ABSTRACT

Title of Document: STRUCTURED PROJECT FINANCE FOR PUBLIC-PRIVATE PARTNERSHIPS IN THE U.S.:
AN ENHANCED APPROACH TO BETTER ACHIEVE FINANCIAL AND POLICY OBJECTIVES

Morteza Farajian,
Ph.D. Candidate, Project Management Program
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Directed By: Qingbin Cui, Ph.D.
Associate Professor, Department of Environmental and Civil Engineering

As existing U.S. infrastructure ages, government entities are looking to the private sector and to alternative financing mechanisms, such as project finance, to help leverage traditional funding sources and pay for the increasing needs. As a result, the use of Public-Private Partnership (P3) delivery method in the U.S. has increased over the last two decades. The question is how the existing cases can be used to potentially enhance the current P3 model both in terms of bankability and overall procurement process maturity.

This study is organized into three main parts. In the first section, project finance in general and the role of different credit enhancements in structured project finance in

particular have been. In the second section, a QCA analysis has been perfumed to study and compare 18 P3 projects that have been procured in the U.S. over the last two decades. The goal is to identify logical patterns between project characteristics (i.e. capital value, term of contract, construction risk, traffic and revenue risk, and procurement competition level) and financial characteristics (i.e. equity IRR, interest rate on debt and leverage). The results are further analyzed to refine conclusions that to can provide a better understanding of how financing package of P3 projects may change based on project characteristics and policy objectives. In the third section, an enhanced P3 model has been proposed by using crowdfunding. A SWOT analysis has been conducted to explain how the proposed approach can improve current P3 model.

The findings of this study can help P3 practitioners to better utilize available tools and also provides them with new tools to further enhance procurement of P3 projects. The case library provides a significant resource to practitioners as well as researchers and the proposed corwdfunding approach is a novel step toward taking P3 projects to a new maturity level.

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By

Morteza Farajian

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Advisory Committee:
Dr. Qingbin Cui, Chair
Dr. Lei Zhang
Dr. Miroslaw Skibniewski
Dr. Peter Sandborn
Mr. John Cable

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Dedication

I dedicate my dissertation work to my family and many friends. A special feeling of gratitude to my loving parents, Tayebe and Mostafa Farajian whose unconditional support, words of encouragement and push for tenacity ring in my ears; and my sister Nasim and my brother Masoud have never left my side and are very special.

I also dedicate this dissertation to my many friends who have supported me throughout the process. I will always appreciate all they have done.

I dedicate this work and give special thanks to my wife and best friend Saadia for being there for me throughout the entire doctorate program and being my best cheerleader to complete it.

Lastly, I would like to dedicate this work to my grandfather who passed away during this study but his memories will always stay with me.

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Lastly, I would like to thank my family for all their love and encouragement. For my parents who raised me with a love of learning and supported me in all my pursuits. For the support of my brother and sister who have always encouraged me to work harder. And most of all for my loving, supportive, encouraging, and patient wife whose faithful support during the final stages of this Ph.D. is so appreciated.

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Chapter 1: Introduction

Existing infrastructure facilities in the United States have aged over the last decades, and the need for new improvements has emerged in order to maintain the economic competitiveness of the country and address the growing needs; however, the funding availability for infrastructure projects has not increased at the same rate as the growing needs for creating fiscal constraints. The use of deficit financing through municipalities has delayed dealing with the problem, and this mechanism cannot be used further since debt limits have been reached and the overall rating of the governments are at risk. As a result, a shift away from traditional funding and municipal financing to project financing, particularly for development of new facilities, is taking place. This fundamental shift for large infrastructure projects explains an expanding use of project financing via P3 delivery models.

Large infrastructure projects are expensive, and in most cases cannot be financed solely by user fees. User fees can be used to determine how much the private sector can invest in a project in terms of debt and equity; however, if project cost is larger than debt capacity and equity capacity, government assistance can be used with a structured project finance approach to make projects bankable. This assistance can be either in terms of subsidies or credit enhancements. Due to fiscal constraints, providing subsidies to projects might still be challenging; however, structured finance techniques can be used to minimize the level of subsidy needed to bridge the financing gap by increasing debt capacity and equity capacity.

What factors influence debt capacity and equity capacity and how can better financing be structured to improve overall financing of a project? To structure a better financing package, one should know what tools are available and how they can improve the debt capacity and the equity capacity. This study attempts to take a step toward better understanding of the role of structured project finance and different types of assistance in public-private partnership (P3) projects. The motivation and approach of this study is discussed in detail in this opening chapter. To understand the current state of knowledge and practice, available literatures have been reviewed and the implications in P3 projects have been discussed to provide a better understanding for decision-makers and practitioners. This study also provides a review of 18 P3 projects in the United States to identify logical patterns between project characteristics and risk profiles, and characteristics of financing packages in terms of debt, equity and leverage. This dissertation provides an enhanced P3 model using principles of crowdfunding that can be used to enhance project delivery, both in terms of financing and policy considerations, for P3 projects.

Funding Challenges in the U.S.

The Global Financial Crisis of 2008 caused a severe credit crunch, in which the general availability and supply of private finance severely decreased. The downgrading of the "monoline industry (which guaranteed bond repayment if an issuer defaulted)" coupled with the capital constraint made banks the only viable source for infrastructure projects and raised concerns about the quality of bank assets (Connoly & Wall, 2013). New banking regulations were enacted, which resulted in a reduced amount of risk-weighted assets. Consequentially, private lenders and

investors changed their perspective on risk-return trade-off, becoming more risk adverse (Burger, 2009). The reduction in availability of private finance and investor risk appetite due to the crisis greatly affected the investment profile of long-term illiquid investments, especially within the infrastructure sector.

The impacts caused by the Global Financial Crisis on infrastructure investments are further magnified by government budget constraints due to reductions in tax revenue and increases in competition for funds (Beniad, Lavee, & Solomon, 2011). Traditionally, U.S. transportation infrastructure projects have been procured at the state or local level as design-bid-builds and received substantial capital funding from either the federal government through the Highway Trust Fund (HTF) or state issued bonds (EnoTrans, 2014). The HTF has been supported by numerous acts since 1991, of which the most current act passed in 2012 is the Moving Ahead for Progress in the 21st Century Act (MAP-21). While MAP-21 and other prior acts are a vital funding source for transportation projects, they have also experienced funding shortages and required general fund infusions. The HTF is currently facing this problem with a funding shortage projection over the coming months. Moreover, state and local government borrowing in the form of state issued bonds has decreased because of the availability of debt capacity and restrictions on debt finance (Small, 2010).

As existing U.S. infrastructure ages, the need to address improving this aging infrastructure, meeting growing capacity demands, and maintaining economic competiveness emerges. This need combined with capital and U.S. government budgetary constraints creates a critical point for U.S. infrastructure investments, in

which government entities are struggling to find new funding and financing approaches.

The Shift to Innovative Financing Approaches

States and local entities are looking to the private sector and to alternative financing mechanisms, such as project finance, to help stretch their infrastructure dollars as traditional funding sources diminish (EnoTrans, 2014). Partnering with the private sector via project finance enables the government to reduce its share of financing in the project and thus reduce its expenditure (Beniad, Lavee, & Solomon, 2011). Furthermore, the state and local entities can utilize project finance to transfer debt off their balance sheet and also deliver needed infrastructure projects to the public.

A trend towards project finance is evident in MAP-21. Over the period of October 1, 2012 to September 30, 2014, MAP-21 provides federal funding for surface transportation of greater than $105 billion, of which $1.75 billion is exclusively set aside for the Transportation Infrastructure Finance and Innovation Act (TIFIA) program (FHWA, 2012). The TIFIA program provides credit assistance for qualified projects of regional and national significance and, historically, each dollar of funding has allowed TIFIA to provide approximately $10 in credit assistance. Thus, TIFIA can leverage $1.75 billion in funding to provide approximately $17 billion of low interest rate loans to transportation projects (USDOT, 2012). For eligible transportation projects, credit assistance from the TIFIA program usually covers up to 33% of the total project cost. Therefore, the $1.75 billion specific for the TIFIA program can potentially help finance approximately $52 billion worth of transportation projects (FHWA). By comparing the total funding of $105 billion

available for transportation projects and the $52 billion worth of project cost that can be leveraged through TIFIA, the importance of project finance at a federal level is clear.

In addition to TIFIA credit assistance, "the federal tax exemption of interest payments on state and local bonds is clearly an important cost saving, often highlighted in comparisons of public and private options" (Small, 2010). Private activity bonds (PABs) are tax-exempt bonds issued by a state or local government, in which the proceeds are used for a qualifying purpose by a private user (IRS).[1] In 2006, the Internal Revenue Code was amended to add highway and freight transfer facilities as a purpose for which PABs can be issued. This change in regulation reflects a federal desire to increase private sector investment in U.S. transportation infrastructure and supports the trend towards project finance (FHWA). Furthermore, new discussions on creating state infrastructure banks and lifting the limitations on tolling interstate systems reflects a change in federal policy to help states deliver infrastructure projects using project finance rather than federal funding. The shift away from traditional funding and towards project finance puts states in the driving seat in developing transportation projects and shows the importance of addressing transportation investment needs over the coming years.

[1] Internal Revenue Service (IRS) explains that qualified PABs that are issued by a state or local government may be considered as tax-exempt bonds, if 95% or more of the net bond proceeds are used for one of the several qualified purposes described in sections 142 through 145, and 1394 of the Internal Revenue Code (Internal Revenue Service).

Project Finance in P3 Projects

Project finance in the general form, as limited recourse financing of stand-alone projects, has been used for centuries (Kensinger & Martin, 1988). The modern version of project finance, as a loan financing technique used in large-scale high-risk projects based on contractual allocation of project risks and rewards, has received special attention since the 1970s (Kleimeier & Megginson, 2000). Private finance gained more momentum in the 1990s (Shaoul, Stafford, & Stapleton, 2006) and is currently starting to again gain momentum. Public and private partners are coming together to utilize private finance via project finance structures, especially public-private partnerships (P3s). The Congressional Budget Office (2012) defines P3s as "a variety of alternative arrangements for highway projects that transfer more of the risk associated with and control of the project to the private sector." Since P3s can take different forms, disagreements about the exact definition of a P3 delivery method exist. For the purpose of this study, a P3 is defined as a long-term contractual arrangement between public and private partners to develop a transportation asset by, at a minimum, bundling capital financing with design, construction, and possibly operations and maintenance.

The shift from public funding and municipal finance to project finance at a state level has been implemented in large transportation projects, particularly through the P3 model. As of June 2014, thirty-three U.S. states and one U.S. territory enacted statutes that enable the use of various P3 approaches for the development of transportation infrastructure (FHWA). While P3s have become more widely utilized, help leverage resources, and align interests to create value, they cannot solve the

infrastructure crisis. “Ultimately, solutions to the infrastructure crisis require dollars that necessarily will need to come from user fees, tax revenues, or other dedicated funding sources” (EnoTrans, 2014). Project finance structures in the form of P3s are one tool to use and can help mobilize the upfront investment resources needed to get projects started.

Basic Principles of Project Finance

Project finance structures differ from sector to sector and from project to project; however, the basic principles of off-balance sheet and leverage underlying these structures are common (Yescombe, 2013). Basel Committee on Banking Supervision in the context of ‘Basel II’ defined project finance as “a method of funding in which the lender looks preliminary to the revenues generated by a single project, both as the source of repayment and as a security for the exposure.” This definition explains the off-balance sheet nature of project finance, which allows isolation of project risk in a separate stand-alone entity where the sponsoring firms may receive limited collateral risks. Since public entities “need to pay attention to their amount of debt, because it affects their credit rating and creates obligations for future taxpayers,” the off-balance sheet principle is important when it comes to state debt capacity (Small, 2010).

The other basic principle in project finance is leverage. The project finance framework is usually based on debt financing, particularly in large infrastructure projects (Esty, 2004). The financing cost can be minimized by maximizing the amount of the cheapest source of financing, which is usually debt. In most P3 projects, equity finance is required in combination with debt finance. The viability of

a toll concession P3 project is highly dependent on the expected toll revenue, which determines how much lenders are willing to lend to the project and how much equity investors may invest in a project. Answering these questions results in the debt-to-equity or leverage ratio. While a highly leveraged structure maximizes the cheapest form of financing, it also increases the probability of bankruptcy (Small, 2010). Therefore, the goal is to optimize leverage in the financial model by maximizing finance for the project based on the constraints and security features, protecting lenders and equity investors from default. If debt and equity are insufficient to pay for project costs, then a financing gap exists, which may be bridged by optimization of leverage ratios through credit enhancement structures.

Debt Capacity

Due to non-recourse nature of project financing, the amount of debt the project developer can issue under a project finance approach is limited. This limit is usually determined through a systematic analysis known as the Debt Financing Test. In this process, cost of revenue generation, such as the operation and maintenance (O&M) expense, is subtracted from the rated revenue[2] (RREV) to determine the debt free cash flow, which is the yearly cash available to pay off debt. In order to account for uncertainty in forecasts, the debt free cash flow is divided by a safety factor, the Debt Service Coverage Ratio (DSCR). Finally, an average interest rate (i) will be used as a discount factor to find the net present value of the project's debt free cash flow over

[2] Rated revenue (RREV) is the forecasted revenue rating agencies determine for the project in the rating case.

the concession period (j). The output of this is the amount of debt a private company can leverage for the project.

$$Debt\ Capacity = \sum_{j=1}^{n}[((RREVi - O\&M)/DSCR\ )/(1+i)^{j}] \quad (1)$$

Looking at equation (1), the rated revenue and estimated O&M expenses are variables linked to project characteristics and have no direct correlation to the financial elements. The DSCR and interest rate are financial variables, which are calculated based on the project risk profile. The DSCR is a safety factor directly related to the uncertainty associated with revenue forecasts and determines the level of leverage in a project. As discussed previously, leverage can make a project cheaper, but can also contribute to the probability of default and ultimately to the project risk profile. The interest rate is comprised of risk-free and the risk premium components. The risk free component is a function of market conditions, including expected inflation, and is not linked to project characteristics. A risk premium is added to the risk free component to account for investment risks directly associated with a project, such as construction cost, operating costs, traffic levels and future regulations (Small, 2010). This portion of the interest rate can vary from project to project - the higher the project risk profile, the higher the risk premium and "the higher return needed to attract investors to markets for private capital" (Small, 2010). Assuming other variables remain constant, a lower DSCR results in a higher amount of leverage and increases the project risk profile, which may increase the expected interest rate.

Equity Capacity

The same debt capacity concept applies to equity capacity. Lenders and project sponsors usually enforce a minimum equity investment in P3 projects in order to minimize opportunistic behavior of the concessionaire (Cui, Farajian, & Sharma, 2010). In the Equity Financing Test, payments to equity holders are assumed to fall below debt service payments in the waterfall of project accounts. This means the risk profile and internal rate of return (IRR) for equity investors is higher than the risk profile and IRR of debt holders. Concessionaires are assumed to take a more optimistic view of the revenue line compared to the forecasted revenue for debt. The revenue line for equity investors can be called total revenue[3] (TREV). Free equity cash flow is the yearly cash available to pay dividends to equity investors and calculated by subtracting O&M, debt service (DS) payments and taxes from TREV. This free equity cash flow should be discounted back to the year of analysis by using an appropriate Minimum Acceptable Rate of Return for the private sector (MARR). The output of this test is the amount that the private company will most likely be willing to invest in the project as equity.

$$Equity\ Capacity = \sum_{j=1}^{n}[((TREVi - O\&M - DS - TAXi)/(1 + MARR)^{j}] \quad (2)$$

In equation (2), the only financial variable is the MARR which is directly linked to the risk of investment for equity holders. Assuming other variables remain constant, the higher the investment risk for equity holders, results in a higher MARR required and lowers the equity capacity. If some of this risk can be mitigated through

[3] Total revenue (TREC) is the forecasted revenue determined from the base case traffic model.

financial and contractual mechanisms, then the MARR will decrease and the amount of equity capacity will increase.

The Financing Gap

The sum of equity capacity and debt capacity represents the total financial capacity of the project and "hence the cost to the public purse of private finance and the price paid for risk transfer—the risk premium" (Shaoul, Stafford, & Stapleton, 2006). If the financial capacity can cover all project expenses, the project will be "financially viable" and there will be no need for public funds. Otherwise, the project will have a financing gap, as shown in equation (3), and will be "financially un-viable."

$$Financing\ Gap = Project\ Cost - (Debt\ Capacity + Equity\ Capacity) \quad (3)$$

A financing gap means the project is missing an overwhelming demand profile. This gap can be bridged but "will require a significant level of public involvement and, perhaps, public investment, to reach investment-grade levels" (Forsgren & Macdonald, 2005).

Research Need and Pursuit

The discussion in the previous sections provides the foundation for the main question of this study: *How can the bankability of large infrastructure projects procured as P3s be enhanced using innovative financing mechanisms and approaches in today's economy?*

As discussed earlier, a review of the basic principles and equations of project finance explains the emergence of financing gaps. Financing gaps demonstrate that debt and

equity capacity is insufficient to cover project costs and must be bridged to make projects bankable.

In chapter two, two bridging mechanisms are addressed, including public subsidies and the growing role of structured project finance approaches in the form of credit enhancements. Literature on structured project finance has been reviewed as a part of this study and the lack of availability of literature addressing this topic, particularly by academic researchers, is identified. Structured project finance credit enhancements are categorized as: financial guarantees, contractual guarantees and subordinate debt.

In chapter three, different research methodologies that can be used in this study are discussed and the selection of a hybrid research methodology based on Qualitative Comparative Analysis (QCA) and limited statistical analysis is discussed and justified. A step-by-step discussion on identification of outcomes, cases, conditions and variables for the QCA analysis is provided followed by a special discussion on translation of the meanings into variables that develop the raw data.

In chapter four, the data collection on the cases is discussed and internal validity tastings are performed to check the consistency of the data table. The data table is analyzed based on the principles of the QCA and the results are discussed. Some sensitivity tests are conducted in this chapter to help interpret the results.

In chapter five, some additional statistical analysis is performed to better refine the results from the QCA analysis. This chapter has a detailed discussion on the results and summarizes the findings.

In chapter six, a special discussion is provided to discuss application of the results in policy and practice. A new framework has been developed in this chapter as an option that can enhance feasibility and desirability of delivering infrastructure projects using a P3 delivery method.

Chapter seven, the conclusion chapter, summarizes the findings and the contributions, discusses policy implications and provides suggestions for future research pursuit.

Chapter 2: Available Strategies for Bridging the Financing Gap

The elements of debt capacity, equity capacity and project cost are the key factors in financial viability of P3 projects. A financial close cannot be achieved on a P3 project unless financing gap is bridged and the sources and a balance is created between sources and uses of funds. This gap can be bridged by public subsidies, enhancing debt capacity and/or enhancing equity capacity. This chapter offers a summary of strategies that can be utilized to enhance financial viability of P3 projects.

Bridging the Financing Gap with Public Subsidies

In practice, using public subsidies to bridge the financial gap has traditionally received the most attention. Many states in the U.S. have enabling legislation permitting local, state and federal funds to be combined with private sector funds on P3 projects. As illustrated in Table 1, most of the P3 deals in the U.S. have been financed with some sort of direct financial contribution from the state in the form of a subsidy. The World Bank defines subsidies as "direct fiscal contributions or grants paid by the government to a project when revenues from user fees are insufficient to cover all capital and operating costs while still providing private investors with a reasonable rate of return" and argues that "without subsidies, some infrastructure projects that would provide economic or social gains, but are not financially viable, would go undeveloped" (The World Bank Institute, 2012).

	Public Financing ($ millions)		*PPP Project Financing* ($ millions)				
	State/Local*	TIFIA **	PABs	Bank Sr. Debt	Equity	Total	Financial Close
91 Express Lanes, CA (TR)	0	0	0	100	30	130	7/93
Dulles Greenway, VA	0	0	0	298	80	378	9/93
So. Bay Express, CA (TR)	0	140	0	400	160	700	5/03
I-495 Express, VA (TR)	409	589	589	0	350	1,937	7/08
SH 130 seg. 5+6, TX (TR)	0	430	0	686	210	1,326	3/08
I-595, FL (AP)	0	603	0	781	208	1,592	2/09
Port of Miami Tunnel, FL (AP)	100	341	0	342	80	863	10/09
No. Tarrant Express, TX (TR)	573	650	400	0	426	2,049	12/09
LBJ Expressway, TX (TR)	490	850	615	0	672	2,627	6/11
Denver Eagle rail, CO (TR)	1,312!	280	396	0	54	2,042	8/10
Jordan Bridge, VA (TR)	0	0	0	0	120	120	1/12
Midtown Tunnel, VA (TR)	731	422	675	0	272	2,100	4/12
Presidio Parkway, CA (AP)	0	60+90°	0	167	45	362	6/12
I-95 HOT Lanes, VA (TR)	83	300	253	0	280	916	12/12
East End Bridge, IN (AP)	392	0	677	0	82	1,151	3/13
No. Tarrant Exp. 3A/B, TX (TR)	0	531	274	0	430	1,235	9/13
Goethals Bridge, NY (TR)	456	474	457	0	113	1,500	11/13
US 36 Managed Lanes, CO (TR)	76	60	20	0	41	208	2/14
I-69 Managed Lanes, IN (AP)	80	0	244	0	40.4	370	7/14
I-4 Managed Lanes, FL (AP)	861	949	0	486	104	2,300	2/14
Total	**$5,563**	**$6,769**	**$4,600**	**$3,260**	**$3,797**	**$23,989**	

(TR) Toll revenue risk financing
(AP) Availability payment financing

* excludes public development costs
** excludes capitalized interest
! Federal grant (FTA FFGA), sales tax revenue, revenue bond proceeds
° $60m 30yr loan + $90m 3yr loan

Source: *Public Works Financing* (9/14)

Table 1: Financial Structure of recent P3 projects in the US (Public Works Financing, 2014)

The Asian Development Bank (ADB) categorizes three types government subsidies used in the financing of P3 projects: one time, transitional and ongoing subsidies (Asian Development Bank , 2008). ADB considers grants as one time subsidies usually paid during the construction phase to cover the gap between financing raised based on the projected user fees and the actual costs of the project. Transitional subsidies are normally paid during a transition period, or ramp-up period, to ease the transition to full capacity operation. Ongoing subsidies are annual payments paid based on availability of services or level of traffic and are usually “linked to a sustainable source of funding such as general tax revenues, earmarked tax revenues,

or explicit cross-subsidies" (Asian Development Bank , 2008). Figure 1 shows different types of public subsidy.

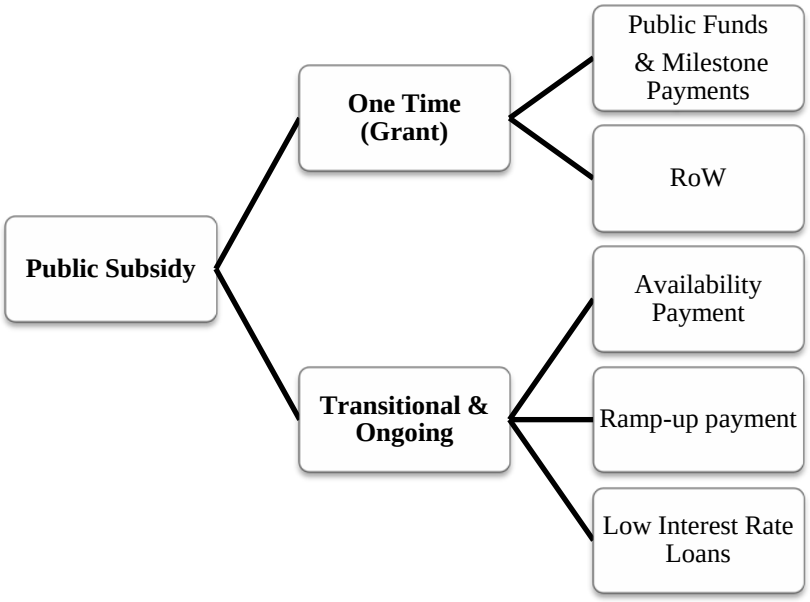


Figure 1: Different Types of Public Subsidy

One-Time Subsidies

In this study, a grant is considered a subsidy which is usually made to the project during the design and construction phases. A grant demonstrates the commitment of the public entity and bridges the financing gap. Since it does not provide a sustainable source of revenue for the project, however, it usually cannot be used in the financial model to leverage resources through debt financing. The U.S. Route 460 Corridor Improvements Project is one of the more recent examples, in which the Commonwealth of Virginia is providing an approximate $1,153 million grant. This grant bridges the financing gap between a total project cost of $1,466 million and the total projected revenue (Route 460 Funding Corporation of Virginia Toll Road Senior

Lien Revenue Bonds: Series 2012: Official Statement, 2012). Public subsidies can also be in the form of milestone payments, which are grants paid to the developer based upon project progress normally tied to completion of a certain portion of construction. A recent example of using a milestone payment on a P3 deal is Presidio Parkway. For this project, the developer will receive approximately $185 million from Caltrans upon substantial completion of the project (presidioparkway.org). A grant can also be made available to the project in the form of contributions for certain activities, including Right-of-Way (RoW) contributions, wetland or stream credit contributions, and funding assistance in utility work.

Transitional and Ongoing Subsidies

The subsidy concept has been extensively studied in the economic literature, particularly by Gerald Faulhaber (1975) in regards to public utility. A subsidy contribution can be in the form of transitional or ongoing payments, such as providing availability payments,[4] low interest rate loans or tax-exempt bonds. Due to the recent changes in the financial markets, more states have started using tolled or non-tolled availability payment models. In this model, a series of payments are made to the developer based on performance during the operation of the facility. The payments are usually supported through general public funds, annual maintenance funds and/or toll revenue if there are any user fees. Availability payments are usually treated as project revenues and can be used in private financing to include private equity and

[4] Availability payment can be considered both as credit enhancement or subsidy. In the context of a toll road in which the revenue risk stays with the sponsor, availability payment is a credit enhancement due to its ability to reduce revenue risk for investors. In the context of a non-toll road in which availability payment is a performance based payment paid from future funds available to the sponsor, availability payment can be considered as a subsidy due to the fact that the road is being provided to the users at no user fee.

debt. On a tolled facility the public agency takes the underlying revenue risk associated with the availability payments; therefore, the project can usually receive better interest rates, DSCR and potentially attract more equity at a lower expected IRR. This enhanced financial structure may result in a lower initial contribution of public funds compared to a tolled concession project, in which the concessionaire takes the underlying revenue risk. A recent deal to close in the U.S. using an availability payment model is the East End Crossing (East End Crossings).

Other types of government subsidy have been used in the U.S. P3 projects. For instance, TIFIA loans can be categorized as subsidies.[5] The TIFIA program utilizes federal funds to provide low interest rate loans to qualifying transportation projects. A recent TIFIA loan agreement for the SR 91 Corridor Improvement Project in Southern California provides a $421 million loan at a rate similar to the rate for AAA bonds as opposed its actual rating of BBB- rating (Federal Highway Administration, 2013). The other financing mechanism that is subsidized by the U.S. federal government is tax-exempt bonds that can be used in P3 deals, such as tax-exempt PABs. Since the interest earned on these bonds is not subject to federal tax, investors are likely willing to accept a lower return on their investment, resulting in a lower interest rate and financing cost for the project (Federal HIghway Administration).

The amount of academic literature in which the formation of an optimal P3 financial structure are analyzed and discussed is gradually growing (see eg. Lopez-Lambas and

[5] TIFIA can also be considered as a Credit Enhancement since it provides flexible financing terms, takes subordinate role in the financing structure, and may provide guarantees in the form of Letter of Credit.

Monzon, 2010; Moszoro, 2010; Zhang, 2005a,b; Dewatripont and Legros, 2005; Reeves, 2005; Sharma and Cui, 2010; Jasiukevičius, 2012). An underlying assumption in most of this literature is an unlimited availability of public funds. As discussed earlier, however, recent funding challenges in practice have limited the ability of government agencies to invest additional funds into projects without facing short-term and long-term fiscal consequences. After the limited funds are utilized through public subsidies, the key question becomes how to bridge the remaining gap by increasing debt and equity capacity and thereby enhancing the project risk profile for investors and making the project financially feasible.

Bridging the Financing Gap through Structured Finance

A structured project finance approach can increase debt capacity, as well as equity capacity, by using complex legal and financial models to rearrange the risk profile in economic assets. This technique increases the overall financial capacity of the assets. The basis of structured finance is on the prioritization of economic assets (e.g. loans and bonds) and issuance of a prioritized capital structure of claims against these collateral pools (Coval, Jurek, & Stafford, 2009). Although project finance might be considered as a division under structured finance, the influence area of structured project finance goes beyond the credit limits of the project itself and may include the credit of different parties involved in the project. The possible impacts and consequences of using a structured project finance approach on all involved parties are not covered in this study, and are a future research need.

States are starting to utilize structured project finance techniques in the form of credit enhancements to both bridge financing gaps and reduce public subsidies. Credit enhancements facilitate access to long-term financing with better terms on the debt and open the project up to new categories of debt and equity investment by enhancing the overall investment risk profile for investors. They are provided through contractual provisions or financial guarantees and thus are less tangible and more difficult to be analyzed than public subsidies. This type of assistance has special importance in P3 agreements due to the unique characteristics of P3 projects – high uncertainty embedded in a long-term contract with multiple stakeholders (Athias, 2007). Risk allocations, payment mechanisms, flexibility and renegotiation, contract duration, refinancing, non competing facilities, protections against changes in law and contract termination are examples of commercial terms used in P3 contracts, which determine the risk profile of P3 projects (Iossa, Spagnolo, & Vellez, 2007).

In a report published by the European P3 Expertise Center (EPEC), different European credit enhancement mechanisms available in for P3 projects are categorized as: financial guarantees, contract provisions and sub-sovereign creditworthiness guarantees (SCG) (European PPP Expertise Center, 2011). Scott L. Hoffman (2008) provides additional sub-categories for credit enhancements in his book "The law and business of international project finance." We use a similar approach in this study to categorize different types of credit enhancements. Financial guarantees include loan guarantees and refinancing guarantees. Contractual provisions include risk sharing mechanisms, including: revenue or usage guarantees, guaranteed minimum service charges, change of law/regulation undertakings, cost sharing mechanism, protections

against future competing developments, termination payments, debt assumption undertakings and residual value payments. We consider contractual guarantees a form of sub-sovereign creditworthiness guarantees, in which payment obligations by the sponsor are pledged to the project to enhance the risk profile for investors. Figure 2 illustrates a high-level breakdown of different types of credit enhancements.

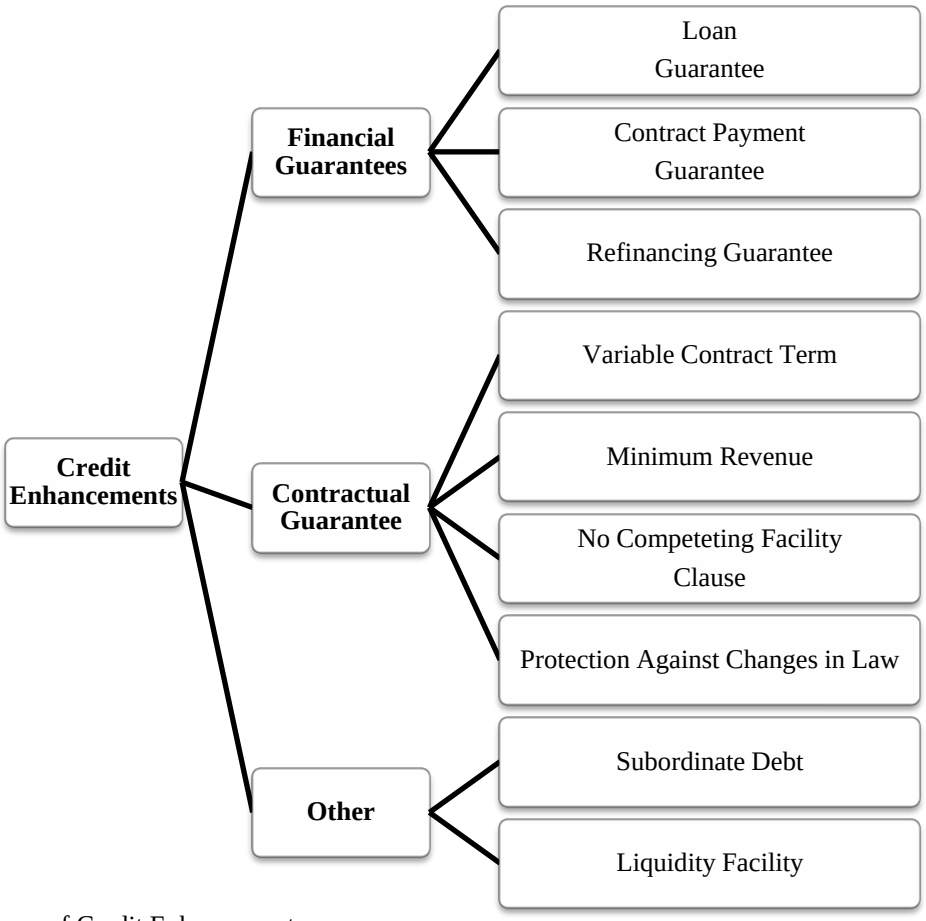


Figure 2: Types of Credit Enhancements

Financial Guarantees

The lack of resources, knowledge and experience by investors to understand P3 project risk and the lack of appetite by some investors to accept complex risks associated with P3 projects limits the market penetration for P3 financing (Delmon, 2011). Financial guarantees can help to solve these problems by limiting the level of risk investors may face. In addition, the provider of the financial guarantees goes through extensive analysis to identify and quantify the risks associated with the P3 project. This provides an additional layer of confidence for investors to ensure the government entity familiar with the P3 project has diligently analyzed all the risks associated with the project and will have responsibilities should any issues occur.

Financial guarantees are given in two forms: loan or contract payment guarantees. Loan guarantees are usually designed to increase the liquidity of the financial structure and ensure prompt payment of debt service. Loan guarantees can be provided to the project in the form of a line of credit (LOC). For instance, in the financing of U.S. Route 460 Corridor Improvements project in Virginia, a revolving $80 million LOC has been provided by the Virginia Transportation Investment Bank (VTIB). The sole purpose of this LOC is to decrease the probability of default on debt service payment. Loan guarantees can also be provided by development banks or even insurance companies. For instance, BANOBRAS, the development bank of the Mexican Federal Government, provides a guarantee known as a “Timely Payment Guarantee,” which is an unconditional irrevocable package that guarantees timely payment of principal and interest payment. The other guarantee package that BANOBRAS provides is a “Contract Payment Enhancement Guarantee,” which assures the timely payment of contractual obligation by the government entity. This

type of guarantee may be valuable in countries with a high risk of default by the government and may not be applicable to U.S. P3 projects.

Financial guarantees can help to increase credit worthiness of projects and enhance the credit rating, resulting in savings on interest rates. The savings will depend on the size of guarantee and the amount of coverage. Government entities can subsidize the price of a guarantee by using other tools, such as TIFIA guarantees. Without any subsidy, the guarantor is protecting the downside and may charge a price tag for the guarantee because they require a more significant share of the upside. Available literature on sizing and pricing of guarantees reveals the importance of this topic particularly in the complex financial structures used in P3s (see eg. Irwin, 2007; Mody & Patro, 1995; Jones & Mason, 1980; Haastrecht, Plat & Pelsser, 2010). Lack of literature on the quantitative analysis of the sizing and valuation impacts of financial guarantees or contractual; however, makes in depth analysis on this topic in the context of P3 projects challenging.

Contractual Guarantees

A report published by the World Bank Institute finds that contractual guarantees provided by the government agency through P3 agreements may be more effective than guarantees provided to enhance the bankability of P3 projects (The World Bank Institute, 2012). The concept that project risks can be transferred to the private sector is sometimes misunderstood. The main value in P3s is created through optimal allocation of risks to the parties that can best manage these risks. Contractual obligations help to achieve this goal.

In a review of comprehensive agreements for multiple P3 projects in the U.S., we have identified main clauses that provide contractual guarantees to investors. For instance, non-compete clauses can provide a higher certainty in terms of forecasting the traffic demand over the term of the comprehensive agreement. The provisions related to changes in law, such as tax laws, will provide more clarity to the concessionaire on the amount of taxes that it should pay, and will reduce the risk of future tax increases. In the U.S., both clauses have created very controversial discussions. Some have criticized the state agencies of eliminating the option to make future improvements to adjacent roads as a result of non competing facility clauses, and some have raised doubts on constitutional issues associated with providing a protection against changes in law, as it may be interpreted as interfering with the law setting authority that only elected bodies may exercise. This study does not intend to explore these issues further as it is beyond the scope of this study; however, authors wish to emphasize the knowledge gap for future research projects.

Another example of contractual obligations is risk sharing in terms of environmental impacts, unknown underground conditions or RoW impacts. For instance, in U.S. Route 460 Corridor Improvements Project, the total risk that the developer faces in terms of wetland mitigations or RoW acquisition cost has been caped through contractual provisions. This provides a higher certainty regarding potential cost creeps as a result of these risks and thus a lower DSCR has been used in the project without impacting the credit rating of debt, which determines the interest rate used. The other example of contractual guarantees is minimum revenue guarantees, which have received special attention in the literature (see eg. Ashuri, 2011; Jun, 2010;

Kokkaew & Chiara , 2013). A minimum revenue guarantee acts similar to other contractual guarantees by reducing the level of uncertainty for investors. Therefore, the guarantees contribute to a reduction in the required level of DSCR and, as a result, increase debt capacity. Different contractual guarantees may create contingent liability that stays with the government entity. A financial obligation for a contingent liability is only triggered when the dependent event occurs; otherwise, the government entity has no financial obligation. For instance, a minimum revenue guarantee may not trigger a financial obligation unless the revenue falls below the guaranteed revenue. In this case, the government entity will have to make a payment to honor its minimum revenue guarantee. The literature on minimum revenue guarantee impacts on the credit rating of government entities and on the rating and accounting impacts of materialization of the contingent liability associated with these guarantees is limited. Moreover, additional insight on how government entities should treat contingent liabilities in terms of accounting and debt affordability is very limited. The closest accounting standard that can be used to evaluate such contingencies is GASB 60.[6] As new mechanisms emerge in structured project finance, the need to update the accounting standards becomes more tangible.

A good alternative to a minimum revenue guarantee could be a variable contract term, in which the term of contract is extended if a certain IRR on equity is not achieved. This concept was first introduced by Engel, Fischer, and Galetovic (2001) and has been used in a few projects in Chile; however, it is a new concept in the U.S. and has

[6] The Government Accounting Standards Board (GASB) is the source of generally accepted accounting principles (GAAP) in the United States. GASB Statements 60, *Accounting and Financial Reporting for Service Concession Arrangements*, (GASB 60) addresses public-private partnerships as service concession arrangements.

yet to be utilized. The rationale behind the term extension structure is to provide, if needed, a “tail” in the financing to bring additional equity to the structure. Assuring a minimum IRR on equity using the term extension will likely decrease the expected IRR for equity investors; however, it is difficult to predict the extent to which the market may react to this idea. The amount of benefit that would be ascribed to the term extension mechanism will vary dependent upon the goals and objectives of the equity investor, as well as the level of the minimum IRR on equity established by the government entity. A variable contract term does not require a cash payment obligation; therefore, from an accounting perspective, it may be viewed as a deferral of future revenues instead of a cash obligation and does not introduce the same debt affordability challenges that a cash obligation may create. Although a variable contract term may be appealing to equity investors, it does not provide the same confidence that a minimum revenue guarantee provides in terms of the timing of debt service payments. Thus, it may not increase the debt capacity of the project. If the objective is to minimize upfront subsidy on a revenue risk project, a minimum revenue guarantee may generate better results in terms of accounting and debt affordability analysis. Future research in this area may provide additional insight on the benefits and challenges of this approach in the context of structured project finance, particularly implications of this approach in terms of accounting and credit impact both to the project and to the guarantor.

Subordinate Debt

Subordinate debt is another source of credit enhancement that can be provided by government entities. TIFIA loans are a good example of subordinate debt with more

flexible terms as compared to bank loans or bonds. By having a truly subordinate position to bank debt, TIFIA provides an additional layer of protection to senior lenders and helps to achieve a higher DSCR. This protection provides more flexible terms particularly in terms of debt service payment during construction and ramp-up period, which are particularly important in early years during when cash flows are very constrained. Providing subordinate debt without conducting necessary analysis, however, may result in over leveraged projects, which puts projects at a higher risk of default. After facing issues with loans provided to South Bay Expressway in California and Pocahontas Parkway in Virginia, the TIFIA program seems to have begun taking a more conservative approach to lending. This more conservative approach decreases the opportunity to make TIFIA loans fully subordinate. Thus, the benefits subordinate TIFIA loans provide beyond the subsidized interest rate will be limited and will not help to leverage resources to the extent truly subordinate debt may.

Summary

The above discussion outlines the two options that are available to make a financially unviable P3 project feasible, adding more public subsidy or leveraging available funds by using credit enhancements in structured finance. The discussion in this chapter suggests that project characteristics such as the risk profile and financial elements such as interest rate on debt and equity IRR are the key factors in deterring the overall financing capacity of the project in the form of debt capacity and equity capacity. The following chapter details a research approach for identifying patterns of

relationship between those elements to investigate how current P3 model may be enhanced to increase the overall financing capacity of the project.

Chapter 3: Research Methodology and Framework

The previous chapter provided a summary of state of practice and knowledge on P3 projects. A P3 delivery method is usually used when there is a high level of complexity in the project so the private sector can provide value though innovations and efficiencies. These projects are usually large scale and expensive, and require a significant transaction cost and time (Farajian, 2010). In addition, except for a few states such as Virginia and Texas, most of the states that have the enabling legislation for using P3s, have passed their legislation in the past few years. As a result, only a few P3 projects have reached financial close in the United States, and only a handful of projects have reached substantial completion and are operational. In addition, in many cases, the financial information of P3 projects is considered proprietary or it is considered very difficult to have access to this information even though it may be public information. As a result, the main challenge of this study is having a limited number of cases, and limited information available on each case. Therefore, a sound research methodology should be selected that enables a systematic analysis of the limited cases in order to reach logical conclusions.

Selection of Research Method

Conducting empirical analysis requires a "Medium-N" or a "Large-N" sample size (Yanow & Schwartz-Shea, 1995). Due to this fact, it is very difficult to conduct an empirical study in the P3 field. Therefore, most of the scholars have decided not to use empirical analysis on P3 related topics, at least in the U.S. market.

Due to the number of deals that have reached financial close in the past two years, this study is able to conduct some level of statistical analysis, although this can only happen after a qualitative analysis is performed to understand the logical relationships between different elements of the project and minimize the number of hypotheses needed to reach some preliminary conclusions. Therefore, the main focus of this chapter is on exploring non-empirical methods that can potentially be used as a research methodology to conduct an in-debt analysis of available cases in order to integrate qualitative and quantitative concepts of the cases and reach some preliminary conclusions to reduce the number of variables and provide the opportunity to start a high-level statistical analysis. Figure 3 shows some of the scientific research options that are available to researchers.

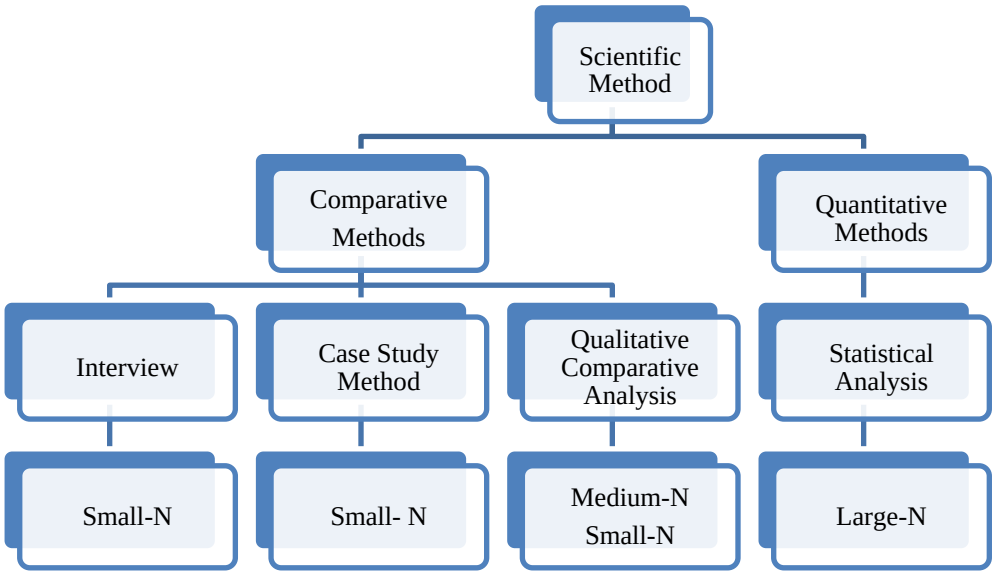


Figure 3: Available Research Methods

Due to the complexity and uniqueness of P3 projects, an in-debt analysis to understand different aspects of the project, especially different project and market

characteristics at the time of project procurement, and the internal or external constraints is required to better understand how the deals were structured. This is why many researchers have used a case-based research approach to study P3 projects. A case-oriented approach enables researchers to develop a deep understanding of that project, limitations and policy objectives, the deal structure, the risk-sharing mechanism and potentially the negotiation process and how the agreement was achieved for a particular project. However, it is hard to demonstrate how this method can provide a scientific comparison across different projects and make a generalization of the findings. The cons of the case-based research approach have mentioned this limitation: "it is very difficult to engage in any form of generalization, as the key findings and conclusions are mostly limited to that single case" (Rihoux & Ragin, 2009).

The question becomes how the complex P3 projects can be compared using a scientific method to study logical patterns. This chapter aims to focus on this question and intends to explore the literature to find the best approach that can be used as the core method of research for this study in order to deliver the expected outcomes.

Case-oriented Research

As discussed before, most of the literature in the P3 field in the United States is that "A 'case-study' is an intensive study of a single unit with an aim to generalize across a larger set of units" (Gerring, What Is a Case Study and What Is It Good for?, 2004). Gerring (2004) believes that the case-oriented approach "is a particular

way of defining cases, not a way of analyzing cases or a way of modeling causal relations." Gerring (2004) argued that most of the debate over the usefulness of the case-oriented approach has little to do with the method itself, but "more to do with the state of current research in the field." On the other hand, some scholars have argued that a case-oriented approach is distinguished from other approaches because of its ability to do in-debt analysis on a single case and extend the findings to reasonable generalizations on a population (Aha, 1992) (Kennedy, 1979). It is important to realize that a case-oriented approach shows strengths and weaknesses like any other research method.

Case-oriented research has received special attention in recent years (Gerring, 2007), especially in the P3 research field (e.g., (Federal Highway Administration, 2007; European Commission, 2004; Asian Development Bank, 2011). However, since every project is a unique project and has its own challenges and special-risk profile, it is very hard to use a case-oriented approach in the P3 field to make generalizations. This research requires a method more powerful than a case-oriented research in terms of making generalizations. On the other hand, since the number of P3 projects in the United States is minimal, there is a need for a method that can effectively work with a Small-N.

It is not easy to reach a conclusion or make a statement without comparing available information and data: "Thinking without comparison is unthinkable" (Swanson, 1971). "Comparison lies at the heart of human reasoning" (Rihoux & Ragin, 2009). Therefore, in order to be able to make a meaning generalization

based on reliable data, one needs to understand how scientific ways can be used while comparing available data in different complex cases.

Most of the literature in case-oriented approach is centered on topics such as qualitative data analysis (Eisenhardt, 1989). Eisenhardt attempted to provide a framework for theory building from cases. “one strength of theory building from cases is its likelihood of generating novel theory” (Eisenhardt, 1989). However, she admits that “some characteristics that lead to strengths in theory building from case studies also lead to weaknesses” particularly in the presence of imperial data (Eisenhardt, 1989). Therefore, a case-based approach might be a good research methodology in some cases, where as in some other cases, this method might not be able to provide a powerful cross-unit analysis for generalization and theory building.

Cross Case-oriented Research

In order to understand a research method better, it is important to look at that method both in the historical context and its unique application in science and problem solving compared to other methods. “Comparison, as a basic and powerful operation, can be translated into a set of systematic comparative *methods and techniques*” (Rihoux & Ragin, 2009). Qualitative Comparative Analysis (QCA) provides cross-case comparison while at the same time gives enough attention to within-case complexity particularly in Small-N research designs (Rihoux & Ragin, 2009).

The QCA was developed by Charles Ragin in late 1980s. The foundation of this method is based on Boolean Algorithms, which was originally developed in 1950s by electrical engineers to simplify switching circuits (Rihoux & Ragin, 2009). This method has been widely used for applications in historical sociology and political science, but recently other fields of science such as engineering have started using the QCA method (Gross, 2010). The QCA method aims to marry the advantages of quantitative methods with case-oriented approaches:

"In short, the ideal synthetic strategy should integrate the best features of the case-oriented approach with the best features of the variable-oriented approach." (Ragin, 1987). The QCA method transforms the complex cases into Configurations in order to link specific combinations of some conditions into a given outcome. By doing so, the QCA enables the researcher to do a cross-case analysis in order to check his hypothesis and make generalizations (Rihoux & Ragin, 2009).

The QCA approach has borrowed the arguments from, in particular, J. S. Mills (1970), where he explained the two methods of comparison:

- Method of agreement:

> "If two or more instances of the phenomenon under investigation have only one circumstance in common, the circumstance in which alone all the instances agree is the cause (or effect) of the given phenomenon"

- Method of difference:

> "If an instance in which the phenomenon under investigation occurs, and an instance in which it does not occur, have every circumstance in common save one, that one occurring only in the former; the circumstance in which alone the two sets of

> instances differ, is the effect, or the cause, or an indispensable part of the cause, of the phenomenon"

The QCA method has evolved over time and has branched out into three different methods:

- Crisp-Set Qualitative Comparative Analysis (csQCA)
- Multi-Value QCA (mvQCA)
- Fuzzy-Set Qualitative Comparative Analysis (fsQCA)

The different methods of QCA provide different advantages to the researcher. As illustrated in Figure 4, the csQCA works well with small sample sizes when there is not a huge need of preserving richness of the data set. On the other hand, the fsQCA works well with more numbers of cases where the need to preserve richness of the data set is high. The mvQCA lies somewhere in the middle of the other two methods and can be applied to a medium number of cases.

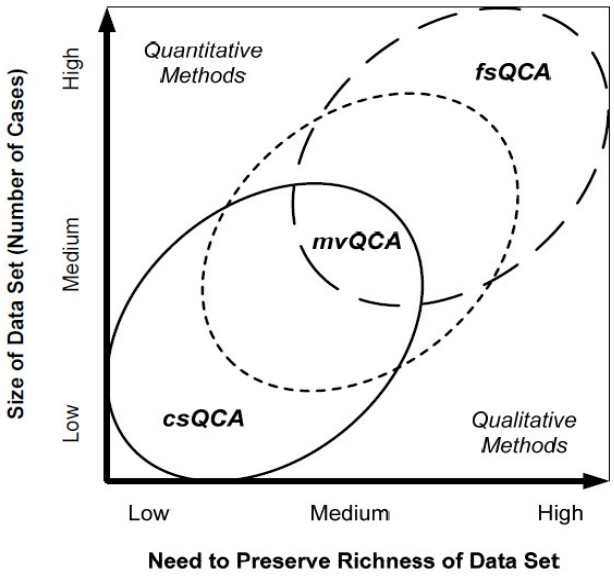


Figure 4: Comparison of QCA methods (Source: Hartman & Cronqvist, 2009)

In general, QCA techniques have the strengths of both qualitative and quantitative approaches, and are good candidates for the research methodology for this dissertation.

The QCA approach enables the researcher to capture the complexity while being able to do a cross-case comparison. The QCA method also helps the researcher to generalize or replicate the results and findings. The QCA techniques are analytical transparent and replicable and have the power to produce modest generalization.

Hybrid Approach for This Study

The P3 projects are a combination of the policy considerations and financial/commercial implications that make it very challenging to marry those two. As explained before, conducting research on P3 related topics is very challenging due to the particular characteristics of P3 projects and P3 market in the United

States. For instance, some of the information that researchers need, particularly financial information, is considered proprietary and is not publicly available. Therefore, the restriction on having access to the information limits the availability of data and makes the design of the research very complicated.

This study uses a hybrid approach with a combination of different approaches. In the first step, QCA will be used to study a medium sample-size of cases to find logical patterns and draw meaningful conclusions in order to minimize the number of hypotheses. The various techniques of QCA precisely identify and narrow down "conditions of occurrence." In the next step, a more detailed analysis will be done using statistical techniques to further analyze findings. Figure 5 provides a summary of the application of the hybrid research methodology used in this study as described in more detail in the following section.

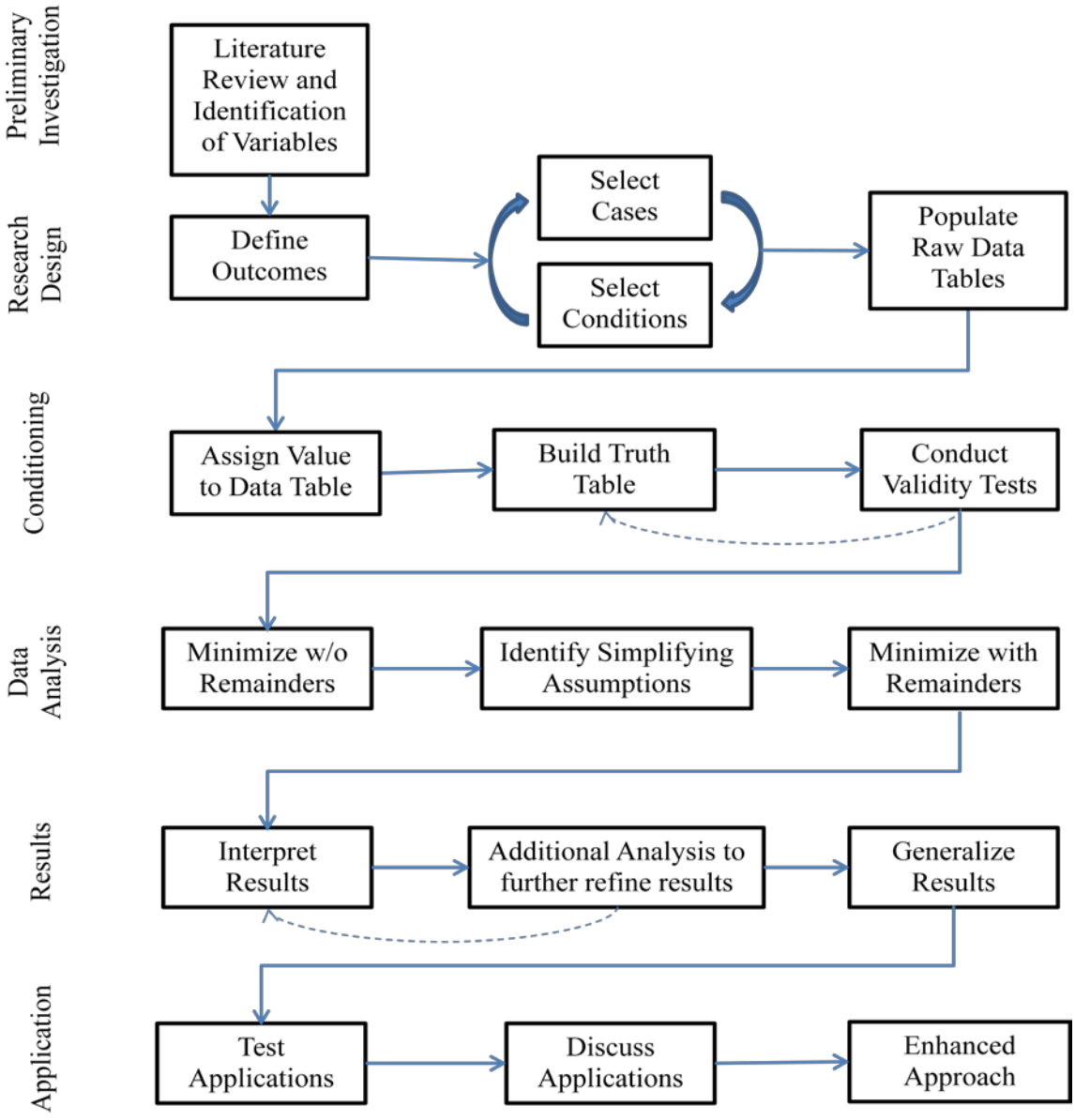


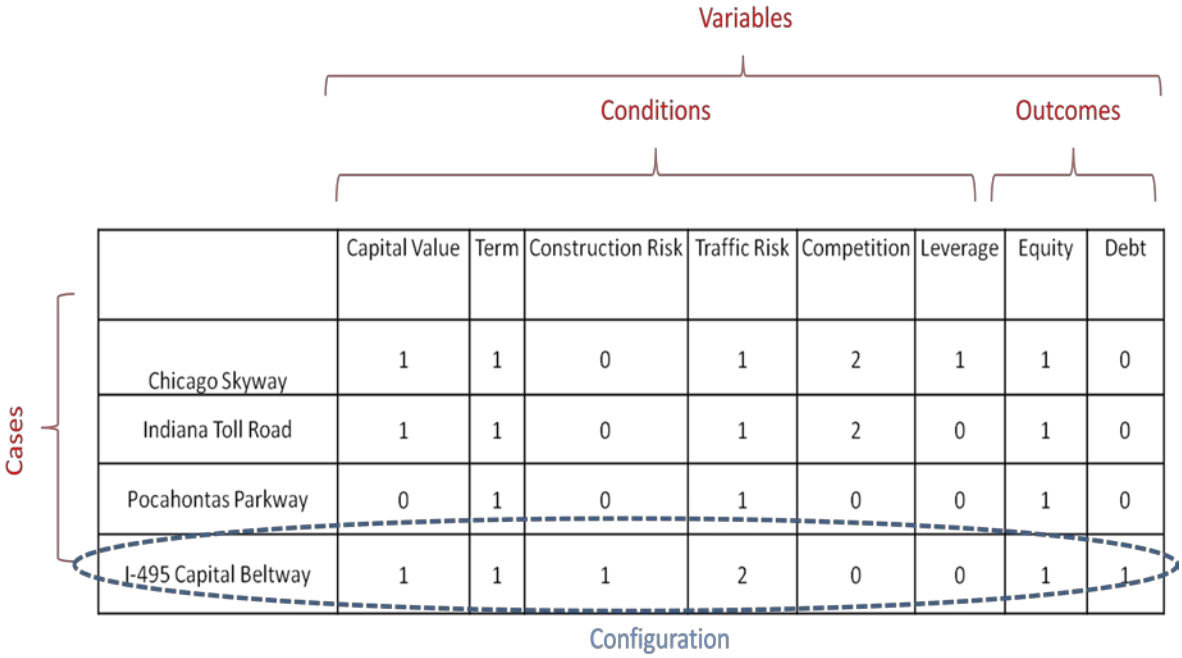
Figure 5: Research Structure

Application of Qualitative Comparative Analysis

In summary, the QCA technique is used to identify different conditions that may result in different outcomes. These conditions are studied and quantified in different cases to find logical combinations of different conditions that may result in

occurrences of specific outcomes. Through this systematic approach, the research question and the hypothesis will be evaluated and certain conclusions that can be made to generalize the findings. This study will use a hybrid approach to take one additional step to further analyze conclusions and refine the findings.

Figure 6 demonstrates a sample QCA Configuration Table and shows what elements are involved in a QCA analysis.



	Capital Value	Term	Construction Risk	Traffic Risk	Competition	Leverage	Equity	Debt
Chicago Skyway	1	1	0	1	2	1	1	0
Indiana Toll Road	1	1	0	1	2	0	1	0
Pocahontas Parkway	0	1	0	1	0	0	1	0
I-495 Capital Beltway	1	1	1	2	0	0	1	1

Figure 6: Sample QCA Configuration Table

The different steps of the QCA method have been explained in detail by Rihoux & Ragin (2009) in their book titled *Configurationally Comparative Methods*. This research project will follow the same steps.

Identification of Outcomes of Interest

The first step in the QCA approach is identification of outcomes of interest. This step is particularly important because it is directly related to the research question and hypothesis. As discussed earlier, this study intends to investigate how financial structure of P3 projects may be improved to enhance bankability of P3 projects and reduce the need for public subsidy.

As discussed in chapter two of this dissertation, the financing capacity of P3 projects is usually determined by debt capacity and equity capacity. Therefore, usually the main objective in structuring the financial package of P3 deals is maximizing the debt capacity and the equity capacity in order to maximize financing capacity of P3 projects. Equation (1) and equation (2) in the introduction chapter of this study explain the main elements that influence debt capacity and equity capacity. It is beneficial to look at those elements once again:

$$Debt\ Capacity = \sum_{j=1}^{n} [((RREVi - O\&M)/DSCR\ )/(1+i)^{j}]$$

$$Equity\ Capacity = \sum_{j=1}^{n} [((TREVi - O\&M - DS - TAXi)/(1+MARR)^{j}]$$

The main objective of this study is to analyze how debt capacity and equity capacity can be improved so the financing capacity of the project can be maximized. The following variables play a role in the above equations:

- Rating-case Revenue (RREV)

- Total Anticipated Revenue (TREV)
- Operation and Maintenance Expenses (O&M)
- Taxes (TAX)
- Debt Service Coverage Ratio (DSCR)
- Interest Rate on Debt (i)
- Expected Rate of Return on Equity (MARR)

The revenue forecasts and O&M expenses are usually a function of project characteristics. Taxes are usually determined by accounting treatments and are subject to legal matters. However, DSCR, expected equity IRR and interest rate on debt are all determined based on the risk premiums and market characteristics and can have a great direct influence on debt capacity and equity capacity. Therefore, the following goals are specified as the objects of structuring project finance for P3 projects and the preferred outcomes of the QCA analysis:

- Minimize Interest Rate on Debt (i)
- Minimize Expected Rate of Return on Equity (MARR)
- Maximize Financing Capacity (maximizing financing leverage by maximizing use of cheaper source of financing, debt, instead of more expensive equity)

The first two objectives are simple to explain. However, the third objective, maximizing leverage, is slightly more complicated. This objective intends to maximize the use of a cheaper source of financing, debt, compared to more expensive source, equity. To do so, the DSCR should be minimized so the maximum amount of debt can be issued and the financing leverage (debt/equity) can be maximized and the weighted average cost of capital can be minimized. As a result, the overall financing capacity will be maximized, which is the main objective of this study.

Selection of cases

Selection of cases in QCA analysis is one of the important steps. The greater the number of conditions and possible the values are, the larger the data space is, which results in a higher accuracy of the results based on the comparison of cases.

If multiple cases are available, identification of cases should be based on the "most similar" versus the "most different" system designs as shown in the Figure 7. All cases should share enough background characteristics and an adequate number of cases with different outcomes, both 'positive' and 'negative' outcomes, should be included.

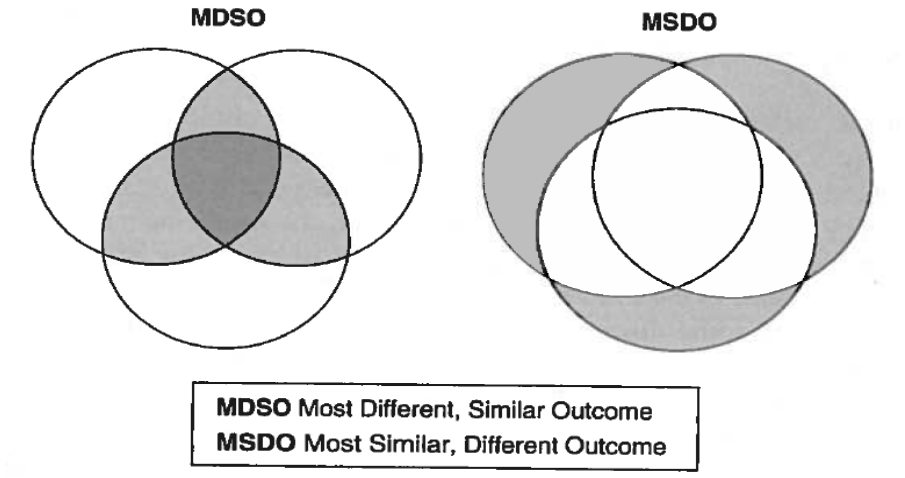


Figure 7: Most Different Vs Most Similar Case Identification (Source: Rihoux and Ragin, 2009)

The total number of P3 projects that have been successfully procured in the United States over the last 10 years is less than 20 projects. This study has identified the following 18 projects to be included in the QCA investigation.

- Chicago Skyway (financial close: Jan-2005)
- Indiana Toll Road (financial close: Jun-2006)
- Pocahontas Parkway (financial close: Jun-2006)
- Capital Beltway (financial close: Dec-2007)
- SH 130 Segments. 5&6 (financial close: Mar-2008)
- I-595 (FL) (financial close: Mar-2009)
- Port of Miami Tunnel (financial close: Oct-2009)
- North Tarrant Express (financial close: Dec-2009)
- I-635 (LBJ Freeway) (financial close: Jun-2010)
- Midtown Tunnel (VA) (financial close: Apr-2012)
- Presidio Parkway (CA) (financial close: Jun-2012)
- I-95 HOT Lanes (VA) (financial close: Jul-2012)
- East End Crossings (Ohio) (financial close: Mar-2013)
- NTE Segments 3A & 3B (financial close: Sep-2013)
- Goethals Bridge (financial close: Nov-2013)
- US-36 (financial close: Feb-2014)
- I-69 Section 5 (financial close: Jul-2014)
- I-4 Managed Lanes (financial close: Sep-2014)

The literature review on QCA did not result in a definite answer on the number of cases that will be required for a QCA analysis; however, Ragin and Rihoux (2004) suggested that an "intermediate-N" sample size should range within 5-40. The 18 cases selected for this study put the number of cases of the study within the specified range.

Selection of Conditions

As discussed earlier, conditions represent characteristics of each case. They are the variables that distinguish cases and, in the case of this study, characteristics that influence overall financing capacity of P3 projects. Conditions should be carefully

selected, since a large number of conditions may result in having too many variables requiring more cases to cover potential outcomes, and a small number of conditions may result in having contradictory outcomes, since projects cannot be properly distinguished based on their characteristics. Based on this approach, five conditions are being considered in this study. The conditions considered in this study are:

- Project Size
- Project Duration
- Construction Risk
- Revenue Risk
- Level of Competition During Procurement

Initial project cost provides an indication of overall size of project and often is the factor that is considered by contractors, lenders and equity investors when selecting the appropriate size of projects based on their resources and capacity. Duration of project is usually indicated by terms of the comprehensive agreement, which is another determining factor since it is an indication of the probabilities for refinancing or long-term investment. Construction risk provides the technical risk profile for the project and revenue risk determines the risk profile for observation of future revenues. The final constraint is the level of procurement, which indicates whether there was a chance to achieve the best value through receiving competitive prices.

Matching Cases, Conditions and Outcomes to develop the Truth Table

As discussed earlier, the QCA method translates different variables into meaningful values so a systematic comparison can be made. The following table represents how the variables are translated into values in this study.

Conditions	Variable Name	Meaning	Value
Project Size	Cost	Low (1 billion or less)	0
		High (over 1 billion)	1
Project Duration	Term	Short (less than 50 years)	0
		Long (50 years or more)	1
Construction Risk	CR-Risk	None (brown-field lease)	0
		Medium (regular construction)	1
		High (special construction)	2
Traffic and Revenue Risk	TR-Risk	None (availability payments)	0
		Medium (toll road with history)	1
		High (managed lane or no history)	2
Level of Competition	Comp	None (One Bidder)	0
		Low (Two Bidders)	1
		High (Three Bidders or More)	2
Outcomes	**Variable Name**	**Meaning**	**Value**
Reduced Expected Equity IRR	Equity	NO	0
		YES	1
Reduced Debt Interest Rate	Debt	NO	0
		YES	1
Maximized Financing Capacity	Leverage	NO	0
		YES	1

Table 2: QCA Variables (Conditions, Outcomes) and Values

Constructing and Reviewing Raw Data Tables

The next step after selecting outcomes, cases, conditions, variables and values is constructing the raw data table to compile all the information into one table in the

form of a matrix for future analysis and refinement. A sample raw data table was previously shown in Figure 6.

One issue that may arise in this step is conflicting information. For instance, two cases may have identical values for conditions, but different outcomes. In that case, further investigation and potential adjustments will be required to understand why the outcomes are different. This may lead to introduction of new conditions that may lead the researchers to find out why outcomes are different. This may also require a trial-and-error process, which may result in developing a new scale for assigning values in order to develop a contradiction-free table that can be used in the next step for analysis.

Analysis, Interpretation and Refinement

The next step in the process is to analyze the table to minimize the table and look logical configurations between conditions that will result in certain outcomes. This analysis is done based on Boolean algebra algorithm as shown below:

Where

- An upper case letter represents the [1] value or existence of a binary variable
- A lower case letter represents the [0] value or absence of a binary variable
- Logical “AND” is represented by [*]
- Logical “OR” is represented by [+]

If : $A * B * Y + A * B * y \rightarrow 0$

Therefore: $A * B \rightarrow 0$

In other words, the [Y] condition is “superfluous” and can be removed.

This analysis can be performed manually or with available software such as TOSMANA (Tool for Small-N Analysis).

The minimization procedure is usually applied twice: first, for the [1] configurations, and then, for the [0] configurations. As discussed earlier, in most cases, the number of cases is not sufficient to represent all possible logical configuration of conditions, and therefore, the software may use some "Logical Remainders" as non-observed cases to the table to simplify assumptions and generalize findings.

In this study, the analysis has been performed both with and without logical remainders to develop information for different purposes. Therefore, four complete minimization procedures have been run for each one of the three outcomes:

- [1] configurations, without logical remainders
- [1] configurations, with logical remainders
- [0] configurations, without logical remainders
- [0] configurations, with logical remainders

Application

At the end of the QCA process, certain generalized patterns will be discovered that will help to refine the hypothesis. Those patterns will be further analyzed to understand why different outcomes were achieved in different projects and discover potential options that can be utilized to enhance debt capacity, equity capacity and, in general, overall financial capacity of the project to achieve maximum leverage at the lowest weighted average cost of capital. As a result of this detailed analysis and discussion, the study will introduce an enhanced approach that can be used by

practitioners to structure P3 financing packages more efficiently. This application has been discussed in more detail in chapter 5 of this dissertation.

Special Discussion on Development of Meanings to Assign Values

As discussed earlier, the QCA analysis in this study includes five conditions and three outcomes. This section provides a summary on how values have been assigned to each condition or outcome based on standard scales and the logic behind selecting those scales.

Project Size

Project size can be one of the indications of the overall size of the financing package and potentially it can impact the availability of market demand for debt or equity. Although in many cases large infrastructures have been successfully financed, the size of debt and equity in large infrastructure projects may impact the overall demand for the private investment in the project. For instance, some concessionaires are able to invest equity up to a certain level. If the size of required equity investment is more than their capacity, they may not be able to bid on the project or they may need to find other partners or one or more investment funds to help them come up with the required level of equity. The same issue may happen in the debt market: providing a bank loan to a large infrastructure project may require different banks to team up with each other to be able to lend the required amount of loan collectively. The bond market may experience the same issue, particularly if a large amount of bonds is being offered in the bond market even though the bond market may be more flexible than the banking system.

For the purpose of this study, it is assumed that there is a relationship between the size of initial capital investment in the project and the size of financing. Therefore, projects with a capital value of $1 billion or more are considered relatively small and have been assigned a 0 value, compared to the projects with a capital value of more than $1 billion that are being assigned a 1 value in the data table.

Project Duration

Project duration is another important element that may influence financing package of P3 projects. In most cases, toll concession roads in the United States have a term that is equal to or more than 50 years and availability payment projects have a duration that is 50 years or less.

Two of the main reasons that toll concessions in the United States have terms of 50 years or more are: (i) flexibility to mitigate revenue risk for debt & equity due to a period of time post scheduled debt full repayment (i.e., beyond 30-35 years), and (ii) tax ownership of the asset.

Tax ownership allows a developer to depreciate certain expenses related to the wear and tear of an asset and, as a result, receive tax savings. The determination as to whether a developer can take depreciation on an asset is based mainly on whether the developer bears the risk of the exhaustion of the associated capital investment.

A key consideration in this regard is whether the useful life of the asset extends beyond the term of the lease contract, so as to give the developer a possession right to that asset.

If the term of a lease covers all (or perhaps even substantially all) of the useful life of the leased asset, then the developer would typically be considered the owner of such property for tax purposes. There are couple different ways to determine the useful life of an asset that consists of many interdependent assets, but it is a very asset- and developer-specific exercise as information on both assets (e.g., walls, foundations, interchanges, lighting, tolling systems) and materials used will be considered.

The in-debt discussion of tax treatment of P3 projects is beyond the scope of this study; however, this study has categorized project terms into a short-term (less than 50 years) with an assigned value of 0, and a long-term (50 years or more) with an assigned value of 1. There is only one project with a term of 50 years (US 36). Since this term is closer to the next higher term (52 years) than the closest lower tern (40 years), it is assumed that 50 years belongs to the long-term category.

Construction Risk

In most P3 projects, construction risk is transferred to the concessionaire except in a few brown-field deals with no construction. This risk usually is usually transferred to the Design-Build contractor through the Design Build Agreement. However, it can still impact the risk profile for equity investors and lenders due to the liquidity issues that it may create in case a claim arises. Therefore, the more construction risk, the higher the risk of facing cash-flow problems as a result of claims or unexpected events.

This study has categorized the cases into three different categories. Category one has no or very limited construction risk which is mainly brownfield projects with a value of 0. Category two has projects with the medium construction risk, which includes regular projects with standard construction risk with an assigned value of 1. The third category has projects with complicated construction elements and special risk profiles such as tunnels or complicated construction in developed urban areas. Category three projects have been assigned a value of 2 in this study.

Revenue Risk

Since the returns on debt and equity investments are paid by project revenues, there should be a direct relationship between the risk profile of project revenues and the risk profile of the debt and equity investment in the project, which results in the premium that should be expected by investors.

There are three main types of risk profiles that can be defined for the cases that have been considered under this study. Some have almost no revenue risk (except appropriation risk) such as availability payment deals. They have received a value of 0. Some have a risk profile similar to a mature toll road with a reasonable history of traffic and revenue. Those deals have some level of revenue risk; however, the uncertainty is minimal due to existence of historic data. Those deals have received a value of 1. On the other hand, some deals such as managed lane projects have a significant uncertainty in their revenue forecast due to lack of information in terms of behavioral responses of users to tolling in managed lanes. The recent issues with the level of actual traffic and revenue compared to the anticipated level of traffic and

revenue in some of those projects explain the high uncertainty and traffic risk for those projects. Those projects have been assigned a value of 2 in this study.

Level of Competition

One of the hypotheses of this study is that the level of competition plays a great role in achieving the best value, including an enhanced financing package, through a competitive procurement process. There are three levels of competition defined in this study. Level 1 with a value of 0 represents no competition, which means a one-on-one negotiation and an interim agreement was used to develop commercial terms and financing package. Level 2 means low competition existed between only two bidders. This level has been assigned a value of 1. Level 3 represents high competition between at least three bidders.

Chapter 4: Data Analysis and Results

The previous chapter laid down the research methodology and framework for this study. This chapter intends to conduct the analysis to investigate relationships between project characteristics and the financial package delivered for the 18 cases that have been selected to form the database of this analysis.

The cases have been limited to P3 projects that at a minimum require development and delivery of a financing package with private sector investment in the form of equity. Therefore Design-Build projects or Design-Build-Operate-Maintain projects have not been included in the pool of cases.

A software, TOSMANA 1.3.2, has been used to conduct the data analysis.

Data Collection and Conditioning

Table 3 summarizes the main project characteristics, financial package and procurement history of the cases selected for analysis in this study. Most of the information in this table has been gathered from project websites and financing documents. However, some information particularly related to expected equity IRR comes from reliable sources who are familiar with projects. Although due to proprietary nature of this information it may not be accurate up to decimal points, the accuracy level of the reported equity IRR in Table 3 is sufficient for the purpose of QCA data analysis.

	Chicago Skyway	Indiana Toll Road	Pocahontas Parkway	Capital Beltway	SH 130 Seg. 5&6	I-595
Description	Urban Brownfield(long-term lease)	Urban Brownfield (long-term lease)	Urban Brownfield(long-term lease)	Greenfield HOT Lanes	Greenfield	Brownfield
Financial Close	Jan-05	Jun-06	Jun-06	Dec-07	Mar-08	Mar-09
Capital Value	$1.83 bn	$3.8 bn	$600 m	$2.1 bn	$1.3 bn	$1.83 bn
Term	99 Years	75 Years	99 Years	80 Years	50 Years	35 Years
Construction Risk	None	None	None	Moderate	Moderate	Moderate
Traffic Risk	Mature, Real Toll, Long Op. History	Mature, Real Toll, Long Op. History	Real Toll w/ 5 yr Operating History	Significant Real Toll, Managed Lane	Real Toll	None (Availability Payments)
Sponsor	Macquarie / Cintra	Macquarie / Cintra	Transurban	Transurban / Fluor	Cintra / Zachry	ACS Dragados
Financing	***Bank Debt*** Refi. w/ Taxable 144a Bonds	80/20 Leverage ***Bank Debt*** w/ Accreting Swap	70/30 Leverage ***Bank Debt***	78/22 Leverage ***PABs***, TIFIA, LOC credit enhancement	65/35 Bank Debt, TIFIA, Equity	87/13 Leverage TIFIA, ***Bank Debt***
Equity IRR	12.30% (post refi)	13.00%	12.60%	13.00%	12.00%	11.54%
Evaluation Criteria	Highest Qualified Bid	Highest Qualified Bid	Negotiation after Unsolicited Proposal	Negotiation after Unsolicited Proposal	Negotiated with winning bidder for TTC-35	Best Value Selection
# of bids	3	4	1	1	1	2
Notes	Cintra/Macquarie - $1.83 billion, Vinci - $700.5 million, Abertis - $505 million	Cintra/Macquarie - $3.8 billion, Babcock & Brown - $2.84 billion, Itinere - $2.52 billion, Morgan Stanley - $1.9 billion	Transurban / DEPFA	Unsolicited Proposal by Transurban and Fluor	Cintra bid $7.2 billion for right to negotiate six projects under Trans Texas Corridor 35.	Four short-listed but only two teams submitted bids: ACS Dragados-Macquarie and Babcock and Brown

	Port of Miami Tunnel	North Tarrant Express	LBJ Freeway	Midtown Tunnel	Presidio Parkway	I-95 HOT Lanes
Description	Urban Greenfield	Urban Greenfield Managed Lanes	Urban Brownfield Managed Lanes	Greenfield / Brownfield	Urban Greenfield	Urban Greenfield
Financial Close	Oct-09	Dec-09	Jun-10	Apr-12	Jun-12	Jul-12
Capital Value	$1.1 bn	$2.0 bn	$2.615 m	$2.10bn	$473.00m	$940.00m
Concession Length	35 Years	52 Years	52 Years	58 years	30 years	76 years
Construction Risk	High	Moderate	Moderate	High	Moderate	Moderate
Traffic Risk	None (Availability Payments)	Significant Real Toll, Managed Lane	Significant Real Toll, Managed Lane	Real Toll, well understood	None (Availability Payments)	Significant Real Toll, Managed Lane
Sponsor	Meridiam / Bouygues	Cintra / Meridiam	Cintra / Meridiam	Macquarie / Skanska	Hochtief / Meridiam	Transurban / Fluor
Financing	90/10 Leverage PABs, ***Bank Debt***	73/27 Leverage ***PABs***, TIFIA, TxDOT contributions	69/31 Leverage ***PABs***, TIFIA, TxDOT contributions	80/20 Leverage ***PABs***, TIFIA, VDOT contributions	87.5/12.5 Leverage ***Bank Debt***, TIFIA	***PABs***, TIFIA
Equity IRR	11.33%	13.12%	12%	12.5%	14.46%	13%
Evaluation Criteria	Best Value Selection	Best Value Selection	Best Value Selection	Best Value Selection	Best Value Selection	Best Value Selection
# of bids	3	2	2	1	2	1
Notes	Three teams shortlisted: Babcock & Brown, ACS/Odebrecht/Parsons, and FCC/Morgan Stanley.	Four teams short-listed out of seven proposals: Balfour Beatty/BRISA, Cintra/Meridiam, Itinere, OHL. Only two submitted proposals: Cintra &OHL	Four teams short-listed and two submitted proposals: Cintra/Meridiam and Dragados/Zachry	VDOT issued Solicition for Proposals after receiving an unsolicited proposal from Skanska	Three teams short-listed and two submitted bids: HOCHTIEF/Meridiam and ACS.	Unsolicited proposal submitted by Clark/Shirley in September 2003 started PPTA process. Fluor/Transurban detailed proposal selected in November 2005.

	East End Crossing	NTE Seg 3A & 3B	Goethals Bridge	US-36	I-69 Section 5	I-4
Description	Urban Greenfield	Urban Greenfield Managed Lanes	Urban Greenfield	Greenfield Managed Lanes	Greenfield	Urban Greenfield Managed Lanes
Financial Close	Mar-13	Sep-13	Nov-13	Feb-14	Jul-14	Sep-14
Capital Value	$763.00m	$1.65bn	$1.30bn	$140.00m	$290 m	$2.30 bn
Concession Length	35 years	52 years	40 years	50 years	37 years	40 years
Construction Risk	Moderate	Moderate	Moderate	Moderate	Moderate	High
Traffic Risk	None (Availability Payments)	Significant Real Toll, Managed Lane	None (Availability Payments)	Significant, real toll, managed lane	None (Availability Payments)	None (Availability Payments)
Sponsor	Walsh / Vinci / Bilfinger Berger	Cintra / Meridiam	Macquaire / Kiewit	Plenary Group	Isolux	Skanska / John Laing
Financing	90/10 Leverage ***PABs***, Subsidy	65/35 Leverage ***PABs***, TIFIA, Subsidy	90/10 Leverage ***PABs***, TIFIA, Subsidy	66/34 Leverage ***PABs***, TIFIA, Subsidy	86/14 Leverage ***PABs***, Subsidy	94/6 Leverage ***Bank Debt,*** TIFIA
Equity IRR	12%	13%	13.80%	13.68%	9.93%	12%
Procurement Evaluation Criteria	Best Value Selection	Negotiated with winning bidder for NTE	Lowest Cost	Best Value Selection	Best Value Selection	Best Value Selection
# of bids	3	1	3	2	4	4
Notes	Three teams short-listed out of five: Kiewit, Skanska and Walsh	2009 agreement with Cintra/Meridiam authorized negotiation of the terms for construction of additional segments	Three teams short-listed: Kiewit/Macquarie, Skanska and ACS.	Three teams short-listed out of four: Cintra, Plenary, Isolux Corsan. Only two submitted binding proposals: Plenary and Isolux Corsan.	Four teams short-listed out of five: Macquarie/Lane, PSP/Isolux, Pleanary and Walsh/Meridiam.	Four teams short-listed out of seven: VINCI/Meridiam/Walsh, Macquarie/OHL/FCC, Skanska/Laing, InfraRed/Fluor/Kiewit

Table 3: Overview of Project Cases

The next step in the QCA analysis is development of the raw data table from the case studies. In order to do so, the information in Table 2 regarding meanings of assignment of values to variables and the detailed case study information presented in Appendix 1 have been used to transform Table 3 into a raw data table. Table 4 summarizes shows the first step in developing conditions side of the raw data.

	Conditions				
	Capital Value (mil)	Term (years)	Construction Risk	Traffic Risk	Competition
Chicago Skyway	$1,830	99	None	Mature, Real Toll, Long Op. History	3
Indiana Toll Road	$3,800	75	None	Mature, Real Toll, Long Op. History	4
Pocahontas Parkway	$600	99	None	Real Toll w/ 5 yr Operating History	1
Capital Beltway	$2,100	80	Moderate	Significant Real Toll, Managed Lane	1
SH 130 Seg. 5&6	$1,300	50	Moderate	Real Toll	2
I-595 (FL)	$1,830	35	Moderate	None (Availability Payments)	2
Port of Miami Tunnel	$1,100	35	High	None (Availability Payments)	3
North Tarrant Express (NTE)	$2,000	52	Moderate	Significant Real Toll, Managed Lane	2
I-635 (LBJ Freeway)	$2,615	52	Moderate	Significant Real Toll, Managed Lane	2
Midtown Tunnel (VA)	$2,100	58	High	Real Toll, well understood	1
Presidio Parkway (CA)	$437	30	Moderate	None (Availability Payments)	2
I-95 HOT Lanes (VA)	$940	76	Moderate	Significant Real Toll, Managed Lane	1
East End Crossings - East End	$763	35	High	None (Availability Payments)	3
NTE Segments 3A & 3B	$1,650	52	Moderate	None (Availability Payments)	1
Goethals Bridge	$1,300	40	High	None (Availability Payments)	3
US-36	$140	50	Moderate	Significant, real toll, managed lane	2
I-69 Section 5	$290	37	Moderate	None (Availability Payments)	4
I-4 Managed Lanes	$2,300	40	Moderate	None (Availability Payments)	4

Table 4: Development of Conditions side of the QCA Raw Data Table

The same step should be taken for development of the outcome side of the raw data table. However, as discussed before assigning meaning to expected equity IRR and debt interest rate is not easy due to the existence of multiple variable and changes in market conditions. Table 5 summarizes the financing structure of the cases.

Project characteristics have an impact on financial package, however, and financing elements are highly dependent on market conditions. Therefore, it is important to provide a benchmark to be able to understand market conditions at the time of financial close. This study has looked at three market benchmarks: LIBOR Swap Rates, Revenue Bond Index (RBI) and 30-year Rates. These benchmarks have been summarized in Table 5 and have been used to calculate the adjusted expected equity IRR and debt interest rate mentioned later in this study.

	Transaction	Chicago Skyway	Indiana Toll Road	Pocahontas Parkway	Capital Beltway	SH 130 Seg. 5&6
	Financial Close	Jan-2005	Jun-2006	Jun-2006	Dec-2007	Mar-2008
BANK DEBT	**amount**	$150.00	$3,248.00	$305.70		$685.80
	pricing	Six month LIBOR + 250 bp	Six month LIBOR + 95 to 125 bp plus swap fees	LIBOR + 85 to 130 bp		LIBOR + 130 to 170 bp
	term	30 year sub debt	20 years	30 years		30 years
	# of banks	three	seven	three		ten
BONDS/PABs	**amount**	$1,400.00		$21.90	$589.00	
	pricing	$961 CABs (LIBOR +38) and $439 Current (LIBOR +28)		Affiliated Subordinate Note (at *10%*)	20-year SIFMA municipal index swap with 3.6% fixed rate (LOC from DEPFA + three banks)	
	term	CABS - 21 years, Current 12 years		10 years	40 years	
TIFIA	**amount**			$150.00	$589.00	$430.00
	pricing			5.16%	4.45%	4.46%
	term			two tranches (2042,2044)	2047	2047
EQUITY	**amount**	$229.00	$770.00	$119.00	$350.00	$209.80
	IRR	12.30% (post refi)	13.00%	12.60%	13.00%	12.00%
	Leverage (equity/total financing)	12.87%	19.16%	19.95%	22.91%	15.83%
Benchmark Rates	**LIBOR Swap Rates**	4.09%	5.59%	5.59%	4.31%	3.39%
	Revenue Bond Index	4.92%	5.24%	5.24%	4.77%	5.17%
	30-Year Treasury		5.15%	5.15%	4.53%	4.39%

	Transaction	I-595 (FL)	Port of Miami Tunnel	North Tarrant Express	I-635 (LBJ Freeway)	Midtown Tunnel
	Financial Close	Mar-2009	Oct-2009	Dec-2009	Jun-2010	Apr-2012
BANK DEBT	amount	$780.00	$341.50			
	pricing	LIBOR + 300 to 400 bp	LIBOR + 300 bp swapped to 6.63%			
	term	10 years	5 to 7 years			
	# of banks	twelve	ten			
BONDS/PABs	amount			$400.00	$615.00	$663.75
	pricing			$59.8 in 2031 at 7.50% and $340.2 in 2039 at 6.875%	7.00% to 7.50%	4.45% to 5.50%
	term			2031 and 2039	2032-2040	2022-2042
TIFIA	amount	$603.00	$341.00	$650.00	$850.00	$422.00
	pricing	3.64%	4.31%	4.52%	4.22%	3.18%
	term	2042	2044	2049	2049	2056
EQUITY	amount	$207.70	$80.30	$427.00	$665.00	$272.00
	IRR	11.54%	11.33%	13.12%	12%	12.50%
	Leverage (equity/total financing)	13.06%	10.53%	28.91%	31.22%	20.03%
Benchmark Rates	LIBOR Swap Rates	2.46%	2.68%	2.69%	2.29%	1.17%
	Revenue Bond Index	5.81%	4.81%	4.94%	4.84%	4.83%
	30-Year Treasury	3.64%	4.19%	4.49%	4.13%	3.18%

	Transaction	Presidio Parkway	I-95 HOT Lanes	East End Crossing	NTE Seg 3A & 3B	Goethals Bridge
	Financial Close	Jun-2012	Jul-2012	Mar-2013	Sep-2013	Nov-2013
BANK DEBT	**amount**	$166.60				
	pricing	2.535% (LIBOR + 175 bp)				
	term	3.5 years				
	# of banks	six				
BONDS/PABs	**amount**		$252.60	$676.80	$274.03	$460.92
	pricing		4.35% to 4.45%	4.56% to 5.01%	6.75% to 7.00%	5.00% to 5.625%
	term		2030-2040	2019-2051	2033-2043	2020-2052
TIFIA	**amount**	$182.00	$300.00		$531.00	$473.67
	pricing	0.46% for $90M 3.5 year tranche; 2.71% for $63M 28-year tranche	2.77%		3.84%	
	term	3.5 and 28 years	2048		2053	2051
EQUITY	**amount**	$45.60	$280.40	$78.10	$430.29	$106.82
	IRR	14.46%	13%	12%	13%	13.80%
	Leverage (equity/total financing)	11.57%	33.66%	10.35%	34.83%	10.26%
Benchmark Rates	**LIBOR Swap Rates**	0.99%	0.85%	0.98%	1.76%	1.47%
	Revenue Bond Index	4.74%	4.54%	4.36%	5.27%	5.23%
	30-Year Treasury	2.7%	2.59%	3.16%	3.79%	3.8%

	Transaction	US-36	I-69 Section 5	I-4 Managed Lanes
	Financial Close	Feb-2014	Jul-2014	Sep-2014
BANK DEBT	**amount**			$486.00
	pricing			*4.04%*
	term			*4 to 9 years*
	# of banks			six
BONDS/PABs	**amount**	$40.91	$251.76	
	pricing	$20.36M PABs at 5.875% and $20.554 Subordinated Loan at 11%	1.50% to 5.00%	
	term	2044 and 2050	2017-2046	
TIFIA	**amount**	$60.00		$949.00
	pricing	3.58%		
	term	2044		$130.7 due 2023 and $818.4 in 2052
EQUITY	**amount**	$20.55	$40.45	$104.00
	IRR	13.68%	9.93%	12%
	Leverage (equity/total financing)	16.92%	13.84%	6.76%
Benchmark Rates	**LIBOR Swap Rates**	1.62%	1.8%	1.77%
	Revenue Bond Index	5.29%	4.98%	4.87%
	30-Year Treasury	3.66%	3.33%	3.37%

Table 5: Financial Package of Cases

The next step is development of the outcome side of the raw data table. There are three outcomes that are being studied in this dissertation: Equity IRR, Interest Rate on Debt and Financing Capacity or Leverage.

It is usually hard to define the equity IRR for P3 projects in the United States, particularly since there are not many projects in the operation phase. Therefore, the Equity IRR in this study is usually referred to as the Expected Equity IRR under the base case financial model for equity that is usually developed during the procurement stage based on the anticipated traffic and revenue. This is often considered proprietary, so it is hard to have access to the exact Expected Equity IRR under this model. In addition, the Expected Equity IRR in different models may not truly be comparing similar actions since the timing of withdrawal on equity may change the overall Expected Equity IRR. In other words, equity investors may not invest their equity dollars in the project in the beginning years, but under the financial model it may be assumed that equity dollars are invested and used in the early years. These differences in the cash flow may create different Equity IRRs making the observed Equity IRR higher than the Expected Equity IRR under the base case equity model. The information used in this study has been collected through multiple sources. Although the Expected Equity IRR numbers used in this study may not be accurate to the decimal points, all efforts have been made to ensure that the most accurate available information has been used.

To adjust equity IRR for timing impact, the Revenue Bond Index (RBI) has been used which is a function of the capital market's interest to invest in infrastructure at any

particular time. In other words, adjusted expected equity IRR is defined as the premium that equity investors are being paid over the RBI.

In a similar way, the interest rate on debt is adjusted to provide similar comparisons between tax-exempt bonds, taxable bonds and bank debts at different maturities using the following steps:

- Convert flexible rate bank loans to fixed rate bank loan: the LIBOR Swap Rate has been used to make this conversion.
- Adjust all terms to an equivalent 30-year term: the difference between treasury rates for the longest term of debt and 30-year treasury rate has been used to convert all terms to 30 years
- Adjust for taxes: taxable debt has been converted to a tax-exempt equivalent debt by reducing the interest rate by 15% which has been the rate selected the most common tax rate for long term investment.
- Finally, the spread over adjusting tax-exempt and adjusted term fixed interest rates and the tax-exempt Revenue Bond Index has been calculated to adjust for the impact of time on interest rates.

Appendix B shows these steps that will eventually lead to calculation of the equivalent 30-year tax-exempt time-adjusted bond interest rate.

Many other factors, such as rating on bonds and market preferences for bonds over bank debt or short-term investments versus long-term investments, may impact interest rates on bonds; however, this study has attempted to develop the best

practical methodology to develop approximate numbers based on available information. Since primarily use of the adjusted debt interest rate in this study is to screen/sort the projects by broad categories to be used in the QCA analysis, the accuracy of this method will be sufficient for the stated purpose. Table 6 summarizes the above discussion and shows the outcome side of the raw data table developed for the QCA analysis in this study.

	Variables			
	Time-Adjusted Expected Equity IRR (Spread to RBI)	Time-Adjusted Term-Adjusted Tax-Adjusted Debt Interest Rate Spread to RBI	Leverage (Equity/Total Financing)	
Chicago Skyway	7.38%	0.68%	13%	
Indiana Toll Road	7.76%	0.57%	19%	
Pocahontas Parkway	7.36%	0.62%	20%	
I-495 HOT Lanes	8.23%	0.58%	23%	
SH-130 Seg. 5&6	6.83%	-0.84%	16%	
I-595 (FL)	5.73%	0.27%	13%	
Port of Miami Tunnel	6.52%	0.61%	11%	
North Tarrant Express (NTE)	8.18%	1.94%	29%	
I-635 (LBJ Freeway)	7.16%	2.16%	31%	
Midtown Tunnel (VA)	7.67%	0.67%	20%	
Presidio Parkway (CA)	9.72%	-0.72%	12%	
I-95 HOT Lanes (VA)	8.46%	-0.09%	34%	
East End Crossings (OH)	7.64%	0.65%	10%	
NTE Segments 3A & 3B	7.73%	1.48%	35%	
Goethals Bridge	8.57%	0.40%	10%	
US-36	8.39%	0.58%	17%	
I-69 Section 5	4.95%	0.02%	14%	
I-4 Managed Lanes	7.13%	-0.25%	7%	
	7.52%	0.58%	18.56%	Median
	7.66%	0.62%	16.50%	Average

Table 6: Development of Outcome side of the QCA Raw Data Table

The final step in development of the raw data table is the assignment of values. The information in Table 2 has been used to transform data in Table 4 and Table 6 into the raw data table as shown in Table 6. The time-adjusted expected equity IRR has been defined as the spread over the RBI. The assumption used for achieving reduced expected equity IRR is having an adjusted IRR less than the average expected equity IRR (8%). This number is close to the average adjusted equity IRR (7.66%), yet it represents a natural gap that exists between 7.76% and 8.15%, making it more appropriate as the threshold separating data while having a balance between the number of cases that fall on each side of the threshold.

The same concept has been used to find a threshold for adjusted debt interest rate. The natural gap between adjusted debt interest rates shows up between 68 bp and 148 bp, which is slightly higher than the average adjusted debt interest rate of (62 bp). Therefore, 70 bp has been used as a threshold for debt interest rate.

The assumption used for achieving maximum financing capacity with the lowest WACC is having the amount of equity 20% or less of the total amount of financing. This is due to the fact that there is a natural gap between 20% and 23%, making it a reasonable place to break the value, while this natural gap is still close to the mean (18.5%).

Table 7 shows the preliminary QCA configuration table based on the above discussion.

	Conditions					Outcomes		
CASE ID	CAPEX	Term	CR-Risk	TR-Risk	Comp	Equity	Debt	Leverage
CHI-Skyway	1	1	0	1	2	1	1	1
IND-Toll Rd	1	1	0	1	2	1	1	1
Pocahontas	0	1	0	1	0	1	1	1
I-495 HOT	1	1	1	2	0	0	1	0
SH-130 Seg.5&6	1	1	1	1	1	1	1	1
I-595	1	0	1	0	1	1	1	1
Miami Tunnel	1	0	2	0	2	1	1	1
NTE	1	1	1	2	1	0	0	0
LBJ	1	1	1	2	1	1	0	0
Midtown Tunnel	1	1	2	1	0	1	1	1
Presidio Pkwy	0	0	1	0	1	0	1	1
I-95 HOT	0	1	1	2	0	0	1	0
East End	0	0	2	0	2	1	1	1
NTE SEG3.A &	1	1	1	2	0	1	0	0
Goethals Bridge	1	0	2	0	2	0	1	1
US-36	0	1	1	2	1	0	1	1
I-69 Section 5	0	0	1	0	2	1	1	1
I-4	1	0	1	0	2	1	1	1

Table 7: Preliminary QCA Configuration Table

Internal Validity Testing

The next step in development of the QCA Configuration Table is milestone checks regarding the validity of the preliminary QCA Configuration Table. This study conducts two main tests: the Intermediate QCA Tests and the Inter-Rater Reliability Test.

Intermediate QCA Tests

The first test is a quick visual test to ensure that the selected cases and variables provide enough diversity and sufficient variation for QCA. The criteria proposed by by Rihoux and De Meur (2009) are used for this purpose:

- Ensure that the selected cases and values provide more than minimal representation of both positive and negative outcomes.
- Ensure that variables vary between cases
- Ensure that cases provide sufficient diversity in terms of pairs of conditions
- Avoid counterintuitive configurations in which all conditions are absent but an outcome is present.

A quick review of Table 7 confirms that the above criteria exist in the preliminary QCA Configuration Table. Therefore, the table passes the Intermediate QCA tests successfully. However, a few observations can be made about the table:

Six projects have similar conditions but they have conflicting outcomes. Further investigation is needed to better understand why these projects behave differently.

- I-495 HOT Lanes and NTE Section 3A & 3B have the same conditions, however, they have different outcomes in terms of equity and debt.
- Similarly, the Port of Miami Tunnel and Goethals Bridge have the same conditions with different equity outcomes.
- NTE and LBJ are also similar in terms of conditions but they have resulted in different equity outcomes.

Two projects have similar conditions and similar outcomes. Usually one of these projects should be eliminated from the table to minimize the number of similar cases; however, for the purpose of this study they will be maintained throughout the analysis.

	Conditions					Outcomes		
CASE ID	CAPEX	Term	CR-Risk	TR-Risk	Comp	Equity	Debt	Leverage
CHI-Skyway	1	1	0	1	2	1	1	1
IND-Toll Rd	1	1	0	1	2	1	1	1
Pocahontas	0	1	0	1	0	1	1	1
I-495 HOT	1	1	1	2	0	0	1	0
SH-130 Seg.5&6	1	1	1	1	1	1	1	1
I-595	1	0	1	0	1	1	1	1
Miami Tunnel	1	0	2	0	2	1	1	1
NTE	1	1	1	2	1	0	0	0
LBJ	1	1	1	2	1	1	0	0
Midtown Tunnel	1	1	2	1	0	1	1	1
Presidio Pkwy	0	0	1	0	1	0	1	1
I-95 HOT	0	1	1	2	0	0	1	0
East End	0	0	2	0	2	1	1	1
NTE SEG3.A &	1	1	1	2	0	1	0	0
Goethals Bridge	1	0	2	0	2	0	1	1
US-36	0	1	1	2	1	0	1	1
I-69 Section 5	0	0	1	0	2	1	1	1
I-4	1	0	1	0	2	1	1	1

Table 8: Intermediate QCA Test Observations

A quick review of the cases reveals that the traffic and revenue forecasts in some projects, such as NTE, LBJ, SH 130 Segments 5 & 6 and NTE Section 3A & 3B in Texas, are highly dependent on expected future traffic growth. On the other hand, some projects such as I-95 HOT Lanes already have a history of congestion and are based on traffic and revenue studies post economic crises. Therefore, they have more conservative forecasts with less risk.

Based on the above discussion, the traffic risk on I-495 HOT lanes, SH-130 Segments 5 & 6, I-95 HOT Lanes and US 36 have been reduced to a medium traffic risk with a value of 1 since all projects deal with congested corridors with proven level of historic traffic.

In addition to adjustments to traffic risk, the construction risk of LBJ project was adjusted to a higher level (2) since LBJ and NTE Section NTE Sections 3A & 3B are both urban green-field projects. Table 9 shows the adjusted QCA Configuration Table based on the above discussion.

	Conditions					Outcomes		
CASE ID	CAPEX	Term	CR-Risk	TR-Risk	Comp	Equity	Debt	Leverage
CHI-Skyway	1	1	0	1	2	1	1	1
IND-Toll Rd	1	1	0	1	2	1	1	1
Pocahontas	0	1	0	1	0	1	1	1
I-495 HOT	1	1	1	1	0	0	1	0
SH-130 S-5&6	1	1	1	1	0	1	1	1
I-595	1	0	1	0	1	1	1	1
Miami Tunnel	1	0	2	0	2	1	1	1
NTE	1	1	1	2	1	0	0	0
LBJ	1	1	2	2	1	1	0	0
Midtown Tunnel	1	1	2	1	0	1	1	1
Presidio Pkwy	0	0	1	0	1	0	1	1
I-95 HOT	0	1	1	1	0	0	1	0
East End	0	0	2	0	2	1	1	1
NTE SEG. 3A &	1	1	2	2	0	1	0	0
Goethals Bridge	1	0	2	0	2	0	1	1
US-36	0	1	1	1	1	0	1	1
I-69 Section 5	0	0	1	0	2	1	1	1
I-4	1	0	1	0	2	1	1	1

Table 9: Adjusted QCA Configuration Table

The only two cases that still deliver contradictory outcomes with identical conditions are Port of Miami Tunnel and Goethals Bridge. This study recognizes this contradiction in the QCA Configuration Table, but moves forward with the analysis with the assumption that this contradiction will be further analyzed in the next chapter after some preliminary results are developed based on the QCA analysis and an in

debt analysis has been performed on other factors that may have impacted those cases.

Inter-Rater Reliability Test

One of the most important factors in most scientific studies is to ensure that the analysis can be replicable with similar results. To check this factor, several practitioners in the P3 industry were asked to use the methodology proposed in this study to assign values to the variables for each case based on the information presented in Table 2 of this study. At the end of this process, the values developed by practitioners were compared against each other and against the values developed in this study. As anticipated, the variation between the values assigned to the conditions was not significant; however, there was some variation in the values assigned to the equity and debt outcomes. After discussing the rationale behind development of values for debt and equity outcomes in this study, a consensus and concurrence was made among participants.

Results

The analysis has been performed in two sets for the three outcomes. In one set, the logical remainders are included to reduce the results, and in the other set, it is not included to produce the more general results.

The results are summarized in separate tables in this section. The first row of each table shows the QCA expression. The second row shows the transition based on the information provided in Table 2. As mentioned before, "+" means OR, and "*" means

AND. Finally, the last row of each table provides the cases that match a particular expression.

Reduced Adjusted Equity IRR

The first part of analysis is finding logical patterns between conditions in different cases that result in achieving a reduced anticipated equity IRR. Without inclusion of remainders (hypothetical cases), the solution for Equity =1 is complex. As shown in the table 10 below, it is hard to find reasonable logical relationships between cases, and the results provide a wide range of answers with only one or two cases for each answer.

Expression	Cases
Term{0} * CR-RISK{2} * TR-Risk{0} * Comp{2} +	(East End Crossing)
Term{0} * CR-RISK{1} * TR-Risk{0} * Comp{2} +	(I-69 Section 5 + I-4)
CAPEX{1} * Term{1} * CR-RISK{0} * TR-Risk{1} * Comp{2}+	(CHI-Skyway, IND-Toll Rd)
CAPEX{0} *Term{1}*CR-RISK{0}* TR-Risk{1}* Comp{0}+	(Pocahontas Pkwy)
CAPEX{1} *Term{1} *CR-RISK{1}* TR-Risk{1}* Comp{1}+	(SH-130 Seg. 5 & 6)
CAPEX{1} *Term{0} *CR-RISK{1}* TR-Risk{0}* Comp{1}+	(I-595)
CAPEX{1} * Term{1} *CR-RISK{2}* TR-Risk{2}* Comp{1}+	(LBJ)
CAPEX{1}* Term{1} *CR-RISK{2} *TR-Risk{1} * Comp{0}+	(Midtown Tunnel)
CAPEX{1} * Term{1} *CR-RISK{2} * TR-Risk{2} * Comp{0}	(NTE Seg. 3A & 3B)

Table 10: Analysis of Equity = 1 (without remainders with inclusion of contradictions for reduction)

Inclusion of the hypothetical cases helps to achieve better solutions; however, the solutions are still very diverse as shown in Table 11.

Expression	Cases
CR-RISK{0,2} +	(CHI-Skyway, IND-Toll Rd + Pocahontas Pkwy + LBJ + Midtown Tunnel + East End Crossing + NTE SEG.A & 3B)
Comp{2}+	(CHI-Skyway, IND-Toll Rd + East End Crossing + I-69 Section 5 + I-4)
CAPEX{1}TR-Risk{0,1}	(CHI-Skyway , IND-Toll Rd + SH -130 S-5&6 + I-595 + Midtown Tunnel + I-4)

Table 11: Analysis of Equity = 1 (with remainders and inclusion of contradictions for reduction)

One the other hand, solving the QCA Configuration Table to explore what logical patterns in conditions may result in achieving higher expected equity IRR without inclusion of hypothetical cases results in diverse solutions again.

Expression	Cases
CAPEX{1}* Term{1}* CR-RISK{1}* TR-Risk{2}* Comp{0} +	(I-495 HOT)
CAPEX{1}* Term{1} * CR-RISK{1}* TR-Risk{2}* Comp{1} +	(NTE)
CAPEX{0} * Term{0} * CR-RISK{1}* TR-Risk{0} * Comp{1} +	(Presidio Pkwy)
CAPEX{0}* Term{1} * CR-RISK{1} * TR-Risk{1}* Comp{0} +	(I-95 HOT)
CAPEX{0}* Term{1} * CR-RISK{1}* TR-Risk{1}* Comp{1}	(US-36)

Table 12: Analysis of Equity = 0 (without remainders with inclusion of contradictions for reduction)

Inclusion of remainders makes the solutions for high expected equity IRR less diverse.

Expression	Cases
CAPEX{0}Comp{1}+	(Presidio Pkwy+US-36)
CR-RISK{1}TR-Risk{2} +	(I-495 HOT+NTE)
CR-RISK{1}Comp{0}	(I-495 HOT+I-95 HOT)

Table 13: Analysis of Equity = 0 (with remainders and inclusion of contradictions for reduction)

Reduced Debt Interest Rate

One of the goals in structuring financing package is reducing the interest rate on the debt. Without inclusion of remainders, the solution for Debt =1 represents the logical patterns between conditions existing of the existing cases resulting in an enhanced interest rate on debt as shown in Table 14.

Expression	Cases
Term{1} * CR-RISK{1} * TR-Risk{1} * Comp{1}+	(SH -130 S-5&6, US 36)
Term{0} *CR-RISK{1} * TR-Risk{0}* Comp{1}+	(I-595 +Presidio Pkwy)
Term{0} *CR-RISK{2} * TR-Risk{0}* Comp{2} +	(Miami Tunnel, Goethals Bridge+ East End Crossing)
Term{0} *CR-RISK{1} * TR-Risk{0}* Comp{2} +	(I-69 Section 5+I-4)
CAPEX{1} * Term{1} * CR-RISK{0} * TR-Risk{1} * Comp{2}+	(CHI-Skyway, IND-Toll Rd)
CAPEX{0} * Term{1} * CR-RISK{0} * TR-Risk{1} * Comp{0}+	(Pocahontas Pkwy)
CAPEX{1} * Term{1} * CR-RISK{1} * TR-Risk{2} * Comp{0}+	(I-495 HOT)
CAPEX{1} * Term{1} * CR-RISK{2} * TR-Risk{1} * Comp{0}+	(Midtown Tunnel)
CAPEX{0} * Term{1} * CR-RISK{1} * TR-Risk{1} * Comp{0}+	(I-95 HOT)

Table 14: Analysis of Debt= 1 (without remainders)

Inclusion of the remainders narrows down the number of logical patterns that can result in an enhanced interest rate on debt only to two. Table 15 summarizes those two results.

Expression	Cases
TR-Risk{0,1}+	(CHI-Skyway, IND-Toll Rd+ Pocahontas Pkwy+ SH -130 S-5&6+I-595+Miami Tunnel, Goethals Bridge + Midtown Tunnel+ Presidio Pkwy+I-95 HOT +East End Crossing+US-36+I-69 Section 5+I-4)
CR-RISK{1}Comp{0}	(I-495 HOT+I-95 HOT)

Table 15: Analysis of Debt = 1 (with remainders)

To find the logical patterns between outcomes that can result in a higher debt interest rate, the QCA Configuration Table is solved for Debt =0 without inclusion of the remainders as shown in Table 16.

Expression	Cases
CAPEX{1} * Term{1} * CR-RISK{1} * TR-Risk{2} * Comp{1}+	(NTE)
CAPEX{1} * Term{1} * CR-RISK{2} * TR-Risk{2} * Comp{1}+	(LBJ)
CAPEX{1} * Term{1} * CR-RISK{2} * TR-Risk{2} * Comp{0}	(NTE SEG.A & 3B)

Table 16: Analysis of Debt = 0 (without remainders)

The solution for Debt=0 with inclusion of the remainders is simpler. The two logical patterns that result to an increased interest rate on debt are shown in Table 17.

Expression	Cases
CR-RISK{2}TR-Risk{2}+	(LBJ+NTE SEG.A & 3B)
TR-Risk{2}Comp{1}	(NTE+LBJ)

Table 17: Analysis of Debt = 0 (with remainders)

Maximized Financing Capacity (Leverage)

In addition to reducing expected equity IRR and debt interest rate, in an efficient financial package, the Weighted Average Cost of Capital should be minimized by maximizing the amount of the cheaper form of financing. In other words, since interest rate on debt is cheaper than expected equity IRR, and usually the financing capacity is maximized by maximizing the amount of debt, or maximizing leverage. To find out how this objective can be achieved, the QCA Configuration Table has been solved to find the solutions for Leverage =1 without inclusion of reminders as shown in Table 18.

Expression	Cases
Term{1} * CR-RISK{1} * TR-Risk{1} * Comp{1} +	(SH -130 S. 5&6, US 36)
Term{0} * CR-RISK{1} * TR-Risk{0} * Comp{1} +	(I-595 +Presidio Pkwy)
Term{0} * CR-RISK{2} * TR-Risk{0} * Comp{2} +	(Miami Tunnel, Goethals Bridge + East End Crossing)
Term{0} * CR-RISK{1} * TR-Risk{0} * Comp{2} +	(I-69 Section 5+I-4)
CAPEX{1} * Term{1} * CR-RISK{0} * TR-Risk{1} * Comp{2} +	(CHI-Skyway, IND-Toll Rd)
CAPEX{0} * Term{1} * CR-RISK{0} * TR-Risk{1} * Comp{0} +	(Pocahontas Pkwy)
CAPEX{1} * Term{1} * CR-RISK{2} * TR-Risk{1} * Comp{0} +	(Midtown Tunnel)

Table 18: Analysis of Leverage= 1 (without remainders)

Solving the QCA Configuration Table for Leverage=1 with remainders reduced the number of solutions to four as shown in Table 19.

Expression	Cases
Term{0}+	(I-595 + Miami Tunnel, Goethals Bridge+ Presidio Pkwy + East End Crossing + I-69 Section 5 + I-4)
CR-RISK{0}+	(CHI-Skyway, IND-Toll Rd+ Pocahontas Pkwy)
CAPEX{0}Comp{1}+	(Presidio Pkwy+US-36)
CAPEX{1}TR-Risk{1}	(CHI-Skyway, IND-Toll Rd + SH -130 Seg. 5 & 6 + Midtown Tunnel)

Table 19: Analysis of Leverage = 1 (with remainders)

The last step of analysis in this study intends to find the logical patterns than prevent achieving the objective of maximizing financing capacity. The solutions for solving the QCA Configuration Table for Leverage=0 without remainders are shown in Table 20.

Expression	Cases
CAPEX{1} * Term{1} * CR-RISK{1} * TR-Risk{2} * Comp{0}+	(I-495 HOT)
CAPEX{1} * Term{1} * CR-RISK{1} * TR-Risk{2} * Comp{1}+	(NTE)
CAPEX{1} * Term{1} * CR-RISK{2} * TR-Risk{2} * Comp{1}+	(LBJ)
CAPEX{0} * Term{1} * CR-RISK{1} * TR-Risk{1} * Comp{0}+	(I-95 HOT)
CAPEX{1} * Term{1} * CR-RISK{2} * TR-Risk{2} * Comp{0}	(NTE SEG.A & 3B)

Table 20: Analysis of Leverage = 0 (without remainders)

Solving the QCA Configuration Table for Leverage =0 with remainders narrows down number of logical patterns into only two. These two solutions are shows in Table 21.

Expression	Cases
TR-Risk{2}+	(I-495 HOT+NTE+LBJ+NTE SEG.A & 3B)
CR-RISK{1}Comp{0}	(I-495 HOT+I-95 HOT)

Table 21: Analysis of Leverage = 0 (with remainders)

Summary

This chapter has documents regarding how the QCA Configuration Data has been developed and tested to ensure the accuracy of variables (5 conditions and 3 outcomes). In addition, this chapter has solved the QCA Configuration Data 12 times (4 times for each one of the 3 outcomes). The study has found results on what logical patterns in conditions may result in a favorable condition of an outcomes or an unfavorable condition of the outcomes, once only with the information from the existing cases and once with simplifying assumptions to create hypothetical cases known as reminders. The next chapter provides a discussion on the achieved results.

Chapter 5: Interpretation and Discussion of the Results

This chapter intends to evaluate the results that were reported in the previous chapter in order to better understand the logical patterns between conditions and outcomes. The ultimate goal of this chapter is to provide meaningful guidance that can be used to generalize the findings of this study and use them in other cases. To do so, this study will discuss and further investigate the results for each outcome individually.

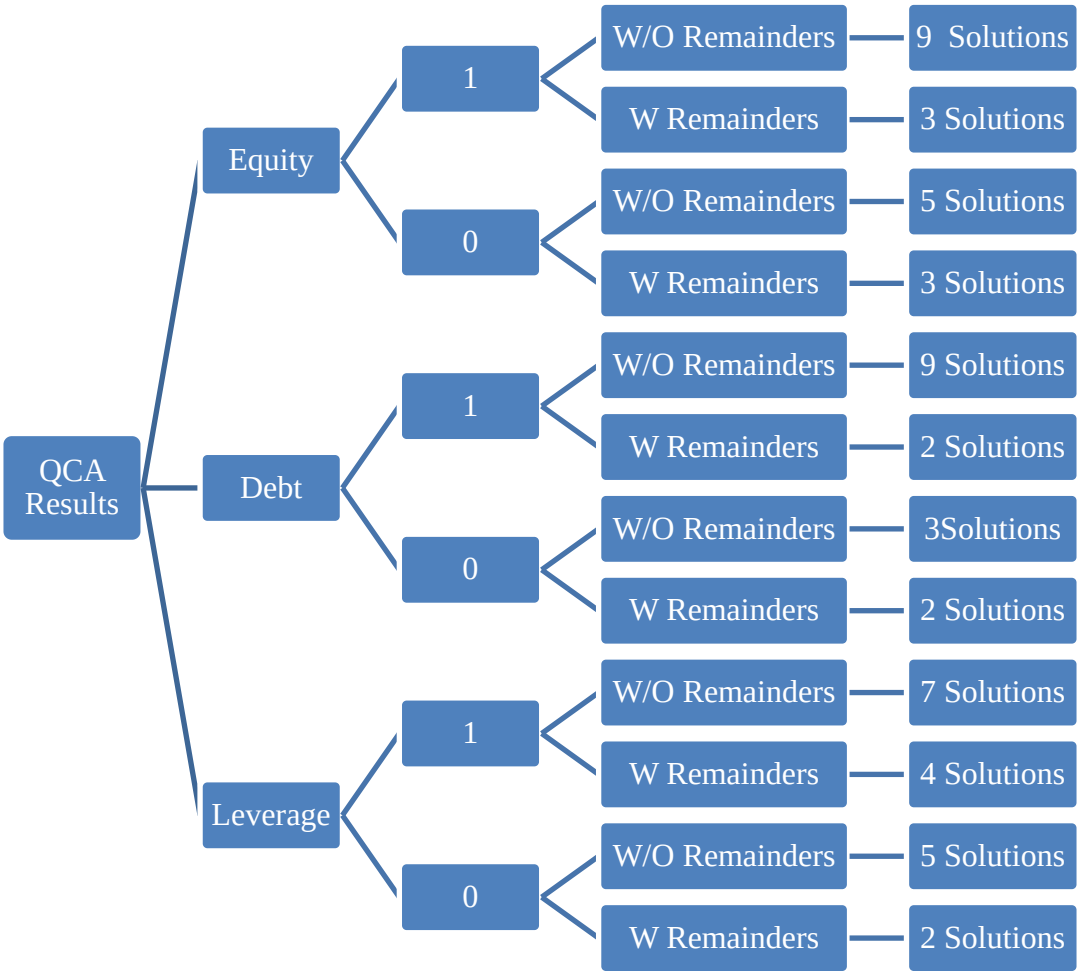


Figure 8: Summary of the QCA Solutions

Figure 8 shows the summary of the QCA solutions for each one of the outcomes with or without remainders. A quick review of the table reveals that the minimum number of solutions (2) occurs for Debt=1, Debt=0 and Liquidity=0 while using remainders. The maximum number of solutions (9) occurs for Debt = 1, Equity =1 and Equity=0 without remainders. In addition, the 4 scenarios for Equity produce 20 solutions together while the 4 scenarios for Debt and Leverage produce 16 and 18 solutions, respectively. Since the higher the number of solutions, the less accurate each solutions is (representing a pattern between less number of cases), it seems that the solutions for Leverage and Debt represent better logical patterns than the solutions for Equity. Therefore, in the following sections of this chapter first the solutions for Leverage and Debt will be further investigated to identify logical patterns, and then Equity will be discussed.

In analysis of each outcome, the most common patterns will be discussed. To select the most common patterns, the solutions representing more number of cases are considered. Since inclusion of remainders simplifies the solutions and identifies more general patterns that can be seen in multiple cases, most of the solutions considered for further discussion and interpretation in this chapter are solutions with the remainders. However, solutions without remainders are reviewed as well when necessary to better understand the logical patterns.

Leverage

One of the outcomes that has been studied in this dissertation is the leverage. In other words, this study is interested is knowing under what conditions a project can issue

more debt which is usually cheaper than equity, and what other conditions the project should be financed at a higher percentage of equity in the overall financing package. The assumption is that the higher the leverage, the lower the overall financing cost which may result in a higher financing capacity for a P3 project.

Table 22 shows the most logical patterns that can be seen in the results for solving the QCA Configuration Table for Liquidity.

ID	Solution for	Expression	Cases
1	Leverage =1 W Remainders	Term{0}	(I-595 + Miami Tunnel, Goethals Bridge+ Presidio Pkwy + East End Crossing + I-69 Section 5 + I-4)
2	Leverage =0 W Remainders	TR-Risk{2}	(I-495 HOT+NTE+LBJ+NTE SEG.A & 3B)
3	Leverage =1 W Remainders	CAPEX{1}TR-Risk{1}	(CHI-Skyway, IND-Toll Rd + SH -130 S-5&6 + Midtown Tunnel)
4	Leverage =1 W Remainders	CR-RISK{0}	(CHI-Skyway, IND-Toll Rd+ Pocahontas Pkwy)

Table 22: Most Common Logical Patterns for Liquidity

The most common pattern is “Term{0}” for Leverage = 1, which can be seen in 7 cases and represents a project duration of less than 50 years. In other words, this solution means the percentage of equity in overall financing package is lower in shorter term contracts.

The second ranked common pattern is “TR-Risk{2}” for Leverage = 0, which can be seen in 4 cases and represents a significant traffic risk. In other words, this solution means that when there is significant traffic risk, the percentage of equity in the overall financing package will be higher. This is a logical conclusion since equity is usually more risk seeking than debt.

The third pattern is “CAPEX{1}TR-Risk{1}” for Leverage=1 which means when project cost is high but there is a good understanding and history of traffic patterns and demand, a significant portion of the financing package will still be debt.

The last pattern that is presented in Table 22 is “CR-RISK{0}” for Leverage=1. In other words, in a project with no or very limited construction risk, a brown-field project, lenders are more willing to offer a loan to the project.

In general, it can be concluded that the percentage of debt in the financing package of a P3 project can be maximized when there is no or limited construction risk and traffic risk. This explains why P3 projects are usually refinanced after construction is completed and the project has gone through its ramp-up period.

Debt

Debt usually covers the majority of the P3 financing package. Therefore, the interest rate on debt has a significant impact on overall financing capacity of the project. However, it is important to point out that the interest rate on debt is a function of two elements, namely, the overall risk free-interest rate in the market, and the premium

that is usually added to the risk-free interest rate to account for the risk profile that the lender is taking. As discussed before, other factors such as the pay back term, tax treatments of the earned interest, etc., may increase or decrease the overall interest rate. As discussed in section 4.2 of this dissertation, a methodology has been developed in this study to convert the interest rate on different types of debt in the cases studied in this dissertation into an equivalent 30-year tax-exempt time-adjusted bond interest rate. In this section, different patterns that may contribute to a higher interest rate and different patterns that contribute to a lower interest rate are discussed based on the QCA results.

ID	Solution for	Expression	Cases
1	Debt =1 W Remainders	TR-Risk{0,1}	(CHI-Skyway, IND-Toll Rd+ Pocahontas Pkwy+ SH -130 S-5&6+I-595+Miami Tunnel, Goethals Bridge + Midtown Tunnel+ Presidio Pkwy+I-95 HOT +East End Crossing+US-36+I-69 Section 5+I-4)
2	Debt = 1 W/O	Term{0} *CR-RISK{2} * TR-Risk{0}*	(Miami Tunnel, Goethals Bridge+ East End Crossing)
3	Debt =0 W Remainders	CR-RISK{2}TR-Risk{2}	(LBJ+NTE SEG.A & 3B)

Table 23: Most Common Logical Patterns for Debt

One general observation about the QCA analysis is on Debt is the lack of a general pattern that represents more than two cases, making it hard to make any generalizations. However, the three patterns summarized in Table 23 represent the

most common patterns that lead to a low interest rate on debt or a high interest rate on debt.

The first pattern, “TR-Risk {0,1}”, which is also the most common pattern occurs in 14 cases for Debt =1 which makes it a very strong pattern. The expression in this pattern means no traffic risk (usually seen in availability payment deals) or low-traffic risk (usually seen in mature roads with a proven traffic history and demand), which contributes to a relatively lower interest rate on debt.

The second pattern that is shown in the table for Debt=1 is a relatively complicated pattern “Term{0} *CR-RISK{2} * TR-Risk{0}* Comp{2}”. This expression means for the projects with relatively shorter terms, high construction risk, low traffic risk and high competition, a relatively good interest rate was achieved on debt. A good observation in this expression is the existence of the no traffic risk again. It seems that lenders are very sensitive to traffic risk, but they can get comfortable with construction risk as long as it can be managed. A review of the contractual agreements of the three projects that have this pattern reveals that all three projects have sufficient levels of security package (as a combination of performance bonds, payment bonds, insurance, letter of credit and/or liquidity fund) or contractual risk sharing mechanisms with the owner (such as usage of Geotechnical Baseline Report (GBR) to cap unforeseen geotechnical conditions, delay and compensation events, force major events, etc.) to reduce the impact of unexpected risks on the project. This pattern is aligned with the discussion in Chapter 2 of this dissertation where the role of credit enhancements in overall financing of P3 projects is discussed. Each credit

enhancement is designed to either reduce the traffic and revenue risk or the construction risk.

The last pattern presented in Table 23 represents conditions, "CR-RISK{2}TR-Risk{2}" that result in not achieving a good interest rate on debt, Debt=0. This pattern explains that in projects with significant risk in terms of traffic and revenue and significant risk in terms of construction, usually the interest rate on debt is higher than other projects. The difference between this pattern and the previous pattern is occurrence of traffic and revenue risk and construction risk simultaneously, which is probably the main reason that lenders increase their rates. A comparison between this pattern and the previous pattern may suggest that one way to decrease the interest rate on debt in P3 projects with significant risk may be using availability payment models to deliver them instead of a toll concession model, or to use significant credit enhancements to reduce the risk profile of the project in regard to traffic risk and construction risk from a level 2 (significant) to level 1 (moderate).

Equity

The results for this outcome are probably the most controversial results among the three outcomes. As shown in Table 10, without inclusion of remainders, it is hard to find any particular pattern that achieves a reduced adjusted Expected IRR and this repeats in more than 2 projects. However, with inclusion of remainders, some patterns rise to the top by repeating in multiple projects; however, still some logical contradictions can be seen in the solutions that may require additional investigation.

Table 24 summarizes those patterns that have been selected for further discussion in this section.

ID	Solution for	Expression	Cases
1	Equity =1 W Remainders	CR-RISK{0,2}	(CHI-Skyway, IND-Toll Rd + Pocahontas Pkwy + LBJ + Midtown Tunnel + East End Crossing + NTE SEG.A & 3B)
	Equity =1 W Remainders	CAPEX{1}TR-Risk{0,1}	(CHI-Skyway , IND-Toll Rd + SH -130 S-5&6 + I-595 + Midtown Tunnel + I-4)
2	Equity =1 W Remainders	Comp{2}	(CHI-Skyway, IND-Toll Rd + East End Crossing + I-69 Section 5 + I-4)
4	Equity =0 W Remainders	CR-RISK{1}Comp{0}	(I-495 HOT+I-95 HOT)
5	Equity =0 W Remainders	CR-RISK{1}TR-Risk{2}	(I-495 HOT+NTE)

Table 24: Most Common Logical Patterns for Equity

The first pattern is "CR-RISK{0,2}", which means when there is little construction risk, or when there is significant construction risk, the time-adjusted expected equity IRR is relatively lower. There is a logical gap in this solution since there is no good explanation why projects with moderate construction risk may increase equity IRR while projects with limited or significant construction risk do not. Therefore, it is difficult to use this pattern as a general pattern that can explain when the expected equity IRR may be relatively lower in P3 projects.

The second pattern is "CAPEX{1}TR-Risk{0,1}", which suggests that when the project cost is relatively high and the traffic and revenue risk is none or medium, the

expected equity IRR is relatively lower. This pattern is seen in six cases, which suggests a strong correlation exists between this pattern and the case bank.

The third pattern is “Comp{2}” which suggests that when there is a high competition, the expected equity IRR is relatively lower in P3 projects.

The fourth patterns is “CR-RISK{1}Comp{0}”, which means when there is a moderate construction risk but no competition, the expected equity IRR increases. Similarly, the fifth pattern, “CR-RISK{1}TR-Risk{2}”, suggests that a significant revenue risk combined with moderate construction risk can significantly can increase expected equity IRR.

The above discussion can be summarized as follows:

- High competition and low traffic risk can help reduce expected equity IRR
- Low competition and high traffic risk and medium construction risk can increase the expected equity IRR.

As noted earlier, some logical contradictions exist in the results as well as in the variables in the QCA Configuration Table, which require additional investigation to better understand how expected equity IRR behaves under different conditions. In the next section of this study, the expected equity IRR is studied in more detail.

Special Discussion on Equity IRR

The most expensive form of capital in P3 projects is equity. The Internal Rate of Return (IRR) on equity investment is one of the major elements that determines the overall equity capacity of a P3 project as explained in equation (2) in Chapter 1 of this study. The question is how equity investors make decisions on the IRR on their investment and how the IRR can be reduced.

Expected Equity IRR in P3 Projects

In a P3 delivery model, a stand-alone project company is formed, a Special Purpose Vehicle (SPV), with limited ties to the parent company(s) to assume certain design, construction, finance, operation and/or maintenance risks. The SPV is responsible for delivering the project's financing package, which normally includes a combination of debt, equity and public funds. The debt is backed by forecasted cash flows from the project, either in form of toll revenue or availability payments. Lenders typically require equity contributions from the SPV's parent companies in order to provide a cushion to absorb some financial risks in the event that the actual revenues are below forecasted revenues (Reinhardt, 2011).

Some of the credit enhancements discussed in the previous chapter reduce the investment risk not only for lenders, but also for equity investors; therefore, if the decision on equity IRR is based on the level of risk that equity investors are taking, reducing the risk profile should potentially reduce the equity IRR in P3 projects. However, since equity investors assume more risk in a P3 project, they require a premium above what lenders may anticipate to receive on their investment. The

question is how investors set their anticipated rate of return on equity and how it can be reduced.

Capital Asset Pricing Model (CAPM)

One way to analyze how investors may adjust the equity IRR in a supply and demand market is the Capital Asset Pricing Model (CAPM), which was developed based on the work of William Sharpe, in his 1970 book "Portfolio Theory and Capital Markets". This method has been widely used in literature as a systematic way to understand returns based on the systematic risk and unsystematic risk as defined in equation (4):

$$K = Rf + ß\,(Rm - Rf) \quad (4)$$

where:

- K = Required return
- Rf = Risk-free rate
- Rm = Return of overall "market" (i.e., S&P 500)
- ß (beta): security's beta risk measure defined as $\boldsymbol{\sigma_m / \sigma^2}$ where σ_m is the covariance of returns of asset a compared to market returns σ^2 is the variance of market returns.

Based on the above discussion, the Expected Equity IRR should be a function of risk-free rate of return, overall market return and asset characteristics. As shown in Figure 9, the Expected Equity IRR has changed over time for different P3 projects; however, this change is not similar to the change in rate of return on other securities such as LIBOR rates, U.S. treasury rates, and Bond Buyer Revenue Bond Index (RBI). In some projects the spread between the rate of return on RBI and the rate of return on expected equity is around 2.6%, for instance the East End Crossings-East End

Crossing, which was closed in 2013. In some cases, this difference has widened to almost 10%, for instance in the financing package for the Presidio Parkway project. Therefore, the trend in equity IRR in P3 projects in the United States is not necessarily following the trend in the capital market (for instance, RBI or treasury rates).

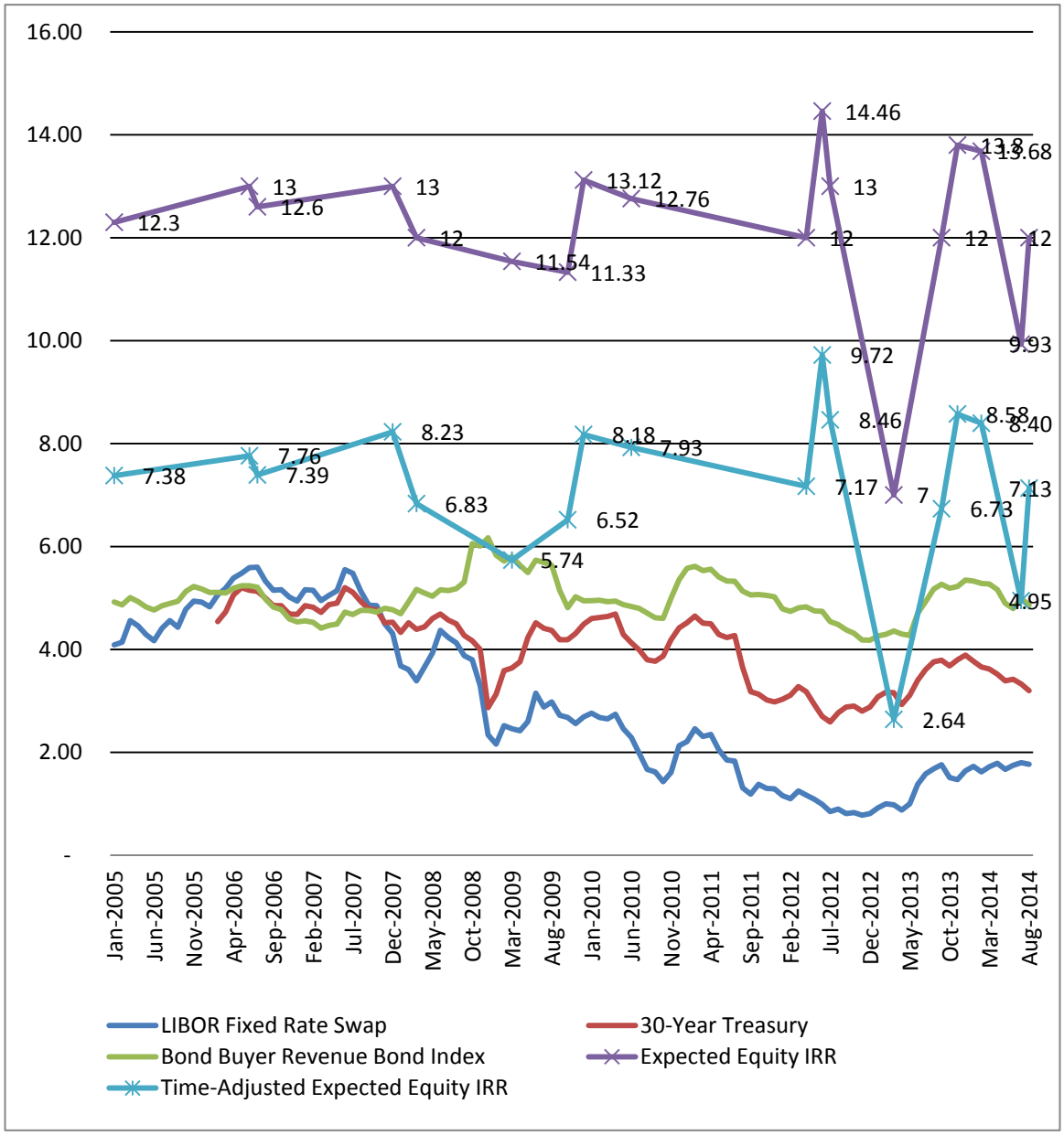


Figure 9: Interest Rate Comparison between Different Securities and Expected Equity IRR

The risk-free rate and the return of overall market conditions are functions of the financial market and impact both bond rates and expected equity IRR, therefore they should not be the major factor in differentiation between security rates and Expected Equity IRR. Thus, the only factor that is left is project characteristics. Next section of this study will divide the cases into availability payment and toll concession cases to further analyze how Expected Equity IRR may be related to traffic and revenue risk.

Excepted Equity IRR in Toll Concession and Availability Deals

As discussed earlier, the CAPM suggests that the variations in the difference between security rates and the Expected Equity IRR in P3 projects is because of the differences between the levels of risk that equity investors take in different P3 projects. For instance, the revenue risk assumed by investors in a toll concession may be different than a revenue risk assumed by investors in an availability payment deal. Figure 10 shows the difference between Expected Equity IRR and Time-Adjusted Expected Equity IRR for projects with no traffic risk (availability payment) and projects with traffic risk (toll concession).

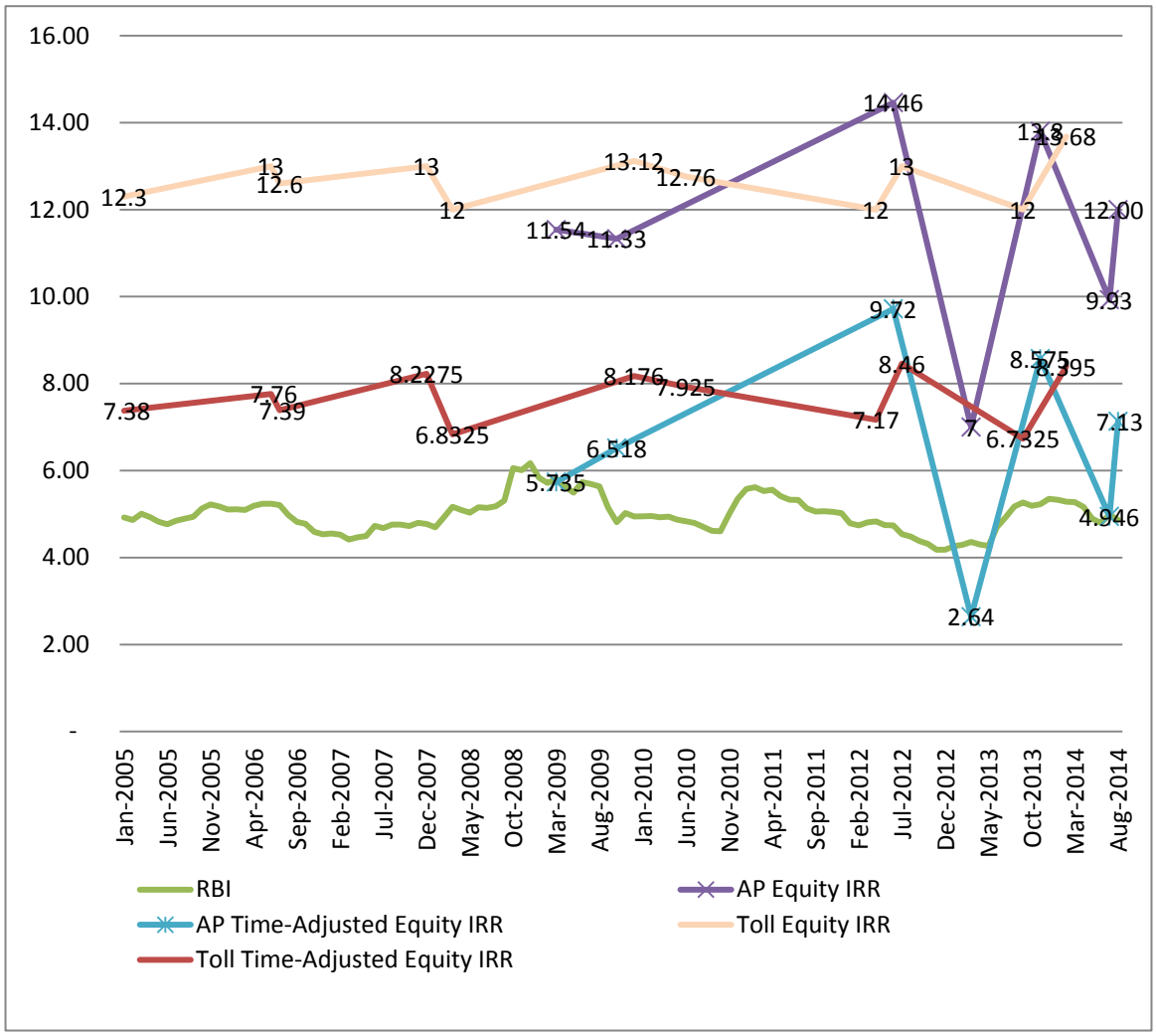


Figure 10: Expected Equity IRR for Toll Concessions vs. Availability Payments

	Toll Concession		Availability Payment	
	Equity IRR	Time-Adjusted Equity IRR	Equity IRR	Time-Adjusted Equity IRR
Mean	12.68	7.74	11.44	6.47
Min/Max Difference	1.68	1.72	7.46	7.08
Standard Deviation	0.55	0.62	2.48	2.34

Table 25: Statistical Analysis of Equity IRR

A quick review of Figure 10 and Table 25 reveals a few interesting observation:

- It seems that on average both the Expected Equity IRR and Time-Adjusted Expected Equity IRR for toll concession projects are slightly higher than for availability payment projects (about 120 bps).
- In some cases the Expected Equity IRR and the Time-Adjusted Expected Equity IRR for availability payment projects are higher than toll concession projects (i.e., Presidio Parkway and Goethals Bridge)
- The difference between high and low Expected Equity IRR in toll concession is only around 170 bps; however, this difference for availability payment projects is more than 700 bps.
- The standard deviation for availability payment deals is substantially higher than the standard deviation for toll concession deals. In general, it seems that the Expected Equity IRR in toll concession projects is more or less within a reasonable range; however, in availability payment projects it varies substantially from one project to the other.

Therefore, it is hard to believe that calculation of the Expected Equity IRR in P3 projects is consistent with the CAPM, particularly in availability payment deals. The question is "what determines the Expected Equity IRR in P3 deals"? Is it competitively priced or not subject to competition?

Competition and Excepted Equity IRR

As discussed earlier, the equity investment market in P3 deals may not follow the rules of a free market. There might be different explanations for this finding. The complexity of the financial structure, the transaction cost of P3 procurements is relatively high and thus, a P3 model is usually only used when delivering a relatively large-scale project with significant financing needs and a complex risk structure (Farajian, 2010). As a result, only a few banks and equity investment funds (normally labeled as infrastructure funds) have the necessary capacities to invest in P3 projects as equity holders. Thus, the largest infrastructure equity funds control most of the equity in P3 projects and create a semi-monopoly market, which could eventually lead to monopolistic claims and behaviors.

	No or Little Competition		More than 2 Teams	
	Equity IRR	Time-Adjusted Equity IRR	Equity IRR	Time-Adjusted Equity IRR
Mean	12.74	7.71	11.34	6.42
Min/Max Difference	2.92	3.99	6.80	5.94
Standard Deviation	0.85	1.08	2.67	2.32

Table 26: Effect of Competition on Expected Equity IRR

The above table confirms that competition in general reduces the Expected Equity IRR by about 130 bps; however, one interesting observation is that the lowest and highest Expected Equity IRRs in both categories are availability payment projects (I-595 and Presidio Parkway as projects with low competition, and I-69 Section 5 and Goethals Bridge as projects with high competition).

It should be mentioned that this study has categorized projects based on the level of competition during procurement. However, a competitive procurement process may still lack competition at equity investment level, since the proposal price submitted by each bidder is subject to multiple prices such as (design-build, operation and maintenance, etc.) and multiple financing elements (such as estimated traffic and revenue, haircut given by rating agencies, debt service coverage ratio, reserve accounts, type of debt, interest rate on debt, liquidity and equity IRR, etc.). In addition, the evaluation criteria may not be based on the best pricing and financing package, but instead based on the best value which may make the winning bid not the best bid as it relates to the financial elements. Therefore, the winning bids used in the cases considered for this study may not necessary have the lowest Expected Equity IRR. The real question is: How may the P3 procurement current model be enhanced to encourage competition at equity level?

Unfortunately under the current P3 model, only a few investment funds and concessionaires have the financial capacity to invest in P3 projects, which are usually large in terms of capital investment; small investors have no opportunities for direct equity investment in the project. The recent innovative mechanism of crowdfunding, which has been already utilized in other sectors such as real estate development and small start-up IT ventures, introduces an opportunity to enhance the current P3 model. Enhancing the model can provide opportunities to broaden the pool of potential equity investors and allow for a real competition at equity level which may reduce the Expected Equity IRR for P3 projects. The next chapter of this study introduces a new approach that can help achieve this goal.

Chapter 6: Application for Policy and Practice

A New Innovative Approach: Crowdfunding

Critics of P3s oftentimes refer to this monopoly issue by challenging the high rate of return on the project's equity investments and the limited opportunity to invest equity in a project with such a return. This limited opportunity is only offered to few infrastructure funds who can afford large equity investments, while the general public cannot enjoy similar returns when they may be willing to accept similar risk profiles (Sanger & Crawley, 2009).

At its basis, crowdfunding is a tool used to raise money for a project or venture from a group of individuals (Levine & Feigin, 2014). As a practice, crowdfunding has a long history, including the fundraising effort conducted by Joseph Pulitzer in 1885 to fund the pedestal on which the Statue of Liberty platform now stands (Davies, 2014). With the growing popularity of the internet transactions, crowdfunding started to emerge "as an online extension of traditional financing by friends and family: communities pool money to fund members with business ideas," (The World Bank, 2013). Recently coined by Michael Sullivan in 2006 (Gobble, 2012), crowdfunding has evolved to refer to the act of raising capital for a project or venture from the general public (the crowd) through an intermediary online platform.

It is a concept at the intersection of crowdsourcing and microfinance (Manchanda & Muralidharan, 2014). Crowdsourcing enables firms to solicit the collective wisdom of the crowd through an open call over the internet and utilize this wisdom to achieve

solutions to problems or outsource work (Misra, Gooze, Watkins, Asad, & Le Dantec, 2014). Microfinancing instruments issue small, unsecured loans to individuals for starting or expanding businesses (Khavul, 2010). Thus, "crowdfunding could be described as a method to establish the connection between entrepreneurs, who aim to raise capital, and novel investors, who form an emerging source of capital and are willing to invest small amounts, through internet-based intermediaries," (Valanciene and Jegeleviciute, 2013). While various definitions for the notion of crowdfunding differ slightly based upon the author's perspective (see Table 1), they all incorporate three involved parties. These parties are: (1) the entrepreneurs (the fundraisers); (2) the investors (the crowd); and (3) the intermediaries (the online platforms).

Crowdfunding Market

Over the past five years, crowdfunding has become a common term in the start-up world through the rise of online platforms, such as Kickstarter and IndieGoGo, to raise money for new ventures. In 2012, 1.1 million worldwide crowdfunding campaigns raised $2.7 billion in donations, in which $1.6 billion was raised in North America. Today, crowdfunding "has reached a market size of approximately $5.1 billion per year either in form of donation, reward, equity, lending or royalty-based," (Massolution, 2013).

The crowdfunding market can be separated into two categories: (1) "crowdfunding," which includes donation and reward; and (2) "crowdfunding investment," which includes equity, lending and royalty-based (The World Bank, 2013). Many of the crowdfunding campaigns to date were not categorized as investments; instead, they

were donations given to an entrepreneur to monetarily support an idea or new venture (Levine and Feigin, 2014). As part of the financial reforms after the 1929 stock market crash, Security and Exchange Commission (SEC) regulations in the United States became much stricter. Consequentially, crowdfunding investment became illegal, the solicitation of equity investments outside a circle of "accredited investors"[7] was forbid and all investments required extensive disclosures (Gobble, 2012).

Legislation

In the United States, the legislative and regulatory environment in regards to crowdfunding is changing rapidly to loosen some of the restrictions on crowdfunding investment, which resulted from the 1929 reforms. On April 5, 2012, President Barack Obama signed into law the JOBS Act. This Act has made crowdfunding investment legal and resulted in reduced SEC regulatory requirements and filings for businesses below certain monetary thresholds, as well as other regulatory rollbacks. The intention of the Act is to allow small and start-up businesses to access the power of the crowds and address the lack of traditional funding sources, such as bank loans (Gobble, 2012). The JOBS Act attracted bipartisan support because both parties agreed that small businesses are the largest source of new jobs in the United States and start-up businesses are a key catalyst for long-term economic recovery. A key result of the JOBS Act is entrepreneurs can legally crowdfund their businesses and offer equities rather than just rewards (Ramsey, 2012). Thus, crowdfunding can not

[7] An “accredited investor” includes any individual who: (1) earned an income exceeding $200,000 in each of the prior two years; or (2) has a net worth over $1 million (SEC, 2013).

only be used as a philanthropic source of capital, but also as an investment or financial mechanism to address lack of traditional funding for projects and new ventures (Davies, 2014). While literature exists on the JOBS Act and resulting changes in SEC legislation, a detailed policy analysis on these changes is beyond the scope of this study.

Recent legislative changes in the United States as a result of the JOBS Act focus on the potential to use crowdfunding as a means of raising capital for small and start-up businesses. Consequentially, little attention has been given to the potential to use crowdfunding for "civic projects – projects involve either directly or indirectly, the use of government funds, assets or sponsorship, which may include the development of public assets," (Davies, 2014). While little attention is given to crowdfunding as a financing mechanism to address a shortage of funding for civic projects, it has been used at local levels mainly for green space projects, such as parks and renewable energy (Davies, 2014). Most of these projects have been relatively small in terms of scope; however, the potential scope and benefits could be large. For instance, every $1 spent on transportation infrastructure results in a $1.5-$2 direct and indirect economic boost (Carew & Mandel, 2014).

Application

Under the current P3 model, each bidding team submits a project proposal, including a committed financial plan, which details the anticipated combination of debt and equity. Equity is provided either by the concessionaire, primary contractor and/or infrastructure funds. Upon selection and announcement of the preferred bidder, the

selected team will be responsible for delivering the committed financial plan. If a P3 project were enhanced by crowdfunding, then a new layer of financing could be added between debt and equity and defined as the “equity share” layer. Under this enhanced model, bidding teams would need to include the assumption that a minimum portion of the equity investment, as required and specified by the sponsoring agency in the procurement documents, is to be crowdfunded in the committed financial plan. Thus, equity shares of the P3 project could be crowdfunded to interested general investors. Similar to equity partners, these general investors could gain a return on their investment reflecting the project’s rate of return and including the project’s potential upside rewards. The general investors, however, will not have a voting right and will bear a similar risk profile as the equity partners. This process requires: (1) offering of equity shares through a P3 crowdfunding platform; (2) pricing; and (3) transaction documentation and after sale services.

– *Offering*

Under this approach, the preferred bidder would offer equity investment through an online platform, which provides the necessary information to investors. This offering can be conducted in multiple stages. For instance, equity shares can be first offered to people who are users of the facility or local to the area or state, and then any remaining shares can be offered nationally or internationally. To perform this investment offering, a platform needs to be created that can accurately manage the transactions. The need to build an online platform specific to crowdfunding for P3 projects has been identified by some startup companies (Ross, 2014). The platform

would be in charge of prequalifying investors, sharing project information, conducting the transaction, and keeping track of documents. This study does not intend to explore the technical discussion regarding the development and operation of a platform, but recognizes the need for additional research in this area.

– *Pricing*

As discussed previously, equity share investors through crowdfunding will own a similar risk profile as the senior equity investors; therefore, the reward profile would also be similar to the senior equity investors. Crowdfunding opens up the door for new investors and changes the semi-monopoly characteristic of the equity market into a more competitive market. Thus, the rate of return on equity investment could potentially decrease as a result of competition and an increase in equity supply. Therefore, one could argue the overall rate of return on equity would potentially be slightly less than what we see in the market under the current P3 model. Additional research is needed to better understand market reaction to the equity crowdfunding approach for P3s.

– *Transaction documentation*

Since equity shareholders take a greater level of risk as compared to bondholders, additional information related to the concessionaire and certain risks taken by the equity shareholders would be disclosed publicly to interested investors on the crowdfunding platform. This disclosure is not only a necessity from an investing standpoint, but also is required by SEC regulations. Disclosure documents would be

publicly accessible on the platform for interested investors include: the project risk register; all publicly available procurement documents; any available Public Offering Statement or Official Statement for bonds; contract agreement documents; and project studies, such as the traffic and revenue study. The audited financial statements and other relevant information regarding the concessionaire would also be shared with the potential equity shareholders. Requirements to disclose documents, however, are not limited to the period before investment. Updated documents, quarterly progress reports or any other relevant documentation would also be provided to equity shareholders after the investment is made to give investors necessary information to evaluate the performance of their investment.

Valuation of Equity Crowdfunding in P3s: SWOT Analysis

In order to investigate and evaluate the effectiveness of the proposed structure, a systematic approach should be utilized to analyze the associated benefits and challenges. The SWOT analysis is a well know qualitative research methodology that provides a comprehensive discussion on the strengths, weaknesses, opportunities and threats of a theory or idea. The study focuses the SWOT analysis on the key benefits and drawbacks of using a crowdfunding enhanced P3 model in comparison to the current P3 model, which restricts equity investment in a project to only institutional investors. This effort will first focus on the strengths and weaknesses, which are internal in origin and result from the incorporation of crowdfunding into the P3 model. Secondly, the analysis will describe the opportunities and threats, which are external in origin and represent aspects of project's social and market environment.

The opportunities are aspects of the environment that improve the method and enable the method to deliver a better value. The threats are aspects of the environment that may negatively impact this approach and decrease performance. Finally, the conclusion ties the different aspects together and describes how they are interrelated.

Strengths

– *Return on equity*

Providing investment opportunity to general public, especially to local communities, changes the current monopolistic market for equity investment in P3s and creates a competitive supply and demand market, which could potentially result in lower rate of returns. This change will potentially reduce the financing cost for P3 projects, making them cheaper and more bankable. Under the proposed approach, only a portion of equity will be invested using crowdfunding and thus the SPV will still have a long-term vested interest in the project. Therefore, the interests of the SPV will be aligned with the interests of equity shareholders, which results in integrity to the overall structure.

– *Equal investment opportunity*

The equity crowdfunding approach for P3s will provide investment opportunity in P3 projects to the general public, especially local communities. Anyone who can legally make crowdfunding investments will be able to invest in P3 projects enhanced by crowdfunding, and take the risk and the rewards that infrastructure funds take. This approach will greatly resolve current critics of the unfair risk and reward package in

P3 projects. For instance, Ellen Dannin (2011), a law professor at Penn State University has reviewed a number of P3 contracts and has concluded that the level of risk transferred to private infrastructure investors is not as nearly as much as it has been advertised to the public particularly in terms of "(1) compensation events; (2) noncompetition provisions; and (3) the contractor's right to object to and receive compensation for legislative, administrative, and judicial decisions". The equity crowdfunding will also provide the opportunity for local and national residents to keep a P3 project's economic benefits resulting from the investment return within their community, state or nation before these benefits are realized overseas by foreign investors.

– *Enhanced stakeholder support*

P3 projects are usually long term and complex; they involve different stakeholders who can help enhance the delivery of the project or hinder the delivery by imposing unnecessary delays and expenses on the project. In particular, an enhanced support from general public, localities, public agencies, elected officials and/or special interest groups can be a catalyst for reducing political and social risks associated with the project. The proposed equity crowdfunding P3 model provides the opportunity to align the interest of local investors and communities with the interest of the SPV, lenders and the sponsoring public agency in order to deliver the project on time and on budget. The combined wisdom of the crowd developed as a result of additional education and awareness under this model and the power of the crowd in a

democratic society could minimize political risks and associated unnecessary delays and expenses.

– *Increased transparency*

Since P3 procurements usually take a different route compared to traditional procurements and have more complexity which makes them more difficult to understand, they have been criticized to not be transparent enough. The proposed equity crowdfunding structure will require a great level of transparency for the equity shareholders of the general public as required by SEC regulations. This transparency can come in two different ways. First, all the risks associated with the project and procurement documents will be offered publicly on a centrally located platform and will be easily accessible by the general public. Second, the general awareness about the project and available documentation and information will increase resulting in a better public outreach for the project because crowdfunding websites heavily rely on social media, which has become the most effective vehicle for dissemination of information, to reach to the maximum possible users..

Weaknesses

– *Induced complexity*

Adding a new layer of investors to the project increases the number of equity stakeholders and could potentially require extra efforts to manage communication and relationships with this new layer of equity stakeholders. In addition, equity shares sold to individual investors through crowdfunding will create a new layer in the pool

of financing between lenders and senior equity holders. This new layer of financing would be defined in financing documents, the risks and responsibilities of these new investors would be defined in contract documents, and the project team would establish a communication strategy to involve them throughout the process. As a result, new complexities will be added to contract documents, procurement efforts, and project implementation strategies and will need to be addressed with additional resources and special attention. In addition, federal and state regulations may require taking additional steps above and beyond what is required under current P3 model steps, making the process more complicated, time consuming and expensive.

– *Lack of track record and market confidence*

The idea of raising equity through crowdfunding might be a challenging idea to implement particularly since it has very limited track record. Similar to other new ideas and methods, building market confidence in equity crowdfunding, potentially through pilot projects at smaller scale, is necessary before this idea can be implicated in large scale P3 projects.

– *Administrative and accounting challenges*

Offering equity through crowdfunding might create accounting and administrative challenges. The SEC regulations require issuance of certain documents such as audited financial statements which may impose additional expenses to the project. This level of effort will be minimal in large P3 projects because some of this effort will be conducted as part of contractual requirements. In addition, in large

infrastructure P3 projects, the amount of equity that may be raised through crowdfunding will not be significant compared to the total equity, which will make the overall percentage of administrative and accounting expenses lower compared to the size of equity investment. This challenge, however, could be a significant cost challenge for smaller P3 projects. In addition, the administrative expenses to create and run the platform might be high, particularly in early days of implementation of this new approach when only a few projects will be financed using this method. As a result, the transaction cost of offering equity shares on the platform could be high making it less attractive. This issue might be resolved if the number of transactions and the amount of equity shares offered on the platform increase to create economy of scale and reduce transaction fee that platform charges.

– *Third-party confidential information*

As discussed earlier, selling equity shares through crowdfunding requires public disclosure of more information than is normally disclosed for P3 projects. In particular, this disclosure includes information related to the performance of project, the SPV's balance sheet and potentially financial information regarding the parent companies. The SPV normally deems some of this information as proprietary information and thus conflicts may exist in disclosing it. Also, many of the parent companies are publicly traded in the stock market and have their own information sharing policies, which may preclude release of their business information.

– *Social equity*

Although crowdfunding provides a great investment and engagement opportunity in P3 projects to individual investors and communities, the crowdfunding tool heavily relies on internet and social media as a marketing tool and information exchange. Unfortunately, many communities particularly in rural areas may not have easy access to social media and online platforms. As a result, a social class will still not be included in the enhanced opportunity in P3 projects by investing as equity shareholders. In addition, SEC regulations would still prevent involvement of certain lower income classes in the equity crowdfunding investments. Although this may be justified by the fact that SEC regulations intends to protect economically vulnerable classes from risky investments, it still raises some concerns as it relates to social equity.

Opportunities

– *Prioritization*

As discussed earlier, there is a huge need for investment in infrastructure projects in the United States; however, the available resources are limited. As a result, projects would be prioritized based on the benefits and costs, purpose and need, and public desire. Providing the opportunity to invest in P3 projects as equity holders to general public can capture their views on needed projects and economic value of those projects. For instance, if a project is offered for crowdfunding and it does not receive a good feedback from general public, it can be assumed that that project does not have a high priority for citizens. On the other hand, high interest in investment of equity in a project can be a good indication that that project is highly desired and so

should receive special attention from decision makers. The platforms can provide this information by running dry-tests on equity offering. , in which potential local investors may be able to register their names in advance during project development or early procurement phase and reserve their right to purchase equity shares, when the shares are ready to be publicly offered, for a small contingency payment.

– *Idea exchange*

Crowdfunding technology brings together community members from different ages and genders, local officials, elected officials, special groups and private companies under one roof in a platform. The information on the platform for a particular project or all other projects in the region and other parts of the country will be readily accessible to all of these stakeholders. As a result of this great database, new ideas can be formulated and exchanged easily and lessons learned can be shared. The platform may also provide the opportunity for community members to share their ideas about critical projects in their community with the decision makers and other investors, and potentially define new projects that can be added to the pipeline and procured as a P3 projects. For instance, people of a community can introduce the idea of building a new access road or bridge to provide a better access for people in that community. This community might be interested to utilize value capture techniques and invest in the project, even at a low rate of return, knowing that the new access road will enhance their community and will increase the price of their property. The new access road may also provide a better circulation of traffic in the community resulting in increased economic activities and increased sales taxes. This new access

road can result in an increase in the value of the properties which may lead to an increase in property taxes. Therefore, the local officials may decide to allocate a portion of this increase in tax revenue to the project over the next few years to make availability payments to a concessionaire who is willing to develop and maintain the road. Therefore, because of this strength of the proposed equity crowdfunding approach in P3s, a simple idea may create a win-win situation for everyone and can be delivered using equity crowdfunding in a P3 delivery method.

Threats

– *Business failure*

Institutional investors usually have the experience to analyze risk and rewards and make educated investment decisions. They usually have a portfolio of investments and closely monitor the investment risk of their profile and manage it appropriately. This level of sophistication usually does not exist at crowdfunding level for individual investors. As a result, they may make investment choices without fully understanding the risks associated with their investment. Although SEC rules try to prequalify investors based on their resources and put a cap on the level of investment that they can make based on their financial status, these rules cannot fully protect individual investors from making wrong choices. Since in a crowdfunding approach many individuals will invest in one project, the failure of that project may result in significant consequences for many people. Such project may become too big to fail creating a political risk for the government. Therefore, it is important to impose business rules around equity crowdfunding for P3s, at a level that provides the

flexibility to responsible investors, but not at a level that opens the door for irresponsible investors who may create a risk bubble.

– *Fraud*

Since equity crowdfunding in general is a new approach, and P3 projects are still evolving in the U.S., the proposed equity crowdfunding approach is still immature and has a weakness toward fraud. As market expands for equity crowdfunding for P3s, there inevitably would be attempts to regulate and defraud the market particularly since most of P3s are off balance sheet financing with limited or no ties to the parent company. As a result, some fraudulent activities may happen both at project level and at the equity crowdfunding market. The risk of these activities can be mitigated by development of business rules, use of technology and providing education to stakeholders particularly investors.

– *Possible misconceptions*

The proposed model requires a novel approach which is relatively new and unexplored. The lack of understanding and experience on this approach may create misconceptions that can create problems for political and public buy-in for the proposed model. For instance, one of the justifications that proponents of P3 models use is the transfer of risks to private sector. Introducing a new P3 model in which general public is taking the risks at equity level may create the misconception that under the new model the project risk is shifted back to general public. However,

proper education can explain that under the enhanced P3 model the general public will have the flexibility to share the risks and rewards with infrastructure funds.

	Internal in Origin		
Advantages	Return on equity Equal investment opportunity Enhanced stakeholder support Increased transparency	Induced complexity Lack of track record and market confidence Administrative and accounting challenges Third-party confidential information Social equity	***Disadvantages***
	Strengths	**Weaknesses**	
	Opportunities	**Threats**	
	Prioritization Idea exchange	Business failure Fraud Possible misconceptions	
	External in Origin		

Table 27: SWOT Analysis Summary

Summary

This chapter takes the advantage of the new flexibility that has been created under JOBS Act to introduce a crowdfunding enhanced P3 model. In order to better understand advantages and disadvantages of this enhanced P3 model, a SWOT analysis has been conducted to provide insight into some questions of significant importance. This analysis addresses some of the challenges associated with the current P3 model, such as high rate of return on equity investment for a few infrastructure funds and lack of transparency. Under the current P3 model a partnership is formed between a private partner and a public agency, however, the

level of engagement from general public and communities is very limited. This study introduces a new framework for the P3 model in which general public and communities will have the opportunities to be involved as a partner in P3 projects.

The strengths of the new model come from involvement of the general public, especially local communities, as a major partner in the model. This engagement provides the opportunity to use the wisdom and power of the crowd to change the semi-monopolist environment under the current P3 model and create opportunities for idea exchange, additional transparency and enhanced public engagement in prioritization decision makings. The risky nature of business failure in infrastructure investment and fraud cannot be fully changed; however, as the enhanced model matures, more data on different projects and transactions becomes available for comparison purposes and investors gain more experience. Consequently, the overall risk of business failure under the enhanced P3 model will be reduced. The widespread use of this model will also draw additional attention from regulatory agencies to protect investors from fraud. A need for additional steps to be taken to ensure enough due diligence has been done on the legitimacy of equity shares that are offered under this model to prevent fraud will still exist.

The roots of weaknesses of the enhanced P3 model are in the additional complexity that will be added to the already complex P3 model. Although this additional complexity may negatively impact favorable opportunities, it can be managed and controlled by developing standardized contractual documents, provisions, administrative procedures, and accounting practices to minimize the negative impact.

Since crowdfunding has been successfully used in other sectors, the chance that it can be successfully used in P3 projects is probable. The large size of P3 projects, however, may create additional sensitivity around these projects making threats more politically sensitive. This challenge can be overcome by educating decision makers and general public on benefits and shortcomings of crowdfunding to ensure this tool is used at the right place, at the right time and by the right people.

In sum, the advantages of the enhanced P3 model outweigh the disadvantages. Many issues, however, still exist that makes implementation of this model challenging. Additional research is needed to further study the details of implications of the enhanced P3 model in practice. In particular, the optimal term for equity shares, differences in the risk and reward profiles between equity shareholders and infrastructure funds, and a standardized process that may be used to price and offer equity shares. A need to gauge the political appetite to champion for introduction of a new P3 model while there is a lot of sensitivity around privatization of public goods exists. The authors also recognize the need to investigate the performance of the new P3 model from a financial perspective, particularly quantification of any potential savings as a result of potential reduction in rate of returns or any credit enhancement impacts of the new model.

Chapter 7: Conclusion

Through a review of infrastructure P3 financing models in the U.S., and the exploration of relevant project characteristics and public goals and objectives, the central research question "how the existing cases can be used to potentially enhance the current P3 model both in terms of bankability and overall procurement process maturity?" has been explored. The research method of QCA provided a framework suitable for the level of information that was available as input, and enabled a systematic way to identify logical patterns between multiple conditions and outcomes. Some statistical methods were used to further refine the results and make conclusions that can help to better understand how financing package of P3 projects may change based on project characteristics and policy objectives.

Summary of Contributions

This work presents six main contributions: the first three are primarily focused toward academia, while the last three provide new decision-making tools to aid practitioners.

1. Collecting and making accessible P3-related studies and publications, both from academic literature and industry information (financing documents, procurement documents, etc.) across a broad range of disciplines, including but not limited to construction, procurement, finance, policy, and law.
2. Providing a comprehensive list of credit enhancements and a discussion on how they have been used and how they may impact project financing and policy objectives.

3. Reviewing multiple project characteristics and identifying the most important variables that may impact outcomes.
4. Introducing a novel approach to compare interest rate on different types of debt (bank loan, variable interest rate bonds, fixed interest rate bonds, tax-exempt bonds, etc.) . To the best of author's knowledge, this is the first time that such a method has been used to compare interest rate on debt in project finance.
5. Developing a P3 case data base particularly as it relates to financing elements of 18 P3 deals that have reached financial closed in the U.S. over the last two decades The QCA patterns identified in this study yield interesting insights into effective combinations of project capital value, term, construction risk, traffic and revenue risk and competition at procurement stage to achieve a better financing package for P3 projects.
6. . Introducing an enhanced P3 model that can enhance delivery of P3 projects through offering equity shares using a crowdfunding approach.

The findings of this study can help P3 practitioners to better utilize available tools and also provides them with new tools to further enhance procurement of P3 projects. The case library provides a significant resource to practitioners as well as researchers and the proposed corwdfunding approach is a novel step toward taking P3 projects to a new maturity level.

Limitations of Study

This contains several limitations both in its approach and in its application. The QCA research methodology in general has limitations due to having a small/medium sample size, making it less powerful than statistical analysis. The method also uses simplifying assumptions to generalize patterns and draw conclusions which makes it even less powerful, however, although as explained earlier this method is the most powerful method that could practically perform the required analysis for the purpose of this study.

Further, given the complexity of the financing packages for P3 projects, and the fact that some information is not publicly available either due to proprietary nature of the information or policy considerations, some of the collected information cannot be verified using publicly available sources. The study has relied on information from reliable sources who have worked on the projects.

Policy Implications

Since P3 industry is still relatively new in the U.S., and it evolving both in terms of practice and policy, the results of this study can help policy makers to better understand benefits and shortcomes of different P3 structures, particularly, the discussion on suitability of different P3 models for projects with different characteristics and policy objectives. Unlike the direction in most literature to choose one over another, this study has taken an unbiased view on different P3 models such as availability payments and toll concessions to better analyze how, and under what circumstances, each model may deliver better value. As a result, this study provides

an unbiased view of how different tools in the toolbox can be used to deliver policy objectives.

The other major policy implication of this study is reaffirmation of the fact that enhanced transparency and better competition, at different levels of the deal, will provide better value for the public. In particular, this dissertation has focused on the competition at procurement stage, and competition at equity investment level to identify opportunities that exist and the values that can be gained through enhanced completion.

Directions for Future Work

This study is a step toward better understanding policy and financial implications of different P3 structures. It has collected one of the first comprehensive datases on transportation P3 projects in the U.S., and has tried to take the discussions from whether P3s are useful or not, to a new level that how P3s can be optimized.

This area is still relatively new, and under evolution. There is a research need to further analyze data collected in the database to further refine the results by (a) introducing new conditions into the QCA analysis to consider other aspects of P3 projects and (b) further analyzing the application of the proposed enhanced P3 model using crowdfunding and how it may add value to the financing package of P3 projects

.

Appendix A: QCA Case Studies Summary

I-4 Ultimate (Florida)		
Description	Urban Greenfield Managed Lanes	
Financial Close	Sep-14	
Capital Value	2.3 billion	
Term	40 years	
Construction Risk	High	
Traffic Risk	None (Availability Payments)	
Sponsor	Skanska / John Laing	
Financing Summary		
Debt/Equity Leverage	94/6	
Bank Debt	Amount	$486.00
	Pricing	*4.04%*
	Term	*4 to 9 years*
	# of Banks	six
Bonds/PAB	Amount	
	Pricing	
	Term	
TIFIA	Amount	$949.00
	Pricing	3.16%
	Term	$130.7 due 2023 and $818.4 in 2052
Equity	Amount	$104.00
	IRR	12%
Benchmark Rates	LIBOR Swap Rates	1.77%
	Revenue Bond Index	4.87%
	30-Year Treasury	3.37%

Procurement Summary

Security	Type of Procurement	Bid/Proposal Submitted	Financial Close	# of Bidders	Notes
AP	Best Value Selection	Mar-2014	Sep-2014	4	Four teams short-listed out of seven: VINCI/Meridiam/Walsh, Macquarie/OHL/FCC, Skanska/Laing, InfraRed/Fluor/Kiewit

QCA INDEX

Capital Value	Term	Construction Risk	Traffic Risk	Competition		Equity	Debt	leverage
1	0	1	0	2		1	1	1

I-69 Section 5		
Description	Greenfield	
Financial Close	Jul-14	
Capital Value	$290.00million	
Term	37 years	
Construction Risk	Moderate	
Traffic Risk	None (Availability Payments)	
Sponsor	Isolux	
Financing Summary		
Debt/Equity Leverage	86/14	
Bank Debt	Amount	
	Pricing	
	Term	
	# of Banks	
Bonds/PAB	Amount	$251.76
	Pricing	1.50% to 5.00%
	Term	2017-2046
TIFIA	Amount	
	Pricing	
	Term	
Equity	Amount	$40.45
	IRR	9.93%
Benchmark Rates	LIBOR Swap Rates	1.8%
	Revenue Bond Index	4.98%
	30-Year Treasury	3.33%
Procurement Summary		

Security	Type of Procurement	Bid/Proposal Submitted	Financial Close	# of Bidders	Notes
AP	Best Value Selection	Jan-2014	Jul-2014	4	Four teams short-listed out of five: Macquarie/Lane, PSP/Isolux, Pleanary and Walsh/Meridiam.

QCA INDEX								
Capital Value	Term	Construction Risk	Traffic Risk	Competition		Equity	Debt	leverage
0	0	1	0	2		1	1	1

US 36		
Description	Greenfield Managed Lanes	
Financial Close	Feb-14	
Capital Value	US$140.00m	
Term	50 years	
Construction Risk	Moderate	
Traffic Risk	Significant, real toll, managed lane	
Sponsor	Plenary Group	
Financing Summary		
Debt/Equity Leverage	66/34	
Bank Debt	Amount	
	Pricing	
	Term	
	# of Banks	
Bonds/PAB	Amount	$40.91
	Pricing	$20.36M PABs at 5.875% and $20.554 Subordinated Loan at 11%
	Term	2044 and 2050
TIFIA	Amount	$60.00
	Pricing	3.58%
	Term	2044
Equity	Amount	$20.55
	IRR	13.68%
Benchmark Rates	LIBOR Swap Rates	1.62%
	Revenue Bond Index	5.29%
	30-Year Treasury	3.66%

Procurement Summary

Security	Type of Procurement	Bid/Proposal Submitted	Financial Close	# of Bidders	Notes
Tolls	Best Value Selection	Mar-2013	Feb-2014	2	Three teams short-listed out of four: Cintra, Plenary, Isolux Corsan. Only two submitted binding proposals: Plenary and Isolux Corsan.

QCA INDEX

Capital Value	Term	Construction Risk	Traffic Risk	Competition		Equity	Debt	Leverage
0	1	1	1	1		0	1	1

Goethals Bridge (NY/NJ)		
Description	Urban Greenfield	
Financial Close	Nov-13	
Capital Value	$1.30bn	
Term	40 years	
Construction Risk	High	
Traffic Risk	None (Availability Payments)	
Sponsor	Macquaire / Kiewit	
Financing Summary		
Debt/Equity Leverage	90/10	
Bank Debt	Amount	
	Pricing	
	Term	
	# of Banks	
Bonds/PAB	Amount	$460.92
	Pricing	5.00% to 5.625%
	Term	2020-2052
TIFIA	Amount	$473.67
	Pricing	
	Term	2051
Equity	Amount	$106.82
	IRR	13.80%
Benchmark Rates	LIBOR Swap Rates	1.47%
	Revenue Bond Index	5.23%
	30-Year Treasury	3.8%
Procurement Summary		

Security	Type of Procurement	Bid/Proposal Submitted	Financial Close	# of Bidders	Notes
AP	Lowest Cost	Jan-2013	Nov-2013	3	Three teams short-listed: Kiewit/Macquarie, Skanska and ACS.

QCA INDEX

Capital Value	Term	Construction Risk	Traffic Risk	Competition		Equity	Debt	Leverage
1	0	2	0	2		0	1	1

NTE Segments 3A & 3B		
Description	Urban Greenfield Managed Lanes	
Financial Close	Sep-13	
Capital Value	$1.65billion	
Term	52 years	
Construction Risk	Moderate	
Traffic Risk	Significant Real Toll, Managed Lane	
Sponsor	Cintra / Meridiam	
Financing Summary		
Debt/Equity Leverage	65/35	
Bank Debt	Amount	
	Pricing	
	Term	
	# of Banks	
Bonds/PAB	Amount	$274.03
	Pricing	6.75% to 7.00%
	Term	2033-2043
TIFIA	Amount	$531.00
	Pricing	3.84%
	Term	2053
Equity	Amount	$430.29
	IRR	13%
Benchmark Rates	LIBOR Swap Rates	1.76%
	Revenue Bond Index	5.27%
	30-Year Treasury	3.79%

Procurement Summary

Security	Type of Procurement	Bid/Proposal Submitted	Financial Close	# of Bidders	Notes
Tolls	Negotiated with winning bidder for NTE	Jul-2011	Sep-2013	1	2009 agreement with Cintra/Meridiam authorized negotiation of the terms for construction of additional segments

QCA INDEX

Capital Value	Term	Construction Risk	Traffic Risk	Competition		Equity	Debt	Leverage
1	1	2	1	0		1	0	0

East End Crossings – East End Crossing (OH)		
Description	Urban Greenfield	
Financial Close	Mar-13	
Capital Value	US$763.00m	
Term	35 years	
Construction Risk	Moderate	
Traffic Risk	None (Availability Payments)	
Sponsor	Walsh / Vinci / Bilfinger Berger	
Financing Summary		
Debt/Equity Leverage	90/10	
Bank Debt	Amount	
	Pricing	
	Term	
	# of Banks	
Bonds/PAB	Amount	$676.80
	Pricing	4.56% to 5.01%
	Term	2019-2051
TIFIA	Amount	
	Pricing	
	Term	
Equity	Amount	$78.10
	IRR	12%
Benchmark Rates	LIBOR Swap Rates	0.98%
	Revenue Bond Index	4.36%
	30-Year Treasury	3.16%

Procurement Summary

Security	Type of Procurement	Bid/Proposal Submitted	Financial Close	# of Bidders	Notes
AP	Best Value Selection	Nov-2012	Mar-2013	3	Three teams short-listed out of five: Kiewit, Skanska and Walsh

QCA INDEX

Capital Value	Term	Construction Risk	Traffic Risk	Competition		Equity	Debt	Leverage
0	0	2	0	2		1	1	1

I-95 Express Lanes (VA)

Description	Urban Greenfield	
Financial Close	Jul-12	
Capital Value	US$940.00m	
Term	76 years	
Construction Risk	Moderate	
Traffic Risk	Significant Real Toll, Managed Lane	
Sponsor	Transurban / Fluor	
Financing Summary		
Debt/Equity Leverage	65/35	
Bank Debt	Amount	
	Pricing	
	Term	
	# of Banks	
Bonds/PAB	Amount	$252.60
	Pricing	4.35% to 4.45%
	Term	2030-2040
TIFIA	Amount	$300.00
	Pricing	2.77%
	Term	2048
Equity	Amount	$280.40
	IRR	13%
Benchmark Rates	LIBOR Swap Rates	0.85%
	Revenue Bond Index	4.54%
	30-Year Treasury	2.59%

Procurement Summary

Security	Type of Procurement	Bid/Proposal Submitted	Financial Close	# of Bidders	Notes
Tolls	Best Value Selection	Nov-2005	Jul-2012	2	Unsolicited proposal submitted by Clark/Shirley in September 2003 started PPTA process. Fluor/Transurban detailed proposal selected in November 2005.

QCA INDEX

Capital Value	Term	Construction Risk	Traffic Risk	Competition		Equity	Debt	Leverage
0	1	1	1	0		0	1	0

Presidio Parkway (CA)		
Description	Urban Greenfield	
Financial Close	Jun-12	
Capital Value	US$473.00m	
Term	30 years	
Construction Risk	Moderate	
Traffic Risk	None (Availability Payments)	
Sponsor	Hochtief / Meridiam	
Financing Summary		
Debt/Equity Leverage	87.5/12.5	
Bank Debt	Amount	$166.60
	Pricing	2.535% (LIBOR + 175 bp)
	Term	3.5 years
	# of Banks	six
Bonds/PAB	Amount	
	Pricing	
	Term	
TIFIA	Amount	$182.00
	Pricing	0.46% for $90M 3.5 year tranche; 2.71% for $63M 28-year tranche
	Term	3.5 and 28 years
Equity	Amount	$45.60
	IRR	14.46%
Benchmark Rates	LIBOR Swap Rates	0.99%
	Revenue Bond Index	4.74%
	30-Year Treasury	2.7%
Procurement Summary		

Security	Type of Procurement	Bid/Proposal Submitted	Financial Close	# of Bidders	Notes
AP	Best Value Selection	Oct-2010	Jun-2012	2	Three teams short-listed and two submitted bids: HOCHTIEF/Meridiam and ACS.

QCA INDEX								
Capital Value	Term	Construction Risk	Traffic Risk	Competition		Equity	Debt	Leverage
0	0	1	0	1		0	1	1

Midtown Tunnel (VA)		
Description	Greenfield / Brownfield	
Financial Close	Apr-12	
Capital Value	US$2.10bn	
Term	58 years	
Construction Risk	High	
Traffic Risk	Real Toll, well understood	
Sponsor	Macquarie / Skanska	
Financing Summary		
Debt/Equity Leverage	80/20	
Bank Debt	Amount	
	Pricing	
	Term	
	# of Banks	
Bonds/PAB	Amount	$663.75
	Pricing	4.45% to 5.50%
	Term	2022-2042
TIFIA	Amount	$422.00
	Pricing	3.18%
	Term	2056
Equity	Amount	$272.00
	IRR	12%
Benchmark Rates	LIBOR Swap Rates	1.17%
	Revenue Bond Index	4.83%
	30-Year Treasury	3.18%

Procurement Summary

Security	Type of Procurement	Bid/Proposal Submitted	Financial Close	# of Bidders	Notes
Tolls	Best Value Selection	Sep-2008	Apr-2012	1	VDOT issued Solicition for Proposals after receiving an unsolicited proposal from Skanska

QCA INDEX

Capital Value	Term	Construction Risk	Traffic Risk	Competition		Equity	Debt	Leverage
1	1	2	1	0		1	1	1

I-635 LBJ Freeway (TX)		
Description	Urban Brownfield Managed Lanes	
Financial Close	Jun-10	
Capital Value	US$2.6 blillion	
Term	52 Years	
Construction Risk	Moderate	
Traffic Risk	Significant Real Toll, Managed Lane	
Sponsor	Cintra / Meridiam	
Financing Summary		
Debt/Equity Leverage	69/31	
Bank Debt	Amount	
	Pricing	
	Term	
	# of Banks	
Bonds/PAB	Amount	$615.00
	Pricing	7.00% to 7.50%
	Term	2032-2040
TIFIA	Amount	$850.00
	Pricing	4.22%
	Term	2049
Equity	Amount	$665.00
	IRR	12.76%
Benchmark Rates	LIBOR Swap Rates	2.29%
	Revenue Bond Index	4.84%
	30-Year Treasury	4.13%
Procurement Summary		

Security	Type of Procurement	Bid/Proposal Submitted	Financial Close	# of Bidders	Notes
Tolls	Best Value Selection	Jan-2009	Jun-2010	2	Four teams short-listed and two submitted proposals: Cintra/Meridiam and Dragados/Zachry

QCA INDEX								
Capital Value	Term	Construction Risk	Traffic Risk	Competition		Equity	Debt	Leverage
1	1	2	1	1		1	0	0

North Tarrant Express (TX)		
Description	Urban Greenfield Managed Lanes	
Financial Close	Dec-09	
Capital Value	US$2.0 billion	
Term	52 Years	
Construction Risk	Moderate	
Traffic Risk	Significant Real Toll, Managed Lane	
Sponsor	Cintra / Meridiam	
Financing Summary		
Debt/Equity Leverage	73/27	
Bank Debt	Amount	
	Pricing	
	Term	
	# of Banks	
Bonds/PAB	Amount	$400.00
	Pricing	$59.8 in 2031 at 7.50% and $340.2 in 2039 at 6.875%
	Term	2031 and 2039
TIFIA	Amount	$650.00
	Pricing	4.52%
	Term	2049
Equity	Amount	$427.00
	IRR	13.12%
Benchmark Rates	LIBOR Swap Rates	2.69%
	Revenue Bond Index	4.94%
	30-Year Treasury	4.49%

Procurement Summary

Security	Type of Procurement	Bid/Proposal Submitted	Financial Close	# of Bidders	Notes
Tolls	Best Value Selection	Dec-2008	Dec-2009	2	Four teams short-listed out of seven proposals: Balfour Beatty/BRISA, Cintra/Meridiam, Itinere, OHL. Only two submitted proposals: Cintra and OHL

QCA INDEX

Capital Value	Term	Construction Risk	Traffic Risk	Competition		Equity	Debt	Leverage
1	1	1	1	1		0	0	0

Port of Miami Tunnel (VA)		
Description	Urban Greenfield	
Financial Close	Oct-09	
Capital Value	US$1.1 billion	
Term	35 Years	
Construction Risk	High	
Traffic Risk	None (Availability Payments)	
Sponsor	Meridiam / Bouygues	
Financing Summary		
Debt/Equity Leverage	90/10	
Bank Debt	Amount	$341.50
	Pricing	LIBOR + 300 bp swapped to 6.63%
	Term	5 to 7 years
	# of Banks	ten
Bonds/PAB	Amount	
	Pricing	
	Term	
TIFIA	Amount	$341.00
	Pricing	4.31%
	Term	2044
Equity	Amount	$80.30
	IRR	11.33%
Benchmark Rates	LIBOR Swap Rates	2.68%
	Revenue Bond Index	4.81%
	30-Year Treasury	4.19%

Procurement Summary

Security	Type of Procurement	Bid/Proposal Submitted	Financial Close	# of Bidders	Notes
AP	Best Value Selection	Mar-2007	Oct-2009	3	3 teams shortlisted: Babcock & Brown, ACS/Odebrecht/Parsons, and FCC/Morgan Stanley. Meridian allowed to replace Babcock and Brown equity in May 2009.

QCA INDEX

Capital Value	Term	Construction Risk	Traffic Risk	Competition		Equity	Debt	Leverage
1	0	2	0	2		1	1	1

I-595 (FL)		
Description	Brownfield	
Financial Close	Mar-09	
Capital Value	US$1.83 billion	
Term	35 Years	
Construction Risk	Moderate	
Traffic Risk	None (Availability Payments)	
Sponsor	ACS Dragados	
Financing Summary		
Debt/Equity Leverage	87/13	
Bank Debt	Amount	$780.00
	Pricing	LIBOR + 300 to 400 bp
	Term	10 years
	# of Banks	twelve
Bonds/PAB	Amount	
	Pricing	
	Term	
TIFIA	Amount	$603.00
	Pricing	3.64%
	Term	2042
Equity	Amount	$207.70
	IRR	11.54%
Benchmark Rates	LIBOR Swap Rates	2.46%
	Revenue Bond Index	5.81%
	30-Year Treasury	3.64%

Procurement Summary					
Security	**Type of Procurement**	**Bid/Proposal Submitted**	**Financial Close**	**# of Bidders**	**Notes**
AP	Best Value Selection	Sep-2008	Mar-2009	2	Four short-listed but only two teams submitted bids: ACS Dragados-Macquarie and Babcock and Brown

QCA INDEX								
Capital Value	Term	Construction Risk	Traffic Risk	Competition		Equity	Debt	Leverage
1	0	1	0	1		1	1	1

SH-130 Segments 5&6 (TX)		
Description	Greenfield	
Financial Close	Mar-08	
Capital Value	US$1.3 billion	
Term	Unavailable	
Construction Risk	Moderate	
Traffic Risk	Real Toll	
Sponsor	Cintra / Zachry	
Financing Summary		
Debt/Equity Leverage	84/16	
Bank Debt	Amount	$685.80
	Pricing	LIBOR + 130 to 170 bp
	Term	30 years
	# of Banks	ten
Bonds/PAB	Amount	
	Pricing	
	Term	
TIFIA	Amount	$430.00
	Pricing	4.46%
	Term	2047
Equity	Amount	$209.80
	IRR	12.00%
Benchmark Rates	LIBOR Swap Rates	3.39%
	Revenue Bond Index	5.17%
	30-Year Treasury	4.39%

Procurement Summary

Security	Type of Procurement	Bid/Proposal Submitted	Financial Close	# of Bidders	Notes
Tolls	Negotiated with winning bidder for TTC-35	Aug-2004	Mar-2008	1	Cintra bid $7.2 billion for right to negotiate six projects under Trans Texas Corridor 35. Other bidders for TTC-35 were teams led by Fluor and Skanska

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Capital Value	Term	Construction Risk	Traffic Risk	Competition		Equity	Debt	Leverage
1	1	1	1	1		1	1	1

I-495 Capital Beltway HOT Lanes (VA)		
Description	Greenfield HOT Lanes	
Financial Close	Dec-07	
Capital Value	US$2.1 billion	
Term	80 Years	
Construction Risk	Moderate	
Traffic Risk	Significant Real Toll, Managed Lane	
Sponsor	Transurban / Fluor	
Financing Summary		
Debt/Equity Leverage	78/22	
Bank Debt	Amount	
	Pricing	
	Term	
	# of Banks	
Bonds/PAB	Amount	$589.00
	Pricing	20-year SIFMA municipal index swap with 3.6% fixed rate (LOC from DEPFA + three banks)
	Term	40 years
TIFIA	Amount	$589.00
	Pricing	4.45%
	Term	2047
Equity	Amount	$350.00
	IRR	13.00%
Benchmark Rates	LIBOR Swap Rates	4.31%
	Revenue Bond Index	4.77%
	30-Year Treasury	4.53%

Procurement Summary					
Security	**Type of Procurement**	**Bid/Proposal Submitted**	**Financial Close**	**# of Bidders**	**Notes**
Tolls	Negotiation after Unsolicited Proposal	Jun-2002	Dec-2007	1	Transurban and Fluor

QCA INDEX								
Capital Value	Term	Construction Risk	Traffic Risk	Competition		Equity	Debt	Leverage
1	1	1	1	0		0	1	0

Pocahontas Parkway (VA)		
Description	Urban Brownfield	
Financial Close	Jun-06	
Capital Value	US$600 million (long-term lease)	
Term	99 Years	
Construction Risk	None	
Traffic Risk	Real Toll w/ 5 yr Operating History	
Sponsor	Transurban	
Financing Summary		
Debt/Equity Leverage	70/30	
Bank Debt	Amount	$305.70
	Pricing	LIBOR + 85 to 130 bp
	Term	30 years
	# of Banks	three
Bonds/PAB	Amount	$21.90
	Pricing	Affiliated Subordinate Note (at *10%*)
	Term	10 years
TIFIA	Amount	$150.00
	Pricing	5.16%
	Term	two tranches (2042,2044)
Equity	Amount	$119.00
	IRR	12.60%
Benchmark Rates	LIBOR Swap Rates	5.59%
	Revenue Bond Index	5.24%
	30-Year Treasury	5.15%

Procurement Summary

Security	Type of Procurement	Bid/Proposal Submitted	Financial Close	# of Bidders	Notes
Tolls	Negotiation after Unsolicited Proposal	Oct-2004	Jun-2006	1	Transurban / DEPFA

QCA INDEX

Capital Value	Term	Construction Risk	Traffic Risk	Competition		Equity	Debt	Leverage
0	1	0	1	0		1	1	1

Indiana Toll Road (IN)		
Description	Urban Brownfield	
Financial Close	Jun-06	
Capital Value	$3.8 billion (long-term lease)	
Term	75 Years	
Construction Risk	None	
Traffic Risk	Mature, Real Toll, Long Op. History	
Sponsor	Macquarie / Cintra	
Financing Summary		
Debt/Equity Leverage	80/20	
Bank Debt	Amount	$3,248.00
	Pricing	Six month LIBOR + 95 to 125 bp plus swap fees
	Term	20 years
	# of Banks	seven
Bonds/PAB	Amount	
	Pricing	
	Term	
TIFIA	Amount	
	Pricing	
	Term	
Equity	Amount	$770.00
	IRR	13.00%
Benchmark Rates	LIBOR Swap Rates	5.59%
	Revenue Bond Index	5.24%
	30-Year Treasury	5.15%

Procurement Summary

Security	Type of Procurement	Bid/Proposal Submitted	Financial Close	# of Bidders	Notes
Tolls	Highest Qualified Bid	Jan-2006	Jun-2006	4	Cintra/Macquarie - $3.8 billion, Babcock & Brown - $2.84 billion, Itinere -$2.52 billion, Morgan Stanley - $1.9 billion

QCA INDEX

Capital Value	Term	Construction Risk	Traffic Risk	Competition		Equity	Debt	Leverage
1	1	0	1	2		1	1	1

Chicago Skyway (IL)		
Description	Urban Brownfield	
Financial Close	Jan-05	
Capital Value	US $1.83 billion (long-term lease)	
Term	99 Years	
Construction Risk	None	
Traffic Risk	Mature, Real Toll, Long Op. History	
Sponsor	Macquarie / Cintra	
Financing Summary		
Debt/Equity Leverage	55/65	
Bank Debt	Amount	$150.00
	Pricing	Six month LIBOR + 250 bp
	Term	30 year sub debt
	# of Banks	three
Bonds/PAB	Amount	$1,400.00
	Pricing	$961 CABs (LIBOR +38) and $439 Current (LIBOR +28)
	Term	CABS - 21 years, Current 12 years
TIFIA	Amount	
	Pricing	
	Term	
Equity	Amount	$229.00
	IRR	12.30% (post refi)
Benchmark Rates	LIBOR Swap Rates	4.09%
	Revenue Bond Index	4.92%
	30-Year Treasury	

Procurement Summary

Security	Type of Procurement	Bid/Proposal Submitted	Financial Close	# of Bidders	Notes
Tolls	Highest Qualified Bid	Oct-2004	Jan-2005	3	Cintra/Macquarie - $1.83 billion, Vinci - $700.5 million, Abertis -$505 million

QCA INDEX

Capital Value	Term	Construction Risk	Traffic Risk	Competition		Equity	Debt	Leverage
1	1	0	1	2		1	1	1

Appendix B: QCA Debt Interest Rate Calculations

Transaction	Financial Close	*Benchmark Rates*						Spread between Taxable LIBOR and Tax-Exempt RBI
		LIBOR	LIBOR SWAP Rate	Revenue Bond Index	5-Year Treasury	10-Year Treasury	30-Year Treasury	
Chicago Skyway	Jan-2005	2.89%	4.09%	4.92%	3.70%		4.75%	2.03%
Indiana Toll Road	Jun-2006	5.49%	5.59%	5.24%	4.09%		5.15%	-0.25%
Pocahontas Parkway	Jun-2006	5.49%	5.59%	5.24%	4.09%		5.15%	-0.25%
I-495 HOT	Dec-2007	4.83%	4.31%	4.77%	3.53%		4.53%	-0.06%
SH 130 Seg. 5&6	Mar-2008	2.68%	3.39%	5.17%	2.39%		4.39%	2.49%
I-595 (FL)	Mar-2009	1.83%	2.46%	5.81%	1.90%	2.95%	3.64%	3.98%
Port of Miami Tunnel	Oct-2009	0.59%	2.68%	4.81%	2.41%	3.49%	4.19%	4.22%
North Tarrant Express (NTE)	Dec-2009	0.45%	2.69%	4.94%	2.35%		4.49%	4.49%
I-635 (LBJ Freeway)	Jun-2010	0.75%	2.29%	4.84%	2.09%		4.13%	4.09%
Midtown Tunnel (VA)	Apr-2012	0.73%	1.17%	4.83%	0.86%		3.18%	4.10%
Presidio Parkway (CA)	Jun-2012	0.74%	0.99%	4.74%	0.71%		2.7%	4.00%
I-95 HOT Lanes (VA)	Jul-2012	0.73%	0.85%	4.54%	0.59%		2.59%	3.81%
Ohio River Bridges - East End	Mar-2013	0.45%	0.98%	4.36%	0.88%		3.16%	3.91%
NTE Segments 3A & 3B	Sep-2013	0.38%	1.76%	5.27%	1.71%		3.79%	4.89%
Goethals Bridge	Nov-2013	0.35%	1.47%	5.23%	1.37%		3.8%	4.88%
US-36	Feb-2014	0.33%	1.62%	5.29%	1.53%		3.66%	4.96%
I-69 Section 5	Jul-2014	0.33%	1.80%	4.98%	1.68%		3.33%	4.65%
I-4 Managed Lanes	Sep-2014	0.33%	1.77%	4.87%	1.79%		3.37%	4.54%

Note: The 30-year treasury rate did not exist in January 2005. The number used is this table an approximation.

Transaction	Debt Capital Market	Debt Pricing (Highest Yield)	Estimated Fixed Rate	Adjustment for Term	Adjusted for Taxes	Estimated Rate for QCA Purposes	*Spread to RBI*
Chicago Skyway	Taxable	LIBOR + 250 bp	6.590%		-0.99%	**5.60%**	0.68%
Indiana Toll Road	Taxable	LIBOR + 125 bp	6.840%		-1.03%	**5.81%**	0.57%
Pocahontas Parkway	Taxable	LIBOR + 130 bp	6.890%	-	-1.03%	**5.86%**	0.62%
I-495 HOT	Tax-Exempt	20-year SIFMA municipal index swap + 175 bp	5.350%	-	-	**5.35%**	0.58%
SH 130 Seg. 5&6	Taxable	LIBOR + 170 bp	5.090%	-	-0.76%	**4.33%**	-0.84%
I-595 (FL)	Taxable	LIBOR + 400 bp	6.460%	0.69%	-1.07%	**6.08%**	0.27%
Port of Miami Tunnel	Taxable	LIBOR + 300 bp	5.680%	0.70%	-0.96%	**5.42%**	0.61%
North Tarrant Express (NTE)	Tax-Exempt	PABs maturing in 2039	6.875%	-	-	**6.88%**	1.94%
I-635 (LBJ Freeway)	Tax-Exempt	PABs maturing in 2040	7.250%	-	-	**7.25%**	2.41%
Midtown Tunnel (VA)	Tax-Exempt	PABs maturing in 2042	5.500%	-	-	**5.50%**	0.67%
Presidio Parkway (CA)	Taxable	LIBOR + 175 bp	2.740%	1.99%	-0.71%	**4.02%**	-0.72%
I-95 HOT Lanes (VA)	Tax-Exempt	PABs maturing in 2040	4.450%	-	-	**4.45%**	-0.09%
Ohio River Bridges - East End	Tax-Exempt	PABs maturing in 2051	5.010%	-	-	**5.01%**	0.65%
NTE Segments 3A & 3B	Tax-Exempt	PABs maturing in 2043	6.750%	-	-	**6.75%**	1.48%
Goethals Bridge	Tax-Exempt	PABs maturing in 2052	5.625%	-	-	**5.63%**	0.40%
US-36	Tax-Exempt	PABs maturing in 2050	5.875%	-	-	**5.88%**	0.58%
I-69 Section 5	Tax-Exempt	PABs maturing in 2046	5.000%	-	-	**5.00%**	0.02%
I-4 Managed Lanes	Taxable	*Bank Debt*	3.850%	1.58%	-0.81%	**4.62%**	-0.25%

Note: The estimated fixed rate for I-635 (LBJ Freeway) is yield to maturity for the longest term bond.

Appendix C: Tosmana software results

Appendix D: Main Sources for Financial Data

Transaction	Primary Sources
Chicago Skyway	Skyway LLC Concession Refinancing Case Study, page 26 http://www.morpc.org/trans/funding_FennerInnovativeTransportationFinancing.pdf
Indiana Toll Road	Consolidated Financial Statements - Statewide Mobility Partners LLC, page 17 https://www.macquarie.com/dafiles/Internet/mgl/com/mqa/asset-portfolio/docs/indiana-financials-dec08.pdf
Pocahontas Parkway	Transurban (895) US Holdings LLC Loan Agreement, Page 86-87 http://www.virginiadot.org/business/resources/Principal%20Financing%20Documents.pdf
Capital Beltway	Capital Beltway Funding Corporation of Virginia Senior Lien Toll Revenue Bonds (I-495 Hot Lanes Project) Series 2008 A through D (Tax-Exempt AMT http://emma.msrb.org/MS65630-MS269419-MD533919.pdf "Capital Beltway bonds placed" –Infrastructure Journal and Project Finance Magazine, June 13, 2008
SH 130 Seg. 5&6	Cintra Annual Report 2008 http://memoria2008.cintra.es/en/index.asp?MP=177&MS=901&MN=2
I-595 (FL)	"ACS Finances Florida I-595 Availability-Pay Project" - Public Works Financing, February 2009 http://www.pwfinance.net/document/research_reprints/595_case.pdf Florida I-595 Express Lanes: Case Study on a DBFOM with Availability Payments www.dot.state.mn.us/funding/innovative/pdf/casestudies/I-595ExpressLanes.doc
Port of Miami Tunnel	"Miami Tunnel: Digging deep" – Project Finance magazine, November 2009 www.gtlaw.com/portalresource/lookup/wosid/contentpilot-core-

	1602-10702/pdfCopy.name=/GT%20Team%20Miami-Project%20Finance_Nov2009.pdf?view=attachment
North Tarrant Express (NTE)	Texas Private Activity Bond Surface Transportation Corporation Senior Lien Revenue Bonds (NTE Mobility Partners LLC North Tarrant Express Managed Lanes Project), Series 2009 (Tax-Exempt) http://emma.msrb.org/EP367750-EP288778-EP684048.pdf
I-635 (LBJ Freeway)	Texas Private Activity Bond Surface Transportation Corporation Senior Lien Revenue Bonds (LBJ Infrastructure Group LLC IH-635 Managed Lanes Project), Series 2010 (Tax-Exempt) http://emma.msrb.org/EP445713-EP348800-EP745641.pdf
Midtown Tunnel (VA)	Virginia Small Business Financing Authority Senior Lien Revenue Bonds (Elizabeth River Crossings Opco LLC Project) Series 2012 http://emma.msrb.org/EP631722-EP494216-EP895043.pdf
Presidio Parkway (CA)	"Overview of P3s in California" - Caltrans presentation, March 2013 http://www.acec-rivsb.org/uploads/20130321_Caltrans_P3_Presentation_-_Kome_Ajise.pdf
I-95 HOT Lanes (VA)	Virginia Small Business Financing Authority Senior Lien Revenue Bonds (95 Express Lanes LLC Project) Series 2012 http://emma.msrb.org/ER613442-ER476326-ER879293.pdf
East End Crossings - East End	Indiana Finance Authority Tax-Exempt Private Activity Bonds (East End Crossings East End Crossing Project), Series 2013 http://emma.msrb.org/ER661167-ER513087-ER915758.pdf
NTE Segments 3A & 3B	Texas Private Activity Bond Surface Transportation Corporation Senior Lien Revenue Bonds (NTE Mobility Partners Segments 3 LLC Segments 3A and 3B Facility), Series 2013 (Tax-Exempt) http://emma.msrb.org/ER696737-ER540539-ER941910.pdf
Goethals Bridge	New Jersey Economic Development Authority Tax-Exempt Private Activity Bonds (The Goethals Bridge Replacement Project) Series 2013 http://emma.msrb.org/EP772201-EP598531-EP999920.pdf

US-36	Colorado High Performance Transportation Enterprise, U.S. 36 and I-25 Managed Lanes, Senior Revenue Bonds, Series 2014 http://emma.msrb.org/ER754243-ER586408-ER988403.pdf
I-69 Section 5	Indiana Finance Authority Tax-Exempt Private Activity Bonds (I-69 Section 5 Project), Series 2014 http://emma.msrb.org/ER785628-ER610990-ER1013058.pdf
I-4 Managed Lanes	"$70M Savings on I-4 P3 Financing" – Bond Buyer, September 10, 2014 http://i4ultimate.com/wp-content/uploads/2014/09/0332-Florida-70M-savings-on-I-4-P3-Financing-Bond-Buyer-9.10.14.pdf

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