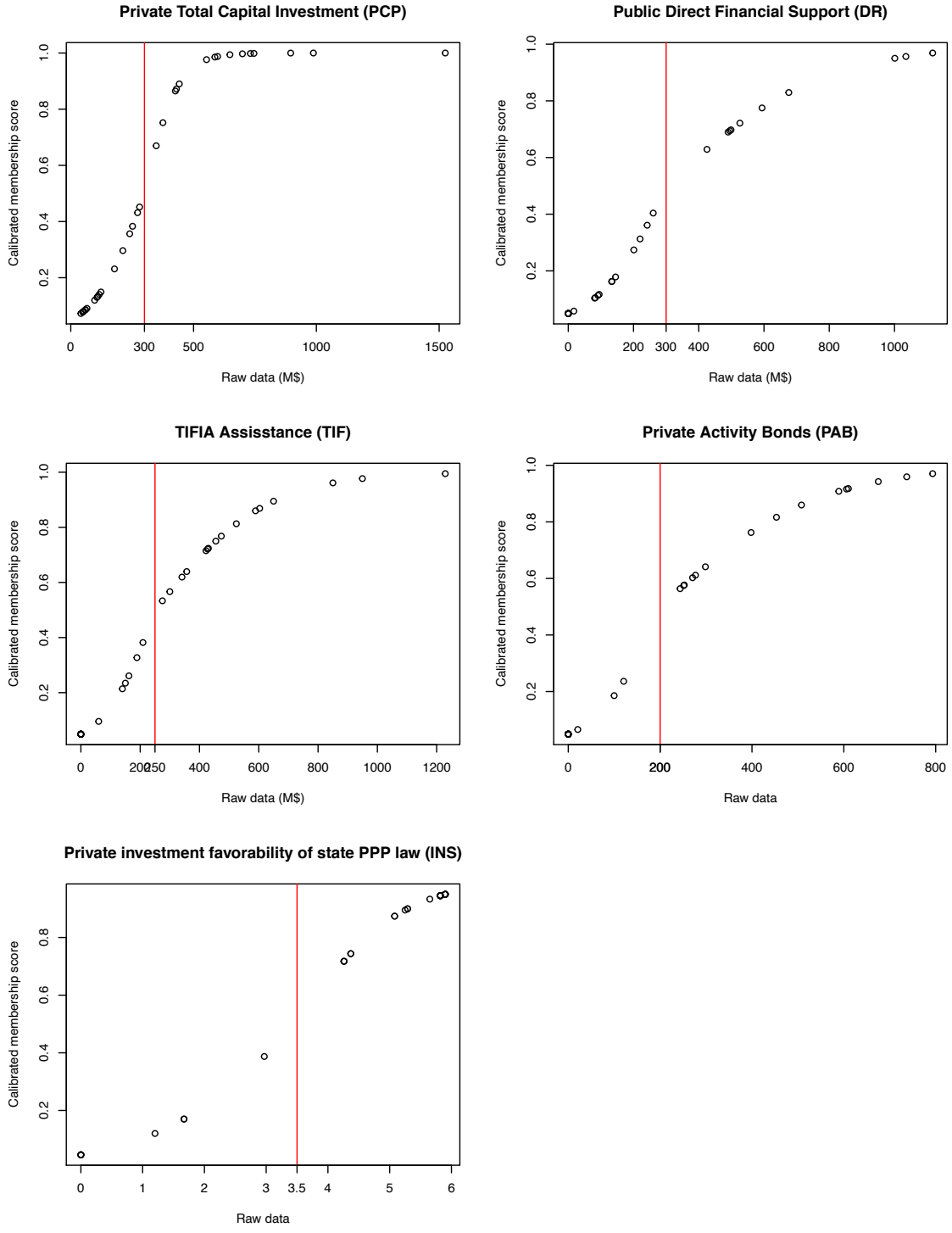


Figure 10: Calibration Plots
(Red lines denotes the cross-over points.)

6.1.3.1. Financial support conditions: DR, TIF, PAB.

Federal, state, and local governments can provide direct cash support through capital subsidies or operational subsidies. Those amounts usually come from governments' capital budgets or operating budgets. In my sample of 33 state-sponsored motorway projects, 22 projects received direct subsidies from governments, representing the most widely used financial support approach.

PPP projects can access loans through various credit assistance programs provided by federal and state governments. Those programs often allow more flexible repayment terms, larger credit amounts, and more favorable interest rates than those offered by private capital markets. The most widely used credit assistance tool for PPP motorway projects is the TIFIA program (U.S. Federal Highway Administration, 2016). The program particularly encourages private participation, and private firms are eligible borrowers (U.S. Department of Transportation, n.d.). In my sample, 22 projects accessed TIFIA credits. Although several other credit assistance tools are available[9], they are infrequently used for PPP motorway projects.

The Tax Reform Act of 1986 permits certain private activity bonds (PABs) to be tax-exempt, "allowing private project sponsor to benefit from the lower financing costs of tax-exempt municipal bonds" (FHWA, n.d.). This bond program particularly shows the federal government's support for increasing private investment in infrastructure. The total amount of PABs is capped at $15 billion by law, and the U.S. Department of

[9] Various federal credit assistance tools are listed at: https://www.fhwa.dot.gov/ipd/finance/tools_programs/federal_credit_assistance/.

Transportation (USDOT) allocates this amount across qualified facilities (U.S. Department of Transportation, 2020). In my sample, 18 projects used PABs.

Thus, I acknowledged three types of government financial support: 1) direct government support (DR); 2) TIFIA credit assistance support (TIF); and 3) PAB tax-exempted bond support (PAB). The three financial conditions were calibrated to fuzzy memberships based on the dollar amount of each investment in a project. The anchor values were determined based on case knowledge and empirical distribution. The processes are similar to the calibration process of the outcome. The details of the calibration of each condition are provided in *Appendix II*. *Figure 10* shows the plots with the original data and membership scores.

6.1.3.2. Revenue payback support condition: AVA.

Governments can use the availability payment mechanism to absorb the revenue risk for private investors (Chauhan & Marisetty, 2019). The availability payment (AVA) condition is a crisp set membership (0 or 1), as it is a dummy concept indicating whether a project used the availability payment mechanism.

6.1.3.3. Institutional support condition: INS.

The final condition, institutional support (INS), was coded based on Geddes and Wagner's (2013) index of private investment favorability of state PPP enabling laws. These authors developed an index reflecting "the degree to which a state's law is encouraging or discouraging of private infrastructure investment" (Geddes & Wagner, 2013, p. 30), based on survey-weighted enabling scores for 13 key provisions of a state's PPP laws. For example, if a state's PPP laws explicitly exempt the private entity from paying property taxes on the land required to operate the PPP facility, then a survey-

weighted positive score (0.47) is assigned to the state. If a state's laws limit the number of projects that can be developed under the PPP approach, then a negative score (-0.54) is assigned to the state. I updated the score for each state to the year 2019. With those in place, I used the index to calibrate fuzzy membership for the private investment favorability of the state PPP legal frameworks. The detail of the calibration of each condition is provided in *Appendix II*. *Figure 10* shows the plots with the original data and membership scores.

6.2. Results from fsQCA

6.2.1. Necessary Conditions for Private Investment

Analyses of necessity should precede analyses of sufficiency (Ragin, 2014). The first task is to determine whether there is a single condition, or a combination of conditions, necessary in projects with high private investment. The necessary conditions may not be sufficient to produce the outcome on their own, but they are important because the outcome can only be triggered by the presence of the necessary conditions (Duşa, 2019). In other words, there should be no case in which the outcome is present, but the condition is absent. With fuzzy-set membership, each case's membership score in the condition set (X) must be equal to or larger than its fuzzy-set membership in the outcome set (Y), or $X \geq Y$ (Schneider & Wagemann, 2012, p. 67).

Following Schneider and Wagemann's (2012) suggested recipe for a good QCA, a threshold of 0.9 is used for the consistency parameter. I conclude that no single condition is consistently necessary for the outcome (see *Table 7*). This indicates that none of the governmental support mechanisms is individually necessary for high private investment in PPPs.

Table 7: Analysis of Necessity for High Private Investment

Condition	Consistency	Coverage	RoN
Total direct financial support (DR)	0.35	0.57	0.83
Tax-exempt Private Activity Bonds (PABs)	0.45	0.61	0.80
TIFIA credit assistance (TIF)	0.67	0.81	0.87
Private investment favorability of state PPP law (INS)	0.84	0.65	0.57
Availability Payments (AVA)	0.24	0.35	0.73
Absence of Total direct financial support (~DR)	0.78	0.61	0.56
Absence of Tax-exempt Private Activity Bonds (~PABs)	0.69	0.60	0.61
Absence of TIFIA credit assistance (~TIF)	0.51	0.48	0.60
Absence of Private investment favorability (~INS)	0.29	0.48	0.80
Absence of Availability Payments (~AVA)	0.76	0.63	0.61

The above necessity tests only focus on individual conditions. The next task is to explore every possible conjunction and disjunction of conditions necessary for leveraging high private investment, using the superSubset function in R (Oana & Schneider, 2018). The result shows no conjunctions or disjunctions of conditions necessary for the outcome at the threshold of 0.9, the consistency parameter.

6.2.2. Sufficient Conditions for Private Investment

Having completed the necessity analysis, a sufficiency analysis was conducted. A condition is considered sufficient if, whenever the condition is present, the outcome is also present. In other words, there should be no case in which the condition is present, but the outcome is absent. For fuzzy-set analysis, each case's membership score in the condition set (X) must be equal to or smaller than its fuzzy-set membership in outcome set (Y), or $X \leq Y$ (Schneider & Wagemann, 2012).

The truth table is central in sufficiency analysis (Thiem & Duşa, 2013). It displays all possible combinations of conditions and their matched cases. The truth table helps to

determine which combinations of public support mechanisms are sufficient to leverage high private investment. I used an *incl* (sufficiency inclusion score) threshold of 0.8, and an *n* (number of cases in configuration) threshold of 1, as suggested by Schneider and Wagemann (2012). *Table 8* is a truth table for the outcome "high private investment."

Table 8: Truth Table for the Outcome "High Private Investment"

Row #	DR	TIF	PAB	INS	AVA	OUT	n	incl	PRI	cases
7	0	0	1	1	0	1	1	1	1	VA8
15	0	1	1	1	0	1	4	0.975	0.955	VA5,TX9,TX15,VA9
11	0	1	0	1	0	1	2	0.945	0.9	TX4,TX3
31	1	1	1	1	0	1	4	0.922	0.865	VA3,TX6,TX5,VA4
12	0	1	0	1	1	1	2	0.864	0.809	FL4,FL3
3	0	0	0	1	0	1	3	0.823	0.724	CO3,GA2,VA7
27	1	1	0	1	0	0	1	0.775	0.512	GA1
28	1	1	0	1	1	0	2	0.696	0.599	FL6,CO5
1	0	0	0	0	0	0	5	0.605	0.39	VA1,NJ1,SC1,CA1,NC3
30	1	1	1	0	1	0	1	0.575	0.176	NY1
19	1	0	0	1	0	0	1	0.527	0.215	TX13
2	0	0	0	0	1	0	2	0.497	0.225	CA2,MI1
6	0	0	1	0	1	0	1	0.452	0.085	MI2
24	1	0	1	1	1	0	1	0.405	0.078	IN1
8	0	0	1	1	1	0	3	0.337	0.063	IN2,OH1,PA1
4	0	0	0	1	1	?	0	-	-	
5	0	0	1	0	0	?	0	-	-	
9	0	1	0	0	0	?	0	-	-	

Note: 14 more rows are omitted due to the lack of actual cases in the configurations.

Initially, I had six rows that passed both thresholds (above the dashed line in Table 5). However, further examination of the XY plots (rows against the outcome) revealed three deviant cases appearing in rows #15, #31, and #3 (see *Figure 11*). Those rows contain cases with both outcome (PCP) and the negation of outcome (~PCP), which are logically contradictory. Despite attempts to solve those rows by changing conditions

or calibration processes, the contradictions remain. Therefore, I dealt with those rows during the process of logical minimization (see Schneider & Wagemann, 2012).

Row #3 includes one deviant case: CO3. Its outcome membership is extremely low (PCP = 0.073), indicating conclusively that CO3 is not a member of the high private investment case set. Hence, I claimed row #3 is insufficient in terms of outcome and excluded it for logical minimization. Rows #15 and #31 include the deviant cases VA5 and VA4, respectively. Their outcome memberships are close to the crossover score (0.5). These cases fall just short of the high private investment set by a relatively small dollar amount (less than 10% of the indifference anchor). In addition, three out of four cases in those rows consistently present the outcome. The PRI (proportional reduction in inconsistency) scores in those rows are also very high (larger than 0.8), indicating that the simultaneous subset relations are very weak in those rows. Therefore, I decided to include rows #15 and #31 in the logical minimization process.

The five remaining configurations were minimized into solution formulas. The logical minimization process seeks to find the simplest possible path that can sufficiently lead to the outcome (Duşa, 2019). Here, I used the "conservative logical minimization" approach (Schneider & Wagemann, 2012) and found three paths for "high private investment", as shown in *Table 9*. Of all the cases with the outcome "high private investment", 60% can be explained by the solution M1 with three paths.

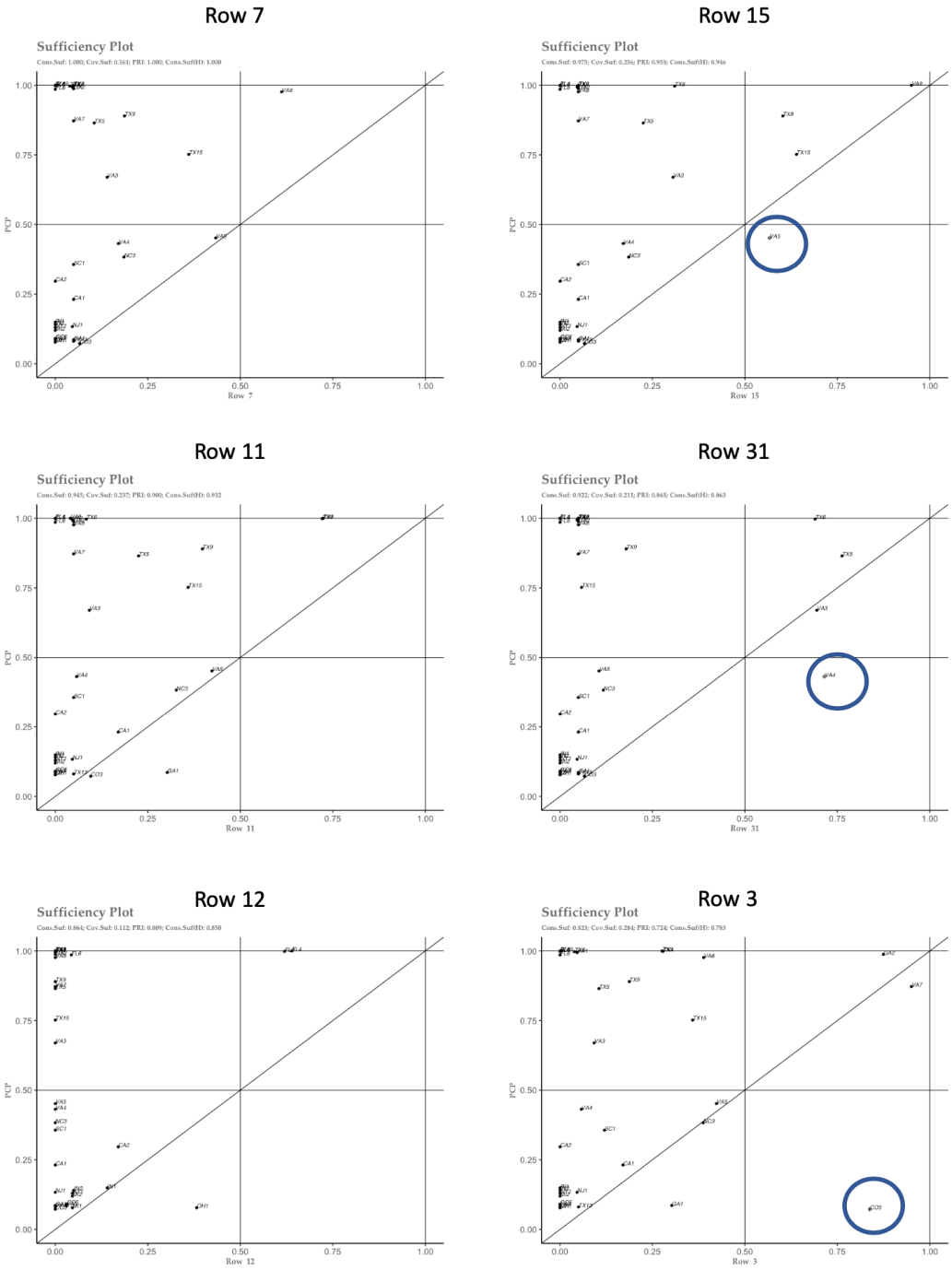


Figure 11: Truth Table XT Plots
(Blue circles denote the deviant cases.)

Table 9: Solution for High Private Investment

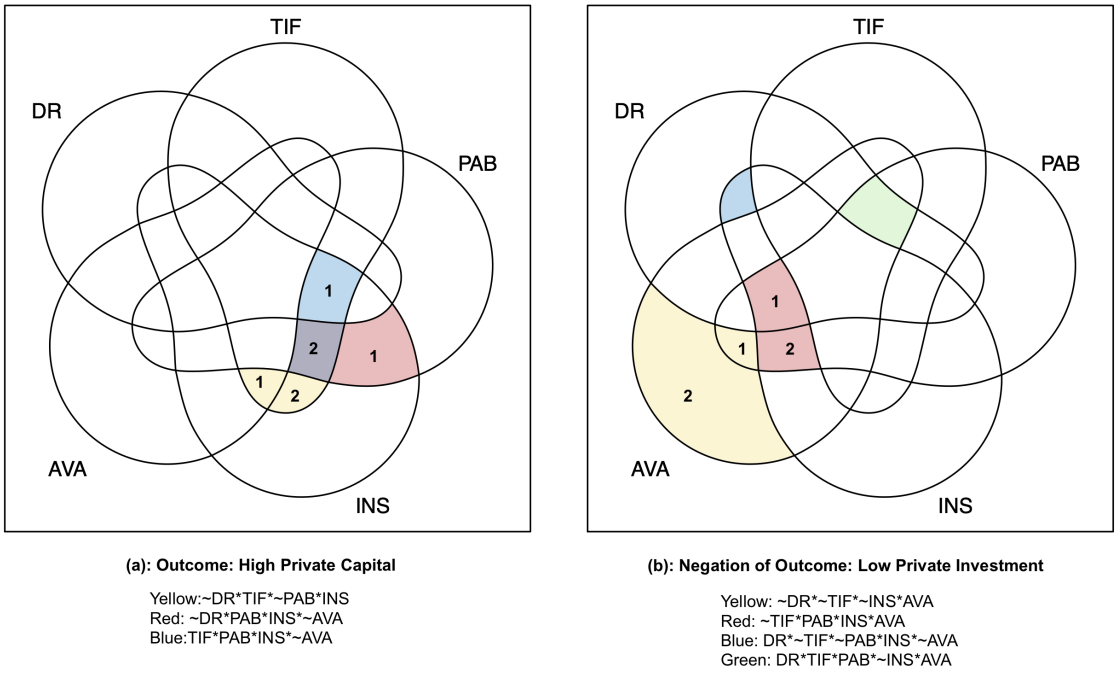
#	Path	inclS	PRI	covS	covU	cases
1	~DR*TIF*~PAB*INS	0.918	0.864	0.348	0.207	TX3,TX4; FL3,FL4
2	~DR*PAB*INS*~AVA	0.976	0.96	0.288	0.032	VA8; TX15,TX9,VA5,VA9
3	TIF*PAB*INS*~AVA	0.913	0.869	0.357	0.102	TX15,TX9,VA5,VA9; TX5,TX6,VA3,VA4
	M1	0.901	0.862	0.596		

M1: ~DR*TIF*~PAB*INS + ~DR*PAB*INS*~AVA + TIF*PAB*INS*~AVA -> PCP
Note: + addition; * multiplication; ~ negation; inclS: sufficiency inclusion score; PRI: proportional reduction in inconsistency score; covS: raw coverage score; covU: unique coverage score.

Path #1 consists of low direct financial support, high TIFIA credit assistance, low PAB bond support, and favorable state PPP institutions (~DR*TIF*~PAB*INS). Path #2 consists of low direct financial support, high PAB indirect financial support, favorable state PPP institutions, and absent availability payment (~DR*PAB*INS*~AVA). Those two paths collectively suggest that if a PPP project is developed in a state with a PPP-friendly legal environment, high private investment will consistently be present when the project receives strong indirect financial support from either one of the debt-financing mechanisms but low government direct financial support. In both paths, large amounts of private investment are only attracted when direct public support is limited. Path #3 consists of high TIFIA credit assistance, high PAB bond support, favorable state PPP institutions, and absent availability payment (TIF*PAB*INS*~AVA). Direct government financial support does not matter in this path when both of the indirect financial support tools are highly utilized.

I translated the solution table into Venn diagrams (*Figure 12a*), which are useful visualization tools for QCA (Duşa, 2019). These diagrams clearly show which combinations of conditions are sufficient for the outcome. It should be noted that the set-

theoretical relationship is not necessarily symmetrical with the correlational relationship. Thus, it was critical to conduct a sufficiency analysis of the negation of the outcome. As the process is similar, I provide its truth table and logical minimization solution table in *Appendix III*. *Figure 12b* shows the Venn diagrams associated with negation of the outcome: low private investment.



(a): Outcome: High Private Capital

Yellow:~DR*TIF*~PAB*INS
Red: ~DR*PAB*INS*~AVA
Blue:TIF*PAB*INS*~AVA

(b): Negation of Outcome: Low Private Investment

Yellow: ~DR*~TIF*~INS*AVA
Red: ~TIF*PAB*INS*AVA
Blue: DR*~TIF*~PAB*INS*~AVA
Green: DR*TIF*PAB*~INS*AVA

Figure 12: Venn Diagrams

The solution M1 in *Table 9* is translated to *Figure 12a*. Path #1 is drawn in yellow, Path #2 in red, and Path #3 in blue. If a project displays conditions that fall within the colored diagram, the project will have a high private capital investment. In other words, these colored diagrams indicate the combinations of support that governments should make available if they aim to attract a high level of private investment in PPPs. *Figure 12b* shows the opposite—the combinations that governments should avoid if their goal is to attract a high volume of private capital, because those combinations show the sufficient conditions for low private investment.

Based on the diagrams, it is reasonable to conclude that direct government financial support (DR) is not necessary to attract high private capital investment. It only attracts private investment when TIF, PAB, and INS are in place, but AVA is absent (blue [1] area in *Figure 12a*). Furthermore, I found direct financial support from the government may crowd out private investment, especially when combined with INS but without all three other support structures (blue in *Figure 12b*), or without INS but with all other three support structures (green in *Figure 12b*), or with both INS and PAB but without TIF (red [1] in *Figure 12b*). This crowding-out effect suggests the need for private capital decreases as the availability of public direct funding sources increases, most likely because private capital is more expensive.

For indirect financial support, TIF, PAB, and their combination with other support mechanisms are also very important in leveraging private investment. In *Figure 12a*, the blue and yellow areas indicate how TIF should combine with other support mechanisms to trigger high private investment. However, the combination indicated by the green region in *Figure 12b* should be avoided, as low private investment consistently appears here. This indicates that even when both direct and indirect financial support and revenue risk mitigation approaches are used, if the state has a less favorable legal framework for private investment, little private investment will be attracted. Similarly, in *Figure 12a*, the blue and red areas indicate how PAB should combine with other support mechanisms to trigger high private investment. Causations should be made when PAB is combined with ~TIF*INS*AVA (red in diagram b), ~DR*~TIF*~INS*AVA (yellow [1] area in *Figure 12b*), and DR*TIF*~INS*AVA (green in *Figure 12b*). In most cases, a

combination of tax-exempted PABs and availability payments appear to lead to low private investment.

I also found that a favorable legal environment (INS) is critical for attracting private investment. INS is a necessary condition if the consistency score is lowered to a 0.8 threshold in the truth table analysis. All of the high private capital PPP assets are situated in states with a favorable legal environment, such as Georgia, Colorado, Texas, Virginia, and Florida. However, caution is advised in the presence of the following conditions: INS*~TIF*PAB*AVA (red in diagram b), or INS*DR*~TIF*~PAB*~AVA (blue in *Figure 12b*). Under these configurations, there are no cases showing high private investment.

Finally, the "ability payment" revenue risk mitigation approach only brings high private capital investment when combined with TIFIA credit assistance and a favorable legal environment (yellow [1] in *Figure 12a*). Availability payment PPPs may attract some conservative investors who aim to avoid revenue risks, but the amounts of their investment are consistently small. In *Figure 12b*, AVA is involved in all paths except the blue one. If an availability payment project satisfies the conditions indicated by *Figure 12b*, it appears that there will be no high private capital involvement.

This section focuses on private investment in PPPs, but I do not suggest that higher private investment in PPPs is always the desired option. Indeed, some scholars have raised concerns that private firms that make large investments will have more leverage in project decision-making, which creates difficulties for public sponsors in controlling the project and monitoring its performance (Bunch, 2012; Forrer et al., 2010;

Haque, 2001; Reynaers, 2014; Sclar, 2015). In the next chapter, I will examine the impact of private investment on PPP performance.

7. Reviewing the Consequences: A Qualitative Case Study

A qualitative comparative case study offers an opportunity to examine whether and how private capital engagement affects the public value delivery of PPP. This case study was guided by Yin (2009)'s suggestions on how to conduct a rigorous case study with linear-analytic structures. First, I employed specific criteria to select two contrasting cases with different types of private capital engagement. Then, using the public value framework of PPP, I collected and assessed the value delivery evidence in both cases in their separate contexts. By comparing the two cases, I was able to test my research propositions regarding the relationships between private capital engagement and public value delivery.

7.1. Case Selection

To enable a comparative study, the two cases should have similar background features but contrasting variations on the research related feature. Thus, I used the following selection criteria. First, to test my research propositions, I selected those cases with contrasting values in terms of private capital engagement. Second, except for their contrasting private capital engagement levels, I made sure they were comparable in terms of other project background features. Third, considering the limited data available, I drew them from the pool of 65 U.S. transportation PPP projects (including the 33 projects with private finance components that were used in fsQCA) because those cases have published financing data. The two cases meeting these criteria are shown in *Table 10.*

Table 10: Case Selection

Project Name	US 181 Harbor Bridge Project (HBP)	Port Miami Tunnel (PMT)
Private Financing Components	0	47% of total Capital Finances[10], including Equity: $80.3M Bank loans: $341.5M
Funding Sources	Federal – $798.8M State – $202.2M Local – $92.0M	State – $447.5M Local - $452.5M
Public Sponsor	Texas DOT	Florida DOT
Financial Close Year	2015	2009
Construction Completion Year	2021(Expected)	2014
Total Project Value (including OM)	$1,065M	$1,113M
Contract Length and Form	30-year DBOM	35-year DBFOM
Major Constructions	Highways and bridges to facilitate seaport transportation	Highways and a tunnel to facilitate seaport transportation

Except for the contrasting private financing component, these two cases are comparable in terms of other project features. First, both projects were developed to facilitate the transportation services of seaports. PMT constructed a tunnel to link the Port of Miami and major highways. It aims to redirect cargo trucks and cruise line buses from congested city streets. HBP constructed a new bridge to replace the old Corpus Christi Harbor Bridge connecting downtown Corpus Christi to Rincon Point (North Beach) across the Corpus Christi Ship Channel. It aims to permit larger ships to pass beneath the bridge. Second, both projects have similar contract lengths (30-35 years) and project

[10] 47% of the project's financing comes from the private sector. The public finance components include a federal TIFIA loan of $381.1M and a FDOT cash payment of $97.5M during construction.

values (about $1.1 billion). Third, both projects' costs are covered by broad public funding sources instead of user tolls.

The idea for a tunnel in the Port of Miami first emerged in 1982. The Florida Department of Transportation (FDOT) officially revealed the plan in 2006. With a cheaper six-lane bridge connecting downtown Miami with the port, the major impetus of the tunnel is to redirect those cargo trucks and cruise line buses away from congested city streets. With a tunnel in place, the traffic can drive directly to the port from MacArthur Causeway and I-395. In 2007, FDOT selected Miami Access Tunnel, LLC (MAT) as the DBFOM developer. MAT was a special purpose vehicle (SPV) concessionaire, a joint undertaking by two France-based companies: Meridiam Infrastructure Finance (90% equity partner) and Bouygues Travaux Publics (10% equity partner). They invested $80.3M in equity and received $341.5M in loans from ten banks. Two subcontractors—Bouygues Civil Works and Ferrovial Services Infrastructure, Inc (originally named Transfield Services Infrastructure, Inc, a Spain-based company)—were responsible for project design, construction, operation, and maintenance. After a 2-year funding battle at the county and city levels, the project reached financial close in 2009. Construction began in 2010 and the tunnel was open to the public in August 2014 after an 11-week delay.

HBP, the second case this chapter explores, also has a very long history. The project had a 17-year planning period. The old harbor bridge, built during World War II, suffers from high maintenance costs and safety concerns. Thus, local legislators and civic leaders proposed building a new bridge. State lawmakers proposed the $1 billion bridge replacement project in the 2011 legislative session. State officials asked local governments to come up with $100M. After 4 years of negotiation, the private developer

was selected, and the project reached financial close in 2015. The local governments (Nueces County and San Patricio County) finally were able to raise $39M using a value capture technique—the Transportation Reinvestment Zone (TRZ). The Port of Corpus Christi provided ROW and several utilities companies donated $53M. The private developer, Flatiron/Dragados LLC, is a joint venture of Flatiron Constructors, Inc. and Dragados USA. Flatiron is an infrastructure contractor headquartered in Colorado. Dragados is a construction subsidiary of the Spain-based civil engineering company ACS Group. The subcontractors included a lead engineer, FIGG Bridge Engineers, Inc., and lead maintenance operators, ACS Infrastructure Development, Inc. and DBi Services. FIGG was replaced by Arup/Carlos Fernandez Casado JV in 2020. The private developers did not commit any equity or debt investment. Funding was from federal, state, and local sources. The bridge was expected to be completed in early 2021 but in July 2020 it was announced the bridge will most likely be finished in 2023 or later.

7.2. Data Collection

Evaluating the performance of PPP is always a challenging task (Warsen et al., 2019). Scholars have argued that the public values created by cross-sector collaborations are hard to identify and interpret "because they are mostly neither visible nor quantifiable"(Reynaers, 2014). The values are expressed through the decisions and actions of related actors (Page et al., 2015; Reynaers, 2014). Thus, to understand the relationship between private capital engagement and PPP value delivery, I had to collect data on the actions and decisions of the partners and related stakeholders in each PPP case.

During the exploratory stage, I focused on document review. Based on the projects' development sequences, I collected 1) project planning studies, such as the feasibility study, the environmental impact study, and the value for money analysis; 2) procurement records and project comprehensive agreements; and, 3) project status reports, community outreach presentations, transportation impact studies, as well as official project webpage information. Some of the documents were downloadable from the global transaction database (Inframation, n.d.). Other documents were found on project websites or the states' department of transportation websites. In total, I collected 25 digital documents for PMT and 36 for HBP.

Those reports and official documents present valuable data on the partners' decisions (manageability) and the substantive outcomes (effectiveness and efficiency) the projects delivered. However, they are limited in showing the attitudes or preferences of related stakeholders, which are important information for assessing the accountability and the equity of their outcomes. Thus, I further surveyed project-related news articles in local newspapers to identify the observations of community stakeholders. Both undertakings were billion-dollar capital projects which attracted substantial local media attention. I used the NewsBank Web App to facilitate my searches. "NewsBank consolidates current and archived information from thousands of newspaper titles, as well as newswires, web editions, blogs, videos, broadcast transcripts, business journals, periodicals, government documents and other publications" (NewsBank, n.d.). *Table 11* shows my search strategy for both projects. I conducted the searches in January 2021.

Table 11: Search Strategies for News Articles

Project	PMT	HBP
Searching Keywords and Filters	"Miami Tunnel" (the exact phrase) in All Text & 1990 - 2029 in Date(s) & USA-Florida-Miami in Source Location	“US 181 Harbor Bridge” (not the exact phrase) in All Text & 2010 - 2029 in Date(s) & USA - Texas in Source Location
Raw Result Counts	446	114
Article Cleaning Criteria	The following articles were dropped: 1. road closure notices; 2. duplicated articles; 3. unrelated article	The following articles were dropped: 1. road closure notices; 2. duplicated articles; 3. unrelated articles.
Results after Cleaning	211	31
Date Range	3/7/06 - 10/20/2020	7/23/2012- 11/18/2020
Source Media (Number of articles)	Miami Herald (201), Miami Examiner (3), The Miami Times (2), Miami New Times (5)	Alice Echo-News Journal (3), Corpus Christi Caller-Times (22), The Nueces County Record Star (4), San Antonio Examiner (1), Sweetwater TX Reporter (1)

Through document review, I have identified several persons that were actively involved in the development of both projects, including public sponsors and project managers. Due to the travel limitations imposed by the COVID-19 pandemic, I was only able to conduct four semi-structured online interviews using Zoom between February and March of 2021. Interview questions focused on the accountability and manageability issues associated with private engagement. The semi-structured nature also allowed for the exploration of other issues. Two interviews were voice recorded with permission. The other two were documented through notetaking. The interview subjects remain anonymous. *Appendix IV* presents the semi-structured interview guide and questions.

7.3. Qualitative Data Analysis

Following the qualitative data analysis approaches described by Yin (2009), I developed a coding scheme based on theoretical propositions guided by the public value framework of PPP (See Section 4.3). As a deductive case study, I then used the coding scheme to assess each case's public value delivery.

My data analysis included two rounds of coding. In the first round, I coded all texts (documents and news articles) that reflect the seven attributes of PPP public value delivery. The sample questions or indicators used to code attributes are listed in *Table 12*. The sample indicators were adapted from Page (2015) and adjusted to incorporate significant concepts that emerged. I used Microsoft Excel and Adobe Acrobat to facilitate the coding process.

Table 12: Public Value Attributes and Indicators

Attributes of Public Value	Sample Questions or Indicators to Assess Attributes	Major Data Sources
Accountability as answerability (AA)	• To what extent do the endorsements of, or informal support from (or resistance, sanctions imposed by), elected officials or agency directors affect the PPP decisions and implementation?	News, Interviews
	• To what extent does the PPP agreement allow future governments to adjust conditions retrospectively?	Documents, Interviews
	• To what extent can the public sector account for and monitor the project's performance specifications and penalize noncompliance?	Documents, News
Accountability as managing expectations (AME)	• To what extent do the endorsements of, or informal support from (or expression of resistance, objections by), the key stakeholders and the community affect the PPP decisions and implementation?	News, Interviews
	• To what extent can the stakeholders and public communities assess the information on project costs and performance?	Documents, Interviews
Procedural rationality	• Logic of planning, decision-making, implementation	Documents, Interviews
	• Use of evidence-based plans, reports, budgets to make decisions	Interviews, Documents
	• Flows of information and communication among collaboration partners	Interviews, Documents

	• Soundness of procedures to handle disputes, exceptions	Interviews, Documents, News
Procedural justice	• Use of inclusive decision-making practices involving a wide range of participants and viewpoints	Interviews, Documents
	• Nature and range of citizen engagement practices in decision making	Interviews, Documents, News
Effectiveness	• Absence of delays and over-budgets	Documents, News
	• Quality of project service, the degree of satisfaction	News, Documents
Efficiency	• Presence of cost/time savings produced by PPP • Value for Money estimates	Documents and studies
Equity	• Estimates or perceptions of the distribution of benefits by researchers, stakeholders, or the public	News, Documents and studies

(Adapted from Page et al. (2015))

After the first round of coding, I conducted interviews with project managers and public sponsors. My interviews enabled data triangulation with the documents and news articles. The interviewees were asked directly to speak about the specific effects of private capital engagement on public value delivery. My second round of coding focused on the interview transcripts and my contemporaneous interview notes.

7.4. Case Study Findings

7.4.1. Accountability

Both projects showed strong accountability as answerability (AA) at the planning stage. The significant differences appeared after the projects reached financial close. With a higher level of private capital engagement, PMT's responsiveness to public officials diminished dramatically in the construction and operation stages. Without significant private capital engagement in HBP, the public sector had a dominant position over the project planning and construction stages. The project has not yet entered the operation stage, but no signal has appeared to show that the public sector's dominant role will be diminished then either. By comparing these two stories, PMT's experience in

particular indicates that by accepting private capital, a project may be less responsive to public officials, especially after the project reaches financial close.

PMT received significant support from Florida's then-Governor Jeb Bush (1999-2007). He viewed the tunnel as his legacy. The project was officially initiated under his administration in 2006 after decades of negotiations. But, his successor, Governor Charlie Crist, did not show great commitment to the project and it almost ended in 2008. Miami-Dade County and Miami City government commissioners could not agree on the project's funding in early 2009, resulting in a delay on financial close. The City Commission's Chairman, Angel Gonzalez, argued to "[l]et the state and the county build it…The county owns the port" (Lebowitz & Pinzur, 2007). The County asked President Obama for help in March 2009 and the Obama administration's secretary of transportation expressed great support and a federal TIFIA loan of $380M was ultimately provided in October 2009.

FDOT did not request major modifications after the deal was made. One FDOT representative explained, "we cannot ask them to do things outside the contract… They're going to try to claim for extra cost. We rarely do that." However, due to technical difficulties, the private sector asked for additional funding during the construction. Those amounts were drawn from the pre-established contingency fund. Some local officials expressed strong opposition when the private firm first made the request but finally gave the green light. The private sponsors were able to go through the contract's Dispute Review Board—a body composed of mostly external, technical experts—to bypass their opposition.

FDOT cared more about the project's outputs and performance and had limited knowledge about its specifications. The county and city governments had opportunities to alter the project when they were offering funds. After the financing agreement was signed with FDOT, however, the county and city government had little direct involvement in steering the project's direction. Design and construction were largely decided by the private firm. The public sector heavily depended on external consultants to conduct construction inspection and performance reporting. They argued that "this might be the only choice considering the complexity of a tunnel project under the sea". However, they did not think the public sector was losing control by using external consultants. They said its "not like European model, who hires an engineer with the PPP firm. We didn't want to turn loose of the range. We wanted to have more control over the project and have a presence there." In addition, they argued the availability payment mechanism was an important tool for FDOT to have leverage over the PPP firm. According to the contract, FDOT could deduct payments if performance was sub-standard.

The one-billion-dollar HBP also received great support from state elected officials in Texas, especially from Senator Juan Hinojosa (D-McAllen) and Representative Todd Hunter (R-Corpus Christi). Local officials acknowledged the importance of a bridge replacement but were struggling with the $100M local commitments at the planning stage. The local governments were finally able to raise the funds partially through a value capture technique called the Transportation Reinvestment Zone. Local officials established a so-called Blue-Ribbon Panel that set out requirements for project construction, resulting in significant project design changes. The state elected officials, agency directors, and local mayors all expressed support for the project at the

groundbreaking ceremony and claimed credit for the project. TxDOT even directly fired the sub-designer FIGG Bridge Engineers, Inc. after it was cited by the National Transportation Safety Board's (NTSB) report regarding the FIU bridge collapse in March 2018. The decision came from the public sponsor rather than the private firm, indicating the public sector has significant control over the project.

In terms of accountability as managing expectations (AME), both projects received expressions of support and objections from different local organized interests and communities. Both projects deployed community outreach activities in response. Based on the interviews with project managers, their goal was not to achieve a higher level of public value by managing expectations. Instead, they sought to relieve pressure from the objections and to reduce the negative effects of the construction work. Based on my review of the documents and interviews, I did not find any evidence of how private capital engagement affected the delivery of AME.

In this area, PMT had a clear risk assignment in the official documents. The interviewee regarded some of the public's expectations as political risks and the public sector managed them. PMT faced two major instances of backlash. The first was the selection of the Paris-based private contractor, Bouygues. The county's Cuban community raised concerns about Bouygue's cooperation with the Cuban military in May 2007. Several Cuban-American county commissioners argued that it was a legal issue rather than a political issue. Thus, they did not block the project for purely political reasons even though they showed great sympathy for the Cuban communities (Lebowitz & Pinzur, 2007).

If the opposition was related to the construction's impacts on local communities, it was managed by the private sector. When the construction started in 2010, local communities criticized the private contractors because they failed to obey environmental standards and created too much noise. However, the impacts of those opposition groups were very limited. The project company actively organized community outreach activities and conducted noise impact control studies to relieve the pressure. According to the interviewees, they believed the effects on project decision-making were minimal. Objections were resolved through actively reaching out to community residents and discussing their needs.

HBP also faced some opposition from local communities and industries. TxDOT set up two committee groups to address the issues: "a community group and a technical advisory group" (Smith, 2012). The Port Industries of Corpus Christi (PICC), which was an industry alliance largely made up of oil refineries, did not support the bridge replacement in 2012 and argued there was no need for larger ships. They also worried about a possible increase in port fees to pay for the bridge replacement. TxDOT eventually brought them into the technical advisory group and no more opposition was expressed publicly.

I also evaluated the projects' transparency practices. The results are mixed. HBP is more active in providing project plans, studies, and procurement documents but does not make its financial data available. In comparison, PMT provides none of those documents directly but does reveal contract financial data through the Department of Financial Services' contract tracking system. I focused on the publicly available information which can be reviewed directly though the projects' webpages. Information

requiring further requests or searches was not included because of the additional barriers for information accessibility. Each project company set up a website, posting community outreach activities, traffic information, and related project documents. Both webpages allow anyone to leave messages and communicate with project employees. HBP provides detailed information on project plans and studies, such as the environmental impact study and the feasibility study. PMT indicated they conducted such studies but none were accessible through its website.

State agencies also host some project information. The TxDOT website provides a digital copy of the HBP agreement and its detailed provisions. However, I cannot find the PMT agreement via the FDOT website. The Florida Accountability Contract Tracking System (FACTS) hosted by the Florida Department of Financial Services makes the PMT contract documents available but only provides a scanned copy. FACTS also publishes detailed budget payment reports showing the amount of FDOT payments to MAT. TxDOT does not report a detailed financial schedule for payments to HBP.

7.4.2. Manageability

Both projects had very long planning periods which enabled them to prepare studies, plans, and contracts. Representatives from PMT were very confident about their procedural rationality in terms of using evidence-based data to make decisions. However, they were also concerned that the public sector heavily depended on external consultants to provide data, conduct analyses, and suggest actions throughout the entire project process. FDOT hired external consultants for design review services, construction engineering and inspection (CEI) services, project management and coordination services, and environmental and legal services. Representatives from PMT argued that

everyone that was involved in the project wanted to “share a piece of the pie of this multibillion-dollar project.” To get private capital involved, PMT conducted a value for money (VfM) analysis and suggested that DBFOM could save 27.5% compared to the traditional design-bid-build model (Kweun et al., 2018). In comparison, HBP did not conduct VfM but instead provided detailed environmental and feasibility studies. The important studies of HBP were conducted by the public sponsor TxDOT.

For both projects, the contracts between the transportation departments and the private companies laid out the bases for the assignment or risks, oversight and monitoring activities, and management plans.

The PMT representative admitted that “I've done all the major projects and I haven't had a contract like that one that covers so many different things.” The interviewees from PMT argued that the contract language was the key to ensuring the project would proceed and finish as planned.

Project managers addressed the importance of information flow for managing these two projects. Submittal review time was an important factor. “Managing such a mega project means a lot of paperwork”. FDOT adopted a Consultant Invoice Transmittal System (CITS) to maintain the information flow within its department and to allow the companies access to it as well. Similarly, TxDOT uses Sharepoint Contract Management Platform for processing submittals and project communications. The developer has its own internal control systems and filed documentation system—*aconex*.

To handle disputes, PMT established a Dispute Resolution Board and Contingency Fund. “When there was a significant disagreement, it was sent to the Board,” interviewees from PMT explained, “the board was also made up with external

experts … tunnel experts from across the country." The interviewees argued that "when the contingency fund was set up, I think, from the beginning they were targeting … they kind of looked at that as their money." HBP also has a dispute resolution procedure, which triggers the establishment of a Disputes Board. However, it does not set aside contingency funds for handling disputes.

The project company and FDOT held weekly meetings during the construction period. These meeting were focused on regular construction claims. In addition, there were monthly meetings that included representatives from the city and county governments. As the project is in the operation period, they now hold quarterly meetings. But, during the claim settlement period, the city and county participated in those meetings. They were more worried about the project going over budget because they did not have additional funds set aside. HBP also encouraged "partnering" which is defined in the agreement as "a voluntary, non-binding procedure available for use by the Parties to resolve any issues that may arise during performance of the work." However, when TxDOT fired the major project designer, the designer responded, "it was 'shocked' by TxDOT's decision." (Ramirez, 2020). This shows HBP is less inclusive in decision-making.

The nature of citizen engagement practices for both projects was not about achieving greater public value but to mitigate backlash from the communities. PMT promoted "Operation 305" during the construction period. About 80% of the project's staff were hired locally. However, there was limited community outreach activities after construction was complete. HBP established the Citizens Advisory Committee and

actively organized community outreach activities. Their goal was mainly to address any complaints from neighboring communities.

7.4.3. Outcome

Both projects experienced delays, but HBP's are more significant. It is more than two years behind schedule. The private capital engagement of PMT and its performance-based "availability payment" mechanism were key incentives for the project company to avoid major delays. The idea for a tunnel for the Port of Miami first emerged in 1982. FDOT officially revealed the plan in 2006. It took three more years to reach financial close and another five years to complete construction. The tunnel opened to the public 11 weeks behind schedule but within budget thanks to contingency funds. The concessioner was able to fine the contractors according to the agreement for the 11-week delay and FDOT deducted and delayed availability payments to the concessioner. HBP had a 17-year planning period. State lawmakers officially revealed the plan in 2012 and took 3 years to reach financial close. Originally, the bridge was expected to be complete in 5 years but it will likely take more than 7 years[11]. The project utilizes a "Noncompliance Points" mechanism to penalize the developer's noncompliance with the contract's specifications. However, I did not find evidence of any penalties levied.

As the interviewee correctly noted, "to build, and especially to maintain, a sea tunnel is very expensive." But, PMT relied so heavily on external experts that the manager admitted "it is not cost-efficient". To involve private capital, PMT conducted a value for money (VfM) analysis and suggested that DBFOM could save 27.5% compared

[11] According to a news article published in the *Corpus Christi Caller-Times* on July 21, 2020, HBP "will more likely be finished in 2023 or later"(Crow, 2020).

to the traditional design-bid-build model (Kweun et al., 2018). Representatives from PMT insisted that the private finance component was the key for the project to be considered a PPP. There was no such study conducted for the HBP and few reports mentioned any financial savings for HBP. Local leaders argued they wanted this new bridge to be a signature project. Local officials were less concerned about the savings because the majority of the funds were "OPM – other people's money" (Casady et al., 2020) from the federal and state governments. HBP's delays are significant. All the costs are retained by the public sector which creates a major threat to the project's outcome efficiency.

Major criticisms of PMT's outcome equity focus on the broad tax revenues used to support it. From this perspective, the tunnel only benefits certain groups of people, primarily affluent cruise customers and port industries. The project directs trucks away from downtown, but critics argued that "there are more homeless people than trucks in downtown" (Maza, 2010). HBP had to expend considerable efforts to ensure outcome equity because its impact area was a historically low-income black community. The communities complained about living with five years of construction. Thus, the project managers organized community outreach activities, conducted Livability Plan, Voluntary Resolution Agreement, and Voluntary Acquisition programs to handle relocation issues for the community. My findings reveal differences in terms of outcome equity between PMT and HBP. However, the complaints about outcome equity arose primarily due to the location and service features of the two projects. Private capital engagement was not the major factor leading to the differences between the projects.

8. Conclusion

This final chapter summarizes my research's empirical findings and their associated policy implications. The theoretical contributions are also discussed. I conclude by discussing my research's limitations and questions for future study.

8.1. Major Empirical Findings and Policy Implications

This dissertation established a workable U.S. infrastructure PPP database, which fills a long-standing data gap in the field. I gathered data about U.S. PPPs from multiple sources, including project websites, commercial and public data houses, and interviews. The dataset contains project-level information of 740 PPP projects (excluding military contracts) between 2000 and 2019. With its huge infrastructure deficit, the U.S. may see PPP as a viable tool. This data contribution is both timely and significant.

In this dissertation, I addressed three empirical links: 1) the link between a state's fiscal conditions and PPP formation; 2) the link between governmental support strategies and PPP private financial engagement; and 3) the link between private financial engagement and PPP performance. The following sections present the summary of findings for each link.

8.1.1. Identifying the Causes of PPP Formation

My quantitative research based on U.S. state-level data contributes to the literature of PPP formation in the following ways. First, PPP formation is a process that involves project initiation, negotiation, adjustment, and final adoption (Tan & Zhao, 2021; van Ham & Koppenjan, 2001). Previous research focused on the projects reaching financial close but ignored the impetus behind project initiation. Based on the public choice and transaction cost theories, I argued the initiation of PPP reflects the

government's motivation to use PPP, but final adoption is another story. Final adoption requires the government to invest financially in order to overcome the transaction cost barriers. My work empirically compared the effects of state financial conditions on PPP initiation versus their effects on PPP adoption.

My research also improves the discourse by using four indicators to systematically measure state financial conditions, including cash solvency, budgetary solvency, debt pressure, and service-level solvency. The previous literature often used one or two indicators to partially speak to state fiscal conditions. This improvement in measuring conditions may resolve the previously inconsistent research results. I found that state cash solvency and budgetary solvency do not affect the number of PPP initiated or adopted. However, states with a higher level of debt outstanding per capita are associated with proposing and adopting more PPP. This indicates that a state facing severe debt stress may choose to use PPP as a circumvention alternative to save its long-term solvency (Buso et al., 2017; Tan & Zhao, 2019). As the public choice theory suggests, taking advantage of a debt hiding opportunity may be the key motivation for public officials to use PPP.

Second, a government uses PPP with private finance primarily to access private financial resources and uses the bundled contracts method to claim other benefits, such as private project management expertise. When a state faces debt insolvency or service-level insolvency, it turns to PPP with private finance components. State financial conditions are associated with PPP formation particularly when the project has private finance components.

8.1.2. Choosing among Government Strategies

The fuzzy-set qualitative comparative analysis of 33 motorway projects examined the government toolbox for leveraging private capital in the U.S. Three broad types of government support were identified: financial support, revenue payback support, and institutional support. To fit the empirical setting, financial support was represented by three supporting programs, including direct government spending, indirect support through Transportation Infrastructure Finance and Innovation Act (TIFIA) credit assistance, and indirect support through private activity bonds (PABs).

I found government financial support is not necessary to attract private investment. Indeed, direct cash support can play a substitute role that crowds out private investment. When public grant funding is available, it is more likely that low-cost public resources will be used rather than high-cost private capital. This might be particularly true in the U.S. where the well-established municipal bond market allows state and local governments to issue bonds at low cost rather than going to private investments (Zhao et al., 2011).

These results reveal multiple configurations of government support strategies that are consistent with either high or low private investment. The combination of governmental support approaches matters. Based on my analysis, I found that even though no condition is necessary or sufficient by itself, some configurations of those conditions are sufficient to lead to high private investment, as indicated by the colored areas in *Figure 12a*. If a government's goal is to attract a large amount of private capital to a project, the results suggest following those configurations. I also found that some configurations are sufficient to lead to low private investment, as indicated by the colored

region in *Figure 12b*. If governments aim to leverage a large amount of private investment, they should avoid those configurations. I urge policymakers to rethink situations in which multiple policy tools are used together to deliver a common goal. Private investors calculate the risks and benefits of those government support approaches differently. With multiple support strategies available, it is important to understand whether those strategies can be used together.

8.1.3. Evaluating the Effects of Private Capital Engagement

Evaluating the performance of PPP is always a challenging task (Warsen et al., 2019). Scholars have debated the scope and standards that should be included in the assessment. With the public value governance movement, much progress has been made on PPP performance research in terms of the expansion of evaluation criteria superseding economization. Those value frameworks, based on empiricism, often lacked a theoretical foundation. The values were scattered without explaining the theoretical rationale behind their selection. Building upon public value theory (Wallmeier et al., 2019) and drawing upon the literature from its application on network governance (Bryson et al., 2014), I proposed a public value framework of PPP performance assessment, which includes accountability, manageability, and outcome.

I used a qualitative comparative case study to examine whether and how private capital engagement affects the public value delivery of PPP. Two PPP projects were selected based on their contrasting levels of private capital engagement. By comparing it with the US 181 Harbor Bridge Project (HBP), the Port Miami Tunnel (PMT)'s experience indicates that by accepting private capital, a project may be less responsive to public officials especially after it reaches financial close. However, with a higher level of

private investment, PMT showed better manageability in terms of procedural rationality by extensively using external private consultants and writing a comprehensive contract. In terms of procedural justice, PMT's decision-making process was more inclusive and cooperative. In comparison, the public sector has a dominant role in HBP's decision-making process. Both projects organized community outreach programs, but neither aimed to create greater public value. Instead, they sought to manage any opposition and to reduce any negative effects on project construction and operations. Research findings demonstrate private capital engagement can both threaten and strengthen the public value delivery of PPP depending on specific value dimensions and project conditions.

8.2. Theoretical Implications

PPP has gained great popularity among public administration scholars in the past few years (H. Wang, Xiong, et al., 2018). In particular, infrastructure PPP is often viewed as "one of the most enduring legacies of NPM" (Bertelli et al., 2020, p. 478) and it is a tool of public governance "which provides infrastructure services through a dense network of state–business linkages" (Casady et al., 2020, p. 162). Although PPP studies have surged in recent years, public administration research on these complex financial and organizational arrangements is still in its infancy. Many scholars have argued that PPP practice is ahead of its academic research (e.g, Engel, Fischer, & Galetovic, 2013).

By incorporating important perspectives from the private sector and literature on organizational economics, my research challenges the conventional theories and practices of public budgeting and financial management which regards the public sector as the dominating actor. My dissertation is therefore significant because it comprehensively demonstrates the interactions between private capital engagement and public motivations,

strategies, and value delivery. It contributes to the inquiry on public administration and finance in the following ways.

In terms of PPP formation, my dissertation decomposes the concept of PPP and argues that the driving factors for states who use PPP as a tool to attract private capital are different from the states which use PPP as a tool to streamline project phases. This decomposition resolves some controversial results in previous literature regarding government financial conditions and PPP utilization.

In terms of PPP financial management, my research establishes a link between government support and private investment in PPPs by adapting theories from market failure, organizational economics on hybrids, and rational choice institutionalism. This theoretical borrowing advances the current discussion on PPPs in the field of public administration by including literature in the areas of management and organizational economics. PPP is considered a modified type of hybrid in which one partner is not a private firm but a government agency. This research highlights the importance of the government's financial, institutional, and risk-mitigation strategies in terms of leveraging private capital in PPPs. It's also the first research using QCA to empirically estimate the configurational effects of multiple governmental support strategies on private capital engagement.

This research also utilizes a comprehensive public value framework to assess and compare two PPP projects' performances. It addresses the issue of the arbitrary selection of public values in PPP performance assessments. The comparative case study also sheds light on how private capital engagement affects the public value delivery of PPPs.

8.3. Future Research

Given the ambiguity of the term, PPP is often defined by scholars to fit the scope of their empirical analyses. Similarly, this research defines PPP based on the empirical setting in the U.S. A common understanding of the languages and references is essential. Future research should harmonize the theories and perspectives that have been used to define PPP in order to give the concept greater clarity and concision.

My quantitative analysis of PPP formation does not provide a comprehensive portrait of PPP formation. To keep the models parsimonious, I primarily focused on the effects of state financial conditions. When more data is available, future research should examine the effects of other state-level institutions and conditions. The regression models also suffer from endogeneity issues. Even though lagged-effects models (LEM) were employed to mitigate those issues, the casual inferences are still weak. Future studies should consider an experimental design or similar approach to tackle the casual links.

My research examines how state-level financial conditions affect PPP numbers. However, according to the case study, local governments' fiscal conditions also played important roles, even for state-sponsored projects. Future research might examine how local governments' fiscal conditions affect PPP formation. There is also a measurement limitation on the number of PPPs because PPP project value and size can vary substantially. For example, a multi-billion-dollar mega-project does not equal a million-dollar small project. If data permits, future research can improve the measurement of PPP formation using project value.

PPP formation is a process that involves project initiation, negotiation, adjustment, and final adoption (Tan & Zhao, 2021; van Ham & Koppenjan, 2001).

Between 2000 and 2019, more than half of the projects were canceled after launch or are still in progress after many years. Future research should examine why projects were canceled, and what factors determine the formation process timeframe.

I found government financial support is not necessary to attract private investment. Indeed, direct cash support can play a substitute role that crowds out private investment based on the QCA results. This is at odds with the findings of a previous study that examined PPP projects in developing countries (H. Wang et al., 2019). Though I believe this is because of the unique context of the U.S., future research could make an international comparative analysis to validate the differences.

My research results also show that the combination of governmental support approaches matters. Even though each strategy can be used to increase private capital involvement, whether those strategies can work together is another question. This research shows which mixes and matches work, but it does not examine why they are complementary or contradictory. Future inquiries might conduct in-depth reviews of those approaches and answer the "why" question.

My QCA focuses on 33 motorway projects and a limited number of government support strategies. Other conditions may also need to be considered when constructing PPPs, such as the government's ability and motivation, the characteristics of private firms, and other contractual and relational conditions. The limited number of cases raises the concern of the generalizability of the results. Thus, the policy implications of my work may only apply to motorway PPP in the U.S. I suggest future research expand the case selection and examine the effects of other conditions.

PPPs are subject to change and the design of my third research question does not address the life-cycle performance of PPP. The two case-study projects are still evolving given their 30-year contracts. A project that performs well in the early years does not indicate that it will also perform well in the later years. To balance the needs for data accessibility, these two recent cases were selected. Future research should track such cases long-term. When the contract ends, researchers may be able to make a conclusive ex-post evaluation of the life-cycle performance of PPP based on the public value framework.

As a distinct arrangement residing between the private and public sectors (Kivleniece & Quelin, 2012), PPP raises important questions regarding budgeting, accounting, and financial management. What should be the proper role of PPP in new infrastructure plans? How should government attract private investment through PPP? How can government govern PPP to achieve better public values? These will be key questions in the next generation of public-private financial management.

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APPENDICES

Appendix I: List of Sample Project for fsQCA

Project Name	QCA Case ID	State Abbr.	Financial Close Year	Contract Model
South Bay Expressway (formerly SR 125 South Toll Road)	CA1	CA	2002	DBFOM
Presidio Parkway (Phase II)	CA2	CA	2010	DBFOM
US 36 Express Lanes (Phase 2)	CO3	CO	2012	DBFOM
Central 70	CO5	CO	2017	DBFOM
Port of Miami Tunnel	FL3	FL	2008	DBFOM
I-595 Corridor Roadway Improvements	FL4	FL	2008	DBFOM
I-4 Ultimate	FL6	FL	2013	DBFOM
Northwest Corridor	GA1	GA	2012	DBF
I-285 / SR 400 Interchange Reconstruction	GA2	GA	2015	DBF
Ohio River Bridges East End Crossing	IN1	IN	2011	DBFOM
I-69 Section 5	IN2	IN	2013	DBFOM
Metro Region Freeway Lighting P3 (Michigan)	MI1	MI	2014	DBFOM
I-75 Modernization Project Segment 3	MI2	MI	2017	DBFOM
I-77 Express Lanes	NC3	NC	2013	DBFOM
Atlantic City-Brigantine Connector	NJ1	NJ	1994	DBF
Goethals Bridge Replacement	NY1	NY	2012	DBFOM
Southern Ohio Veterans Memorial Highway (Portsmouth Bypass)	OH1	OH	2014	DBFOM
Pennsylvania Rapid Bridge Replacement Project	PA1	PA	2014	DBFOM
Southern Connector	SC1	SC	2000	DBFOM
US 181 Harbor Bridge	TX13	TX	2014	DBFOM
SH 288 Toll Lanes Project	TX15	TX	2015	DBFOM
SH 130 (Segments 5-6)	TX3	TX	2007	DBFOM
President George Bush Turnpike Western Extension (SH 161)	TX4	TX	2007	DBFOM
North Tarrant Express I-820 and SH 121 / 183 (Segments 1 and 2W)	TX5	TX	2008	DBFOM
LBJ Express / IH 635 Managed Lanes	TX6	TX	2008	DBFOM
North Tarrant Express 35W (Segments 3A)	TX9	TX	2012	DBFOM
Dulles Greenway	VA1	VA	1992	DBFOM
Capital Beltway High Occupancy Toll (HOT) Lanes (I-495)	VA3	VA	2007	DBFOM
Elizabeth River Tunnels (Downtown / Midtown Tunnel)	VA4	VA	2011	DBFOM
I-95 HOV / HOT Lanes	VA5	VA	2011	DBFOM
395 Express Lanes	VA7	VA	2016	DBFOM
I-95 Express Lanes Fredericksburg Extension	VA8	VA	2017	DBFOM
Transform 66 - Outside the Beltway	VA9	VA	2017	DBFOM

Appendix II: Condition Calibration

Table A1: Calibration Result

ID	PCP	private capital (M$)	DR	public direct grant (M$)	TIF	TIFIA assistance (M$)	PAB	PAB bonds ($M)	INS	law index	AVA
CA1	0.231	178	0.050	0	0.214	140	0.049	0	0.170	1.67	0
CA2	0.296	212.2	0.050	0	0.235	150	0.049	0	0.170	1.67	1
CO3	0.073	41.2	0.162	133.4	0.096	60	0.066	20.67	0.900	5.29	0
CO5	0.091	65.9	0.969	1117	0.750	455.1	0.236	120.7	0.900	5.29	1
FL3	0.998	731.6	0.050	0	0.619	341	0.049	0	0.718	4.26	1
FL4	1.000	988.1	0.361	242	0.869	603	0.049	0	0.718	4.26	1
FL6	0.986	587	0.957	1035	0.977	949.5	0.049	0	0.718	4.26	1
GA1	0.086	59.9	0.698	498.8	0.533	275	0.049	0	0.874	5.08	0
GA2	0.988	598	0.104	81	0.049	0	0.049	0	0.874	5.08	0
IN1	0.149	123.1	0.721	526.1	0.261	162	0.860	507.8	0.744	4.37	1
IN2	0.140	115.8	0.274	201	0.049	0	0.564	243.6	0.744	4.37	1
MI1	0.078	49	0.113	91	0.049	0	0.049	0	0.046	0	1
MI2	0.120	97.4	0.050	0	0.049	0	0.918	609.9	0.046	0	1
NC3	0.383	251.6	0.117	94.7	0.327	189	0.185	100	0.387	2.97	0
NJ1	0.133	110	0.313	220	0.049	0	0.049	0	0.046	0	0
NY1	0.130	106.8	0.629	425.2	0.768	473.7	0.816	453.3	0.046	0	1
OH1	0.078	48.9	0.163	133.5	0.382	209.3	0.575	251.3	0.933	5.65	1
PA1	0.086	59.4	0.404	260.5	0.049	0	0.971	793.4	0.895	5.25	1
SC1	0.356	240	0.050	0	0.049	0	0.049	0	0.120	1.2	0
TX13	0.081	53	0.950	1001	0.049	0	0.049	0	0.945	5.82	0
TX15	0.752	375.3	0.058	17.1	0.639	357	0.641	298.6	0.945	5.82	0
TX3	1.000	895.6	0.050	0	0.724	430	0.049	0	0.945	5.82	0
TX4	0.999	745.9	0.050	0	0.721	427.5	0.049	0	0.945	5.82	0
TX5	0.865	426	0.775	594	0.895	650	0.762	398	0.945	5.82	0
TX6	0.997	699	0.690	490	0.961	850	0.916	606	0.945	5.82	0
TX9	0.890	442	0.179	145	0.813	524.4	0.603	270.6	0.945	5.82	0
VA1	0.994	648	0.050	0	0.049	0	0.049	0	0.046	0	0
VA3	0.670	348	0.694	495	0.860	589	0.908	589	0.950	5.9	0
VA4	0.432	272	0.829	676	0.715	422	0.943	675	0.950	5.9	0
VA5	0.452	280.3	0.105	82.6	0.567	300	0.577	252.6	0.950	5.9	0
VA7	0.872	430.3	0.050	0	0.049	0	0.049	0	0.950	5.9	0
VA8	0.976	552.9	0.050	0	0.049	0	0.611	277	0.950	5.9	0
VA9	1.000	1525	0.050	0	0.995	1229	0.959	737	0.950	5.9	0

Table A2: Anchor Values for Calibration

Condition	Label	Complete absence anchor	Indifference anchor	Complete presence anchor
PCP	Private Capital Investment	1	300	500
DR	Public Direct Financial Support	1	300	1000
PAB	Private Activity Bonds	1	200	700
TIF	TIFIA Assistance	1	250	800
INS	State Institutional Support	0.1	3.5	5.9
AVA	Availability Payment	N/A	N/A	N/A

Appendix III: Sufficiency Analysis of the Negation of Outcome (~PCP)

Table A3: Truth Table of Low Private Capital Investment

Row#	DR	TIF	PAB	INS	AVA	OUT	n	incl	PRI	cases
8	0	0	1	1	1	1	3	0.955	0.937	IN2,OH1,PA1
24	1	0	1	1	1	1	1	0.95	0.922	IN1
6	0	0	1	0	1	1	1	0.931	0.885	MI2
30	1	1	1	0	1	1	1	0.909	0.824	NY1
19	1	0	0	1	0	1	1	0.862	0.77	TX13
2	0	0	0	0	1	1	2	0.832	0.742	CA2,MI1
27	1	1	0	1	0	0	1	0.764	0.488	GA1
1	0	0	0	0	0	0	5	0.696	0.53	CA1,NC3,NJ1,SC1,VA1
7	0	0	1	1	0	0	1	0.644	0	VA8
28	1	1	0	1	1	0	2	0.546	0.401	CO5,FL6
3	0	0	0	1	0	0	3	0.521	0.256	CO3,GA2,VA7
11	0	1	0	1	0	0	2	0.505	0.1	TX3,TX4
15	0	1	1	1	0	0	4	0.463	0.038	TX15,TX9,VA5,VA9
31	1	1	1	1	0	0	4	0.46	0.06	TX5,TX6,VA3,VA4
12	0	1	0	1	1	0	2	0.427	0.191	FL3,FL4
4	0	0	0	1	1	?	0	-	-	
5	0	0	1	0	0	?	0	-	-	

Table A4: Solutions for Low Private Investment

Path#	Path	inclS	PRI	covS	covU	cases
1	~DR*~TIF*~INS*AVA	0.861	0.808	0.22	0.149	CA2,MI1; MI2
2	~TIF*PAB*INS*AVA	0.968	0.959	0.206	0.143	IN2,OH1,PA1; IN1
3	DR*~TIF*~PAB*INS*~AVA	0.862	0.77	0.156	0.156	TX13
4	DR*TIF*PAB*~INS*AVA	0.909	0.824	0.084	0.025	NY1
	M1	0.913	0.879	0.59		

M1: ~DR*~TIF*~INS*AVA + ~TIF*PAB*INS*AVA + DR*~TIF*~PAB*INS*~AVA + DR*TIF*PAB*~INS*AVA -> ~PCP

Appendix IV: Semi-Structured Interview Guide

The main purpose of the interview is to identify the strategies and challenges in protecting public values in public-private partnerships (PPPs). **This is a semi-structured interview, which allows new ideas or questions to be brought up during the discussions**. The following interview questions provide a general guidance rather than a rigorous interview structure.

Interviewer:	Yanbing Han
Date:	
Place	*Online*
Starting Time	
Interviewee/Pseudonym	*Representatives from <project name>*

Section A. Project Experience

A1. Could you please tell me a little bit about your experience with this project? How did you get involved?

A2. What was your role in your organization?

Section B. General Opinion of the model of PPP

B1. Based on your experience, how do you define the term "public-private partnership"?

B2. In your opinion, what makes an infrastructure PPP successful?

B3. Based on your experience, how do you view the differences between the public and private sectors?

B4. How do you view the potential impacts of private engagement on public value delivery? Are there any opportunities or challenges created by the private involvement?

Section C. Specific questions regarding public values in PPPs

C1. How do you perceive the public sector's ability to account for the project *agreement contents* and *specifications* in your project? (Probes: did your project rely on external advisors on these issues?)

C2. How do you perceive the public sector's ability to account for the project *cash flows and budgets*? (Probes: for example, were you able to or someone from DOT was able to explain where public money was going? Or the DOT does not need to account them?).

C3. How do you perceive the public sector's ability to *inspect* or *monitor* the partners' activities and performances? (Probes: was the partner providing enough information on their actives and projects; were there any systematic monitoring strategies in place? Who were performing monitoring activities? How experienced they are? Did the management team satisfied with the reporting system?)

C3.1 How do you perceive the clarity of responsibility sharing among partners? (Probes: who is responsible for what? How to avoid "Blame game"? Not my fault game)

C4. How often did the project organize *meetings with key partners*? Who were the major participants? What were the major agenda items?

C5. When making project decisions, did your team often *exchange viewpoints* among participants from different sectors? How did you deal with *disagreement*?

C6. What were the specific activities that your project has organized to *involve neighboring communities*?

C7. Were there any expressions of support or objections to the project made by the media and public officials? How did your team *handle different expectations*?

C8. Base on your experiences, what was *the most significant challenge* that the project faced and how did your team overcome them?

C9. How do you vision *the future of the project*?

VITA

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