Contractual Approach to Optimising Risk Sharing: A Quantitative Study of the Multidimensional Nature of Risk in Private Provision of Road Infrastructure

By Demi Chung

Thesis submitted in partial fulfilment of the requirements for the degree of
Doctor of Philosophy in the Business School, The University of Sydney, Australia

November 2012

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Abstract

Public-Private-Partnerships (PPPs) are a public procurement policy that argues in support of greater value for money through optimal risk-sharing, by aligning incentives among parties who are profoundly different in terms of interests, objectives and risk preferences. The subject of interest in this thesis is tollroads that are procured under the PPP method, which traditionally involves the transfer of demand risk to the private sector.

Designing contracts to share risk in light of incentive problems is the central premise of contract theory, yet the risk-sharing implications have rarely been adequately tested using micro data at the decision-maker level. In addition, empirical contract studies tend to ignore the risk preferences of contracting parties or assume that the stereotypical risk-averse agent and risk-neutral principal are present in all contractual relationships.

This thesis addresses these shortcomings by presenting the methodology and empirical findings of an online survey within which a stated choice experiment was designed to capture the risk perceptions of contracting parties to a number of hypothetical PPP tollroad concessions. Information from 101 participants drawing on their project experience over 32 countries was collected within an advanced computer-aided personal survey instrument, to condition model estimates on observing the manner in which respondents processed the information presented to them to test the impact of contractual conditions and external institutional variables on their risk preferences, and hence their choice behaviour.

While the findings of this thesis support the concept that risk-sharing in PPPs is in line with contract theory's incentive alignment proposition, they refute the common belief in contract

theory with respect to stereotypical economic actors. Moreover, the results demonstrate the powerful incentive effect of property rights to *ex post* surplus. There are a number of significant implications as to the design of contracts and reform of public policy if PPPs are to gain popularity and to attain value for money. To induce appropriate *ex post* performance efficiency, *ex ante* property rights need to be complemented with equitable risk-sharing among contracting parties. Uptake of the policy by the market can be enhanced by modifications to the identified institutional variables and contractual conditions. Finally, the thesis appeals to the theories of decision making to further pursue the influence of human cognition, particularly bounded rationality, on our decision choices.

CERTIFICATE OF ORIGINALITY

This is to certify that to the best of the author's knowledge, this thesis comprises only the author's original work and it contains no material previously published or written by another person unless due reference to that material is made. This thesis contains no material which has been submitted for the award of any degree or diploma in any university or other institution.

Demi Chung
November 2012

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Preface

Chapter 2 has, in part, been published in the following publications:

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Abbreviations and Acronyms

AADT	Annual Average Daily Traffic
AIC	Akaike Information Criterion
AM	Availability model to incentivise efficient performance during the operational phase
ANA	Attribute on-attendance
APS	Attribute processing strategy
AT	Agency theory
ATO	Australian Taxation Office
BR	Bounded rationality
BCF	Business consideration fee
CAPI	Computer-assisted personal survey instrument
CCM	Cross City Motorway (private consortium that successfully bid for the Sydney Cross City Tunnel project)
CCT	Cross City Tunnel (PPP tolled tunnel in Sydney, Australia)
CEO	Chief Execution Officer
CI	Confidence interval
D&C	Design and construction
D&O	Design and operation
DBFO	Design Build Finance Operate
DURATION	Duration of the tollroad concession
ED	Eastern Distributor (PPP tollroad in Sydney, Australia)
EIS	Environmental Impact Statement
ERS	Ensured Revenue Stream (used in the Sydney Harbour Tunnel contract to ensure the private operator could obtain the pre-determined level of revenue)
EV1	Extreme Type 1 distribution (The phrase 'extreme value' arises relative to the normal distribution. The essential difference between the extreme type 1 and normal distributions is in the tails of the distribution where the extreme values reside.)
FIN_{D1}	Financial Risk Downside - public sector participants

FIN_{D2}	Financial Risk Downside - private sector participants
FIN_{U1}	Financial Risk Upside Gain - public sector participants
FIN_{U2}	Financial Risk Upside Gain - private sector participants
FGROWTH	Future growth of private provision in transport infrastructure
FOR_{D1}	*force majeure* Risk Downside - public sector participants
FOR_{D2}	*force majeure* Risk Downside - private sector participants
FOR_{U1}	*force majeure* Risk Upside Gain - public sector participants
FOR_{U2}	*force majeure* Risk Upside Gain - private sector participants
FPENALTY	Financial penalties imposed on failure to meet performance standards
FREETOLL	Freedom of the private operator to set toll pricing
GFC	Global Financial Crisis
HOT	High Occupancy Toll
HSQI	Hensher Service Quality Index
ICT	Incomplete Contract Theory
IID	Independently and identically distributed
IRR	Internal rate of return
LAND	Land acquisition risk borne by government
LCM	Latent Class Model
LCT	Lane Cove Tunnel (PPP tolled tunnel in Sydney, Australia)
LL	Log-likelihood
M2	M2 Motorway (PPP tollroad in Sydney, Australia)
M4	M4 Motorway (PPP tollroad in Sydney, Australia; concession ended in February 2010; ownership has since been handed back to the NSW Government.)
M5	M5 Motorway (PPP tollroad in Sydney, Australia)
M7	M7 Motorway; also known as Sydney Westlink (PPP tollroad in Sydney, Australia)
MAE	Material adverse event
MCL	Melbourne CityLink (PPP tollroad in Melbourne, Australia)

MED_{D1}	Media Risk Downside - public sector participants
MED_{D2}	Media Risk Downside - private sector participants
MED_{U1}	Media Risk Upside Gain - public sector participants
MED_{U2}	Media Risk Upside Gain - private sector participants
MEL	Melbourne EastLink (PPP tollroad in Melbourne, Australia)
MIG	Macquarie Infrastructure Group
MNL	Multinominal Logit Model
NET_{D1}	Network Risk Downside - public sector participants
NET_{D2}	Network Risk Downside - private sector participants
NET_{U1}	Network Risk Upside Gain - public sector participants
NET_{U2}	Network Risk Upside Gain - private sector participants
NPV	Net Present Value
NSW	New South Wales, Australia
O&C	Operation and construction
O&M	Operation and maintenance
PERSDR	Performance standards embedded in the tollroad concession
PFI	Private Finance Initiative
PFPs	Privately Financed Projects
PL	Peninsula Link (PPP tollroad in Melbourne, Australia)
POL_{D1}	Political Risk Downside - public sector participants
POL_{D2}	Political Risk Downside - private sector participants
POL_{U1}	Political Risk Upside Gain - public sector participants
POL_{U2}	Political Risk Upside Gain - private sector participants
PPPRI	Public-Private-Partnership Risk Index
PPPs	Public Private Partnerships
PRVRI	Risk Index of private sector participants
PUB_{D1}	Risk of public perception Downside - public sector participants
PUB_{D2}	Risk of public perception Downside - private sector participants

PUB_{U1}	Risk of public perception Upside Gain - public sector participants
PUB_{U2}	Risk of public perception Upside Gain - private sector participants
PUBRI	Risk Index of public sector participants
PUSPs	Public sector participants
PVOWNW	Private ownership to help government keep workforce at arms-length
PVOWNT	Private ownership as a way of making it easier to charge users a toll
PVSPs	Private sector participants
Rationale of PPPs	Value for money is achieved through transferring risk to the party that is the least risk-averse to that risk (or that is best able to manage that risk).
RP	Revealed preference
RTA	Road and Traffic Authority, NSW (It has since been restructured and become part of the NSW Transport Roads & Maritime Services Agency under the current Liberal government.)
SC	Stated choice
SCE	Stated choice experiment
SHT	Sydney Harbour Tunnel
SHTC	Sydney Harbour Tunnel Company
SOV_{D1}	Sovereign Risk Downside - public sector participants
SOV_{D2}	Sovereign Risk Downside - private sector participants
SOV_{U1}	Sovereign Risk Upside Gain - public sector participants
SOV_{U2}	Sovereign Risk Upside Gain - private sector participants
SPV	Special Purpose Vehicle
TCE	Transaction cost economics
TDM	Traffic demand management
TNI	Transport network integration
TPRICETD	Proper toll pricing to manage traffic demand
TRA_{D1}	Traffic Risk Downside - public sector participants
TRA_{D2}	Traffic Risk Downside - private sector participants
TRA_{U1}	Traffic Risk Upside Gain - public sector participants

TRA_{U2}	Traffic Risk Upside Gain - private sector participants
TRSHARE	The sharing of toll revenue with the other party
UDS	Urban design solution
UK	United Kingdom
UNC_{D1}	Risk of unclear project objectives Downside - public sector participants
UNC_{D2}	Risk of unclear project objectives Downside - private sector participants
UNC_{U1}	Risk of unclear project objectives Upside Gain - public sector participants
UNC_{U2}	Risk of unclear project objectives Upside Gain - private sector participants
VFM	Value for money
VFMS	Value for Money Statement (An Australian Government-endorsed public document through which the project procurer communicates to the community about how the procurement can provide VFM.)
VIC	Victoria, Australia

CHAPTER 1: INTRODUCTION

1.1 Background

Public-Private-Partnerships[1] (PPPs) are a public procurement policy instrument where the private sector provides infrastructure-based services historically regarded as the responsibility of government (Broadbent and Laughlin, 2004, p. 4). During the last 30 years, we have witnessed a full cycle of changes in the field of PPPs, particularly in the road infrastructure sector. We will document the cyclical trend in Chapter 2 through a series of case studies. A snapshot of the cycle is presented here in order to provide readers with a brief history of the evolution of PPPs in the road infrastructure sector.

When interest in PPP roads first surfaced in the policy and planning process as an emerging idea, a growing number of governments were keen to test the market and were prepared to offer favourable terms, including a revenue guarantee, in order to entice private capital to invest in public infrastructure. After about a decade of implementation, the strategy of rolling out PPPs proved to be quite successful, as evidenced by the increasing number of PPP projects (more details in Chapter 2). As the concept has matured, PPP road projects had become lucrative investments for private investors, and the market for PPP roads has flourished around the world.

Capital markets quickly developed to the point where there was an abundance of private capital seeking investment opportunities. PPP road projects were seen as relatively low risk because they involved governments that were perceived to have a very low risk of default, with some governments even willing to underwrite a risk-free guarantee. Under such conditions, PPP road projects became highly attractive, and competition for projects became fierce. Bidding consortia were willing to low-ball their bidding price in order to win a project. At the same time, some governments realised that private finance was an easier mechanism (in some cases, the only mechanism) to deliver infrastructure-based road services promised to constituents and satisfy public budget constraints.

[1] PPPs are also termed Privately Financed Projects (PFPs) in the NSW Government procurement policy (NSW Treasury, 2006). The early generation of the British equivalent is the Private Finance Initiative (PFI). In this study, the terms PPPs and PFPs are interchangeable, while PFIs refer specifically to projects undertaken in the UK.

Selection criteria for the winning bid were steered toward financial considerations, and the willingness – but not the ability – of the private consortium to bear risks. Toll pricing was the primary source of revenue to recoup private investments[2], and it did not take long for many under-priced projects to go awry. A number of projects went into receivership soon after the infrastructure asset was opened to the public; the Cross City Tunnel (CCT) and the Lane Cove Tunnel (LCT) in Sydney are cases in point. Consequently, billions of dollars of private investment in PPP roads have been written off. One example is the drastic devaluation by $102 million in the CCT holding of one equity investor, CKI, with market confidence falling accordingly[3].

The shortage of private capital worsened after the 2008 global financial crisis (GFC), and governments struggled to raise market interest for PPP road projects. As a result, many governments were forced to revert to financing projects in a traditional procurement manner. The Port Mann Bridge in British Columbia provides one example of a project that going to be a PPP evolved into a more traditional procurement model (Boardman and Vining, 2012). Once again, the scales tipped in favour of private finance as governments became willing to take back risks that previously had been shifted to the private sector. Toll pricing was removed from the risk-sharing equation as toll revenue was increasingly seen as being too volatile to assure an acceptable return to private capital.

The world now awaits the outcome of the latest generation of risk-sharing regimes in PPP road infrastructure, with new lessons learnt along the way and the treatment of risk allocation becoming more sophisticated.

The sections of this chapter are organised as follows. The next section conceptualises the topic of the research, followed by the questions of interest investigated in this thesis in Section 1.3. Section 1.4 identifies the contributions to the literature, and Section 1.5 offers a

[2] Tax benefits were another important source of recouping private capital. For some PPP projects, such as the Eastern Distributor in Sydney, interest earned on the infrastructure bonds issued by the project was exempt from tax. An interviewee indicated to the author that it was the tax-exempt interest that sustained the project during the early years of operation.

[3] Around the time of our data collection in late 2009 and early 2010, the procurement of Peninsula Link in Melbourne had been recently concluded with the availability payment model, where revenue risk is borne by the state government (more on this model in Chapter 2). During the interviews, many private investors, particularly the debt financiers, indicated to the author that their experience with the CCT and LCT left them uninterested in PPP tollroads unless such projects were offered to the market under the availability model.

schematic overview of the entire thesis, and details the structure of the thesis. Section 1.6 presents the summary of the chapter.

1.2 The PPP Procurement Policy

The PPP concept differs from other forms of private provision of assets, such as contracting out and privatisation, in relation to the dimensions of risks and rewards sharing and greater private involvement in the finance arrangements (Hodge, 2005). The relationships within a PPP are established by a concession contract that enables a commercial organisation to design, build, finance and operate an asset for an agreed period, hence they are known as DBFOs[4,5]. The principal rationale for PPPs is that they facilitate the transfer of risk to the party that has the greatest capacity to manage that risk (Partnerships Victoria, 2000; HM Treasury, 2006; NSW Treasury, 2006).

In the DBFO framework, the private sector is contracted to supply a bundled product that comprises two distinct elements; the creation of an asset and whole-of-contract-life asset management (NSW Treasury, 2006, p. 8). The public sector, on the other hand, purchases a service instead of an asset, with pre-defined payment levels that are typically payable only when the service meets required standards (Debande, 2002, p. 359). The payment mechanism is linked to the requirements set out in the output specification and the results of the risk assessment (Akbiyikli *et al.*, 2006, p. 72), and comes with conditions penalising poor performance (English and Baxter, 2010). The objectives of the payment structure are to provide private proponents with a number of incentives to deliver value for money (VFM). Since the recoupment of costs and future profit rely on a flow of suitable quality services from the asset, PPPs encourage the private proponent to build the required asset on cost, and to use efficient technology (Debande, 2002, p. 360). Further, the revenue receipts flow to the private operator only when construction of the asset has been completed and the service is fully operational, thus motivating the private consortium to finish the construction element efficiently. Strong evidence suggests that the PPP contractual mechanism has better facilitated integration between the creation of the asset and its ongoing management compared with contracts delivered under the traditional procurement method (NAO, 2003). Figure 1-1

[4] The use of terminology varies between countries. In the UK, a DBFO project in transport involves the transfer of ownership at the end of the concession period (Glaister *et al.*, 2000), while the similar arrangement in Australia is termed BOOT (Debande, 2002 p. 380).

[5] There are many different types of PPPs, see for example Broadbent and Laughlin (1999) for a review of different organisational structures of PPPs. This thesis only examines the DBFO type.

depicts the incentive scheme established through the interdependence of these core elements in an archetypical DBFO contract. The dashed line connecting the payment mechanism and the asset iterates the primary rationale of DBFO, that is, the purchase of the service and not the asset itself. In short, PPPs are contracts with specified long-term service provisions.

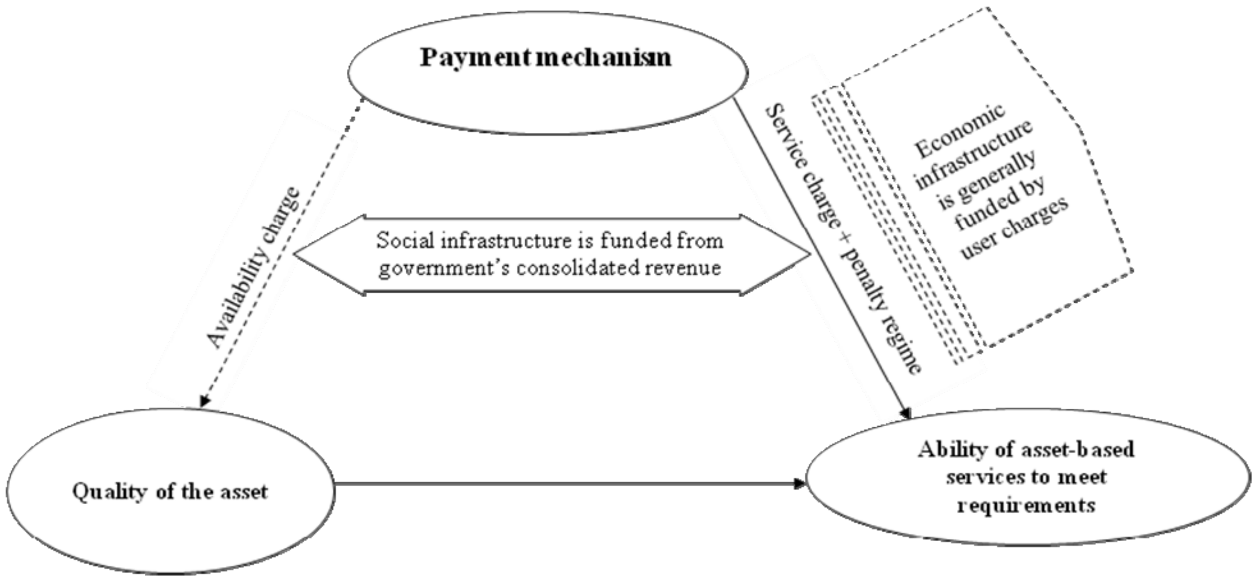

Figure 1-1: Relationship between the payment mechanism, quality of the asset and asset-based services (source: Adapted from (Chung, 2009))

The role that the private sector plays in the second element of this bundled product varies between social infrastructure projects and economic infrastructure projects. Social infrastructure projects, such as hospitals, schools and prisons, where government retains demand risk (NSW Treasury, 2007, p. 1), are normally funded from state revenue (English and Guthrie, 2003, p. 503). Service purchase payments include a direct government subsidy to the private partner for the availability of the facility (English, 2005a), and a revenue stream directly pays for the service provision (English, 2006).

In economic infrastructure projects, such as tollroads and urban rail lines[6], the private sector is usually contracted to bear the market risk, and they are funded by user charges (English and Guthrie, 2003, p. 503) rather than from consolidated revenue[7]. In these capital-intensive

[6] Readers are referred to Phang (2007) for a comprehensive review of PPP urban rail lines.

[7] An exception is the shadow toll program used in the UK in which the private operator is directly compensated by the Highways Agency by a fee based on the vehicle kilometres driven on their private roads (NAO, 1998).

projects, the creation of assets is likely to dominate. In DBFO roads, after the construction is complete, provision of the associated services (e.g., toll collection, roadwork and lighting maintenance) is a relatively minor component of the arrangement (Walker, 2005). The public sector's involvement is limited to monitoring adherence to the contract, and renegotiation of changes to services supplied (Debande, 2002, p. 367) or other contractual elements such as re-financing (VAGO, 2007). In exchange, the private operator negotiates a concession right with the government (English, 2005b) for a period that warrants an agreed rate of return to private equity (Arndt, 1998; Glaister *et al.*, 2000). During the concession period, the private party owns the right to operate the infrastructure facility. The length of the concession period is determined on the basis that sales of the asset-based services are sufficient to discharge construction, financing, operation and maintenance (O&M) costs plus a reasonable profit for private investors (Duffield, 2001, p. 27). At the conclusion of the concession, ownership of the property will normally revert to the public sector at no charge. In addition to financial contributions, governments can exercise their regulatory power to underwrite direct and indirect financial returns to private investment through a number of variables inherent in the procurement model, such as the term of concession, toll escalation options and traffic demand management measures (English, 2006).

In summary, PPP road concessions can offer the private proponent substantial financial and non-financial value in various forms: i) government guarantees of borrowing or a government loan; ii) the right to charge motorists; iii) the right to negotiate for term variations and toll variations; and iv) the right to negotiate with government to change existing traffic arrangements (such as road closures or construction of new ramps to divert traffic to the DBFO road) or to influence future infrastructure planning (details will be discussed in Chapter 2). Recent developments demonstrate that these concessions also deliver substantial financial value to government in different forms: receipt of concession fees, e.g., Sydney's M2 and the Melbourne CityLink (MCL); upfront receipt of Business Consideration Fees (BCFs), e.g., Sydney's CCT and LCT; no net cost to government, e.g., CCT; and no ongoing government contributions in return for ownership of some sections of a new road, e.g., the Melbourne EastLink (MEL) (VAGO, 2005, p. 191; p. 193).

Project financing of the DBFO model comes from private equity and debt and is typically non-recourse to government. These projects are primarily self-funded; i.e., cash flows generated from the project are the main source of return on equity and debt repayments. Each project is organised as a separate legal entity in the form of a Special Purpose Vehicle (SPV) created under private ownership. Therefore, DBFO projects are also known as stand-alone projects (Akbiyikli *et al.*, 2006; NSW Treasury, 2006, p. 55). The SPV is the legal owner of the project-related assets during the concession term (Kozarovski, 2006, p. 309). Complex relationships between the SPV and the contracting government agency are intertwined by two primary documents: (i) the lease agreement that grants the SPV a leasehold estate for a specified period; and (ii) the Project Deed, which specifies the financial arrangements and respective responsibilities between the various parties (Kozarovski, 2006, p. 311). One of the distinct qualities of the DBFO package is that there is a minimum interface between the government body and other parties in the relationship 'cobweb'. Once the project reaches financial close, most aspects of the contract's execution and management are directly dealt with by the SPV. Ideally, this concept should reduce transaction costs for the public sector. The contractual interfaces of the DBFO road model are exhibited in Appendix A.

1.3 Research Questions

The discourse in the PPP literature is diverse and extensive. This thesis focuses on issues related to risk allocation between the two contracting parties – the public sector procuring authority and the private sector consortium. This emphasis is motivated by the rationale that optimal risk-sharing is the underlying driver of VFM.

Risk-sharing optimisation is realised through allocating risk to the party that is the least risk-averse to that risk (Arndt, 2000; Chung et al., 2010). A successful outcome requires knowledge of the risks involved, of each contractual party's risk preference and their willingness and ability to bear risks. Precisely how well the risk allocation in PPP concessions considers these requirements, thus appropriately allocating risks with the view of optimising contractual outcomes, remains poorly understood within the literature. The first research question seeks to redress this gap, with special attention given to the road sector in order to understand the risk allocation process that involves the sharing of market demand risk.

> *Research Question One:*
> *To what extent is the outcome of risk allocation between the public and private sectors influenced by risk perceptions of different stakeholder groups? (i.e., Why is there a need to research risk-sharing optimisation?)*

In this thesis, risk is defined, based on the project management and financial economics literature as (Monteiro, 2010, p. 263):

> An event that may or may not occur and can lead to failure to satisfy project requirements…and is being considered as having an upside and a downside: a party facing risk suffers from negative events, but may also benefit from positive events. In this way, the party will have higher incentives for putting effort into preventing negative outcomes.

Our focus orientates toward risk perceptions because a decision maker's risk preference and hence risk-taking behaviour are decisively influenced by how they perceive risks (March and Shapira, 1987; Sitkin and Pablo, 1992; Weber et al., 2002). Increasingly, perceptions of risk gain regular exposure in risk management research (cf., Scheytt et al., 2006; Power, 2009). Answers to this question will be sought through an in-depth interview study involving interviews with key stakeholders from the public and private sectors who have been directly engaging in decision making in PPP tollroad projects.

The identification of stakeholder perceptions of risk provides a knowledge platform to evaluate how effectively the contractual approach of PPPs facilitate the realisation of VFM. Premised on a number of propositions established in the contracting literature, PPPs are supposedly able to generate VFM from appropriate alignment of risk-sharing incentives. There has not yet been a comprehensive study to diagnose PPPs through the body of work on contracting. The second research question that this thesis poses is to fill in this missing link.

> *Research Question Two:*
> *From the theoretical perspective of contract, to what extent does the PPP procurement method help incentivise risk-sharing? (i.e., What are the possible ways to realise risk-sharing optimisation?)*

This question will be investigated with an integrative appraisal of the different theoretical constructs in the contracting paradigm to analyse the multiple dimensions of risk in PPPs. We propose that PPPs mimic the incentive structure of risk spreading that occupies the central theme of contract theory.

While it is imperative to understand, from the contractual perspective, the extent to which a risk-sharing rationale will help produce VFM, there is a need to appreciate the intricacy of risk amplified by its multidimensional nature. Risk could be interpreted differently by different people (Rohrmann, 1994; Weber et al., 2002), and is contextually dependent (Kahneman and Tversky, 1979). Evidence from the organisational literature (cf., MacCrimmon and Wehrung, 1990; Power, 2009) suggests that the approach of restricting risk analysis to a technical or monetarian perspective is inadequate to reflect the complex pattern of individual risk evaluations. In the domain of the PPP contract process, the accounting literature goes further to question the effect of this narrow approach on silencing uncertainty (Froud, 2003; Broadbent et al., 2008).

Accordingly, traditional project appraisal methods in PPPs, such as comparison of net present value (NPV) through risk transfer vis-à-vis the capital spending associated with the public sector comparator, must be challenged because they do not consider risks beyond the technical and monetarian perspectives. In addition, subjective stakeholder perceptions of risk must be incorporated into evaluations in order to optimise risk sharing among contracting parties. There is a substantial theoretical and empirical literature on risky behaviour that offers insights into what determines risk preferences. Risk preferences are driven by a combination of influences, which have been described as situational factors, such as problem framing (Kahneman and Tversky, 1979), reference points (Lopes, 1987), levels of organisational slack (Cyert and March, 1963) and escalation of commitment (Brockner, 1992), and constant factors, including individual dispositions (Laughhunn et al., 1980), national culture (Hofstede, 1980) and organisational culture (Morgan, 1986). In this thesis, we will examine the multidimensional nature of risk from the behavioural perspective.

> *Research Question Three:*
> *What are the risk preferences of stakeholders engaging in PPP tollroad projects, and how are these preferences affected by factors at contract, policy and institutional levels? (i.e., How can risk-sharing optimisation be realised?)*

This question will be explored using discrete choice models to analyse data collected by an online survey. The survey includes an experiment that gathers stated choice data on international stakeholder perceptions of risk associated with alternative packages of attributes that define the dimensions of PPP risk, and questions to elicit revealed preference data on the stakeholders' experience of risk allocation in past tollroad concessions. The candidate attributes revealed in the in-depth interview study are used in the choice experiment.

1.4 Contributions to the Literature

This study contributes to the literature in four areas. The first is the identification of key risk dimensions and the likely levels associated with each risk attribute inferential to PPP tollroad concessions. Through the process of investigation, the acquired knowledge about key stakeholder perceptions of risk and the associated mitigating factors has opened the possibility of investigating the risk allocation in PPPs from the behavioural perspective.

The second contribution is the diagnosis of the PPP procurement method under the lens of contract. This research task is made possible by the decomposition of the contracting paradigm into three inter-related strands; namely, agency theory, incomplete contract theory and transaction cost economics (TCE).

There are several studies that apply a single theory of contract to analyse PPPs. For example, extending on agency theory, Trailer *et al.* (2004) argued that the multiple, simultaneous conflicting interests inherent in PPPs create difficulties in maximising VFM for all parties involved. In a like manner, Demirag and Khadaroo (2008) surveyed perceptions of the key PPP stakeholders about their consideration of accountability and VFM in the context of three Northern Ireland secondary schools. In applying incomplete contract theory, Hart (2003) formalised a general model of PPPs to evaluate their suitability to certain areas of service provision, while Froud (2003) critically questioned governments' ability to manage PPP risks and uncertainties in the longer term. Grounded in TCE, Ricketts (2004, 2008, 2009) explored the problems associated with contracting out to the private sector services that are controlled by the state, whereas English and Baxter (2010) investigated the nature of changing practices sustaining PPP prison facilities in the state of Victoria, Australia. However, noticeably missing from the literature is a study that consolidates the different views of the contracting paradigm to evaluate the effectiveness of risk-sharing arrangements in PPPs in achieving the policy objective of VFM.

This thesis contributes to the understanding of PPPs through the lens of contract theory in two dimensions. First, it integrates the three strands of contracting theory under the common banner of co-alignment of risk-sharing incentives with minimum transaction costs (see Figure 4-2). Second, by bridging the transaction attributes in each of the three strands, this thesis offers analytics from the microscope level, evidenced by behavioural data, on the structures of incentive alignment in PPPs. It is from this perspective that the thesis supports the position that PPPs can deliver VFM because they consolidate contractual mechanisms with known benefits from decades of research in the contracting paradigm.

The knowledge gained from exploring research tasks one and two is instrumental to addressing research task three, which adds the third contribution to this study; namely, the search for avenues to risk-sharing optimisation in mega infrastructure projects that involve the concession of ownership from the public sector to the private sector. The search is made possible via modifications to the identified factors, including various combinations of risk allocation, contractual conditions and macro- and micro-economic variables underlying the institutional environment, that vary the levels of the derived risk index of PPPs.

This takes us to the fourth contribution, the quantification of stakeholders' risk preferences through the calculus of a PPP risk index. Many empirical studies of contracting assume that the risk preferences of the contracting parties are given (cf., Allen and Lueck, 1999; Martimort and Pouyet, 2008; Chen and Chiu, 2010), or use self-reported measures (cf., Gaynor and Gertler, 1995; Jin and Doloi, 2008), which may lead to conclusions that are potentially biased. This thesis empirically derives a set of risk indices to measure the risk preferences of key stakeholders who have been actively engaging in PPP tollroads. The derived risk indices have made it possible to draw an objective and unbiased conclusion. Although the indices are derived from data that are primarily concerned with PPP tollroad concessions, the process of derivation can be readily applied to other areas of risk management.

1.5 Organisation of the Thesis

This thesis brings together literature from a number of disciplines. The flow of the research themes for the entire thesis is illustrated in the schema in Figure 1-2.

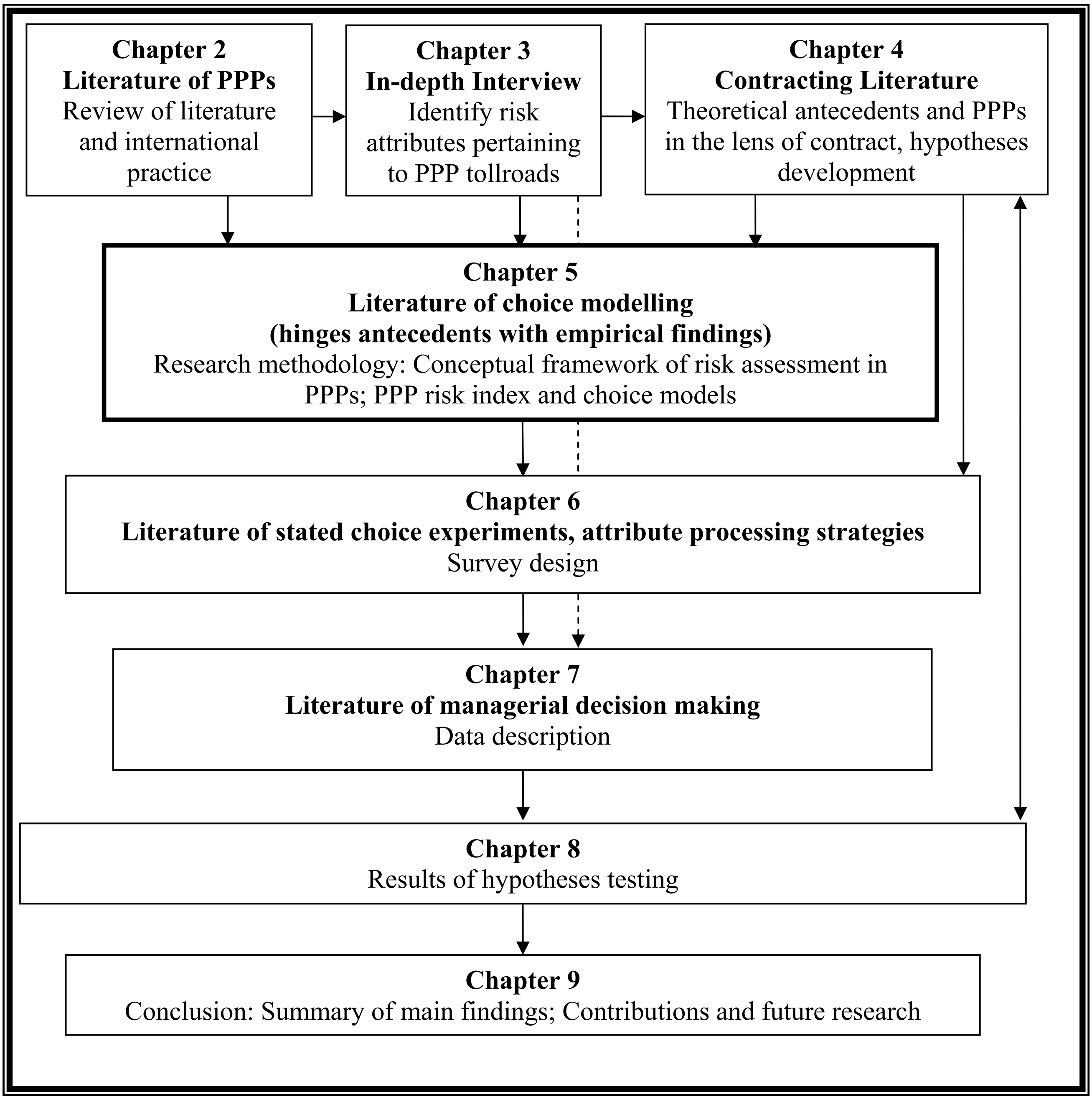

Figure 1-2: Research Framework

Consideration of the literature on PPPs begins in Chapter 2, with the objective of gaining a quality understanding of what has happened in the field and what has been lacking in this research area. The outcome is recognition of the crucial element of risk-sharing that lies in the heart of the procurement policy. The chapter offers an overview of the current state of PPP tollroad concessions. After reviewing the literature and international practice, the chapter develops a framework that disentangles the intricate web of contractual relationships embedded in PPP tollroad concessions in order to investigate the effectiveness of the contractual mechanisms in realising VFM. It concurs with the extant literature that suggests that risk allocation in PPP tollroads aligns with specific project objectives, and that these objectives are at variance with the overall policy rationale of optimal risk-sharing. This finding leads the strategic direction for the subsequent development of the thesis. It recognises that project objectives steer the risk allocations in PPP tollroads, which may become one of the decisive contributors to the formulation of the risk-sharing strategy and are therefore an important source of influence on stakeholders' risk preference. The chapter suggests that although there have been noticeable advancements in contract design and incentive mechanisms to optimise risk-sharing between the public and private sectors, some Australian PPP tollroad concessions have yet to deliver an optimal outcome. Recent developments suggest that the concept of tolling of motorways has gone beyond a simple road solution. It is questionable whether the risk shifting approach in the recent PPP paradigm is suitable for providing infrastructure-based road services where long-term service provision is a requirement, in such cases a proactive risk management approach may be preferred.

Expanding on this finding, Chapter 3 utilises in-depth interviews to survey key stakeholders who have been actively involved in PPP tollroad concessions, and presents a qualitative assessment of the risk perceptions held by key Australian stakeholder groups in the context of PPP tollroads. To gain an understanding of the impact of individuals' perceptions of risk, i.e., Research Question One, the chapter identifies nine key risk attributes pertaining to PPP tollroads, among which is the risk of unclear project objectives identified in Chapter 2. The other eight risk attributes are traffic risk, financial risk, network risk, *force majeure*, sovereign risk, political and reputational risk, media risk and risk of public perceptions.[8] The findings confirm that experience accumulated in recent years has contributed toward the betterment of risk-sharing optimisation among contracting parties. The knowledge acquired through the in-depth interviews supports the common view that equitable risk-sharing is the vital ingredient of VFM. The chapter casts doubt on the proposition that the private sector is better equipped to manage commercial risks involving economic decision making, while risks with embedded unquantifiable social and public values and those in the domain of public governance are best left with government alone.

The chapter also highlights evidence supporting the view that public perception is a malleable concept and should be managed by both sectors. The empirical findings raise a fundamental question about the true value of toll pricing. The spirit of private involvement is to garner the

[8] Chapter 3 also discusses other risks, but these nine risks are the key attributes used in the online survey.

market discipline that is vital to the self-regulation of the supply and demand of the provision of public goods, but the current practice undermines the power of the price mechanism in allocating scarce road space.

The results of Chapter 3 lead to a search for mechanisms that facilitate incentive alignment among parties whose risk perceptions are profoundly different. Chapter 4 focuses on contracting, drawing on a number of theories of contract to assess how the concession approach facilitates efficient risk allocation. Through the lens of contract, we are able to gain an insight into the extent to which risk allocation that accommodates different preferences for risk can foster interests and goals congruent to the realisation of policy objectives. In answering Research Question Two, the chapter argues that PPPs mimic the structures of incentive alignment in theories of contract, and hypothesises a number of propositions to investigate Research Question Three. Hypothesis testing will shed additional light on Research Question Two in terms of the relevance and limitations of the contracting paradigm to the study of PPPs.

The literature review of PPPs in Chapter 2 and the deliberation of antecedents in contract theory in Chapter 3 lay the foundation for the conceptual framework of risk assessment in PPPs. After linking all the findings in Chapter 5, a framework for risk optimisation is developed. The framework identifies the need to derive a set of PPP risk indices and sets the scope for the research design, the development of the data collection instrument and the models of testing stated choice data. It also sets the platform for hypothesis testing within a choice experiment setting and the construction of a PPP Risk Index derived from the contribution of each underlying dimension of risk (e.g., traffic, political, etc.) to the overall index of perceived risk that is a behaviourally powerful, easy-to-understand instrument to evaluate the risk preferences of contracting agents.

The method used to collect data to build the index requires a number of empirical considerations. In developing the data instrument, Chapter 6 examines the literature on stated choice experiments (SCEs) and attribute processing strategies (APSs) in order to gain insights into state-of-the-art practices in constructing the main survey instrument.

After presenting details of survey development and implementation, in Chapter 7 we set out the data collection method and challenges faced in collecting the data worldwide, and a descriptive overview of the data from the choice experiment and other questions in the overall computer-assisted personal survey instrument. Data analysis in Chapter 7 focuses on the contrast between perceptions of risk of public sector participants versus private sector participants. The analysis reveals that the underlying motivation of the PPP procurement policy is, as argued by pundits, essentially to establish a financing mechanism for government road authorities around the world to fulfil their obligations of providing their constituents with public road space. This confirms concerns raised in Chapter 3, namely that toll pricing is currently used as a means of procuring finance rather than rationalising road space. This observation holds true at the country level as well as at the global level. References are drawn from the literature of managerial decision making to explain some of the choices that participants made in our experiment.

Chapter 8 reports the results of hypothesis testing and reflects on the limitations of the contracting paradigm in analysing risk-sharing behaviour in PPPs. The results offer useful policy implications, which are presented in a format to enable readers to consider each implication as the outcome of each hypothesis tested. Chapter 9 concludes the thesis and presents a discussion of the contributions, policy implications and limitations of this thesis.

1.6 Summary of Chapter

This chapter has set the scene for the research in section one; defined the research scope in section two; stated the motivation for the research and introduced the research questions; and presented respective research methods employed to investigate each question in section three. Section four has identified the contributions to the literature, and section five has outlined the organisation of the thesis and summarised each of the remaining eight chapters. In the next chapter, we begin with how PPP tollroads have evolved into their current state.

CHAPTER 2: PRIVATE PROVISION OF MOTORWAYS – TOLLING OUR WAY INTO THE FUTURE

2.1 Introduction

PPP tollroads are growing in popularity throughout the world. This is a response to the need to invest in road infrastructure as well as constraints on public budgets that are increasingly focusing on sectors such as education, law and welfare where the private market is more ambivalent about its potential role. Roads, in contrast, have clear market returns and have attracted growing interest from the private sector at a time when the ability and willingness of governments to raise public debt is limited. Hence, PPPs have been broadly adopted by governments as a financial means to develop infrastructure, including, but not limited to, infrastructure-based road services. A specific rationale of such a procurement policy is that greater VFM in the public interest can be obtained through transferring risk to the party that is least risk-averse (Partnerships Victoria, 2000; HM Treasury, 2006; NSW Treasury, 2006) and best positioned to manage it (cf., NSW Treasury, 2005).

Tollroads have been one of the most active PPP markets in Australia. Since the 1980s, the scheme has delivered 11 tollroads, equivalent to $12 billion investment in the country (Ernst & Young, 2007, p. 1). Over the years, PPP tollroads have evolved to a stage where greater benefit is being delivered to the public sector. Brown (2005, p. 437)[9] succinctly describes the status quo of the Australian market of PPP tollroads as:

> *The structure of early toll road agreements seemed to be tilted in favour of the private sector, with the existence of [material adverse events] clauses and the ability to significantly delay rent payments to the government. In more recent examples the private sector assumes more of the downside traffic risk while the government shares in excess toll revenue.*

[9] Although seven years old, Brown's statement remains relevant to date.

In a social context, the deteriorating road infrastructure (BCA, 2005) together with the growing political realisation[10] of the social significance of a well-functioning transport network suggest the popularity of PPP tollroads in Australia is likely to continue.

New South Wales (NSW) is the Australian state that has shown the strongest preference for utilising the PPP scheme for tollroads, in terms of both number and the financial sums involved (English, 2006, p. 257, Table 1). Of the 11 PPP tollroads in Australia, 8 were developed in NSW. These are the Sydney Harbour Tunnel (SHT), the Eastern Distributor (ED), the Hills M2 Motorway (M2), the M4 Motorway (M4)[11], the M5 South-West Motorway (M5), the Westlink M7 (M7), the CCT and the LCT. The three remaining projects include the Clem 7 Tunnel in the State of Queensland (opened in March 2010); Melbourne CityLink (MCL, opened in August 1999) and EastLink (MEL, opened in June 2008). In addition, two PPP roads are currently under construction: the Airport Link in Brisbane (due for completion in 2012) and the Peninsula Link in Melbourne (scheduled to open in early 2013). These tollroads are shown in Figure 2-1, Figure 2-2 and Figure 2-3. Not all these tollroads are economically viable. For example CCT went into receivership two years after its opening to traffic, it was sold to another private consortium for $700 million in the same year. The original equity investors lost 80 percent of their investment in the project at sale (Clegg and Poljak, 2007). LCT ran into similar problem and went into receivership in 2010, three years after its opening to traffic.

It has been two decades since the SHT, the first PPP tollroad in Australia, was opened to traffic, yet no comprehensive evaluation of PPPs in the road sector has been conducted. It is the intention of this chapter to fill this vacuum in the literature. This chapter evaluates the extent to which the rationale of risk allocation has facilitated the delivery of VFM through private provision. It aims to disentangle the intricate web of relationships to examine the contractual and financial mechanisms used in incentivising the private sector to undertake risks, and to evaluate their effectiveness in terms of meeting the objectives of specific PPP tollroad projects.

[10] Establishment of the statutory advisory body Infrastructure Australia by the Australian Government in 2008 demonstrates that the social significance of a well functioning transport system is a cornerstone of the government's political agenda (see http://www.infrastructure.gov.au/roads/index.aspx, accessed on 30 June 2008).

[11] Ownership of the M4 reverted to the state government in February 2010; as promised, the government removed the toll.

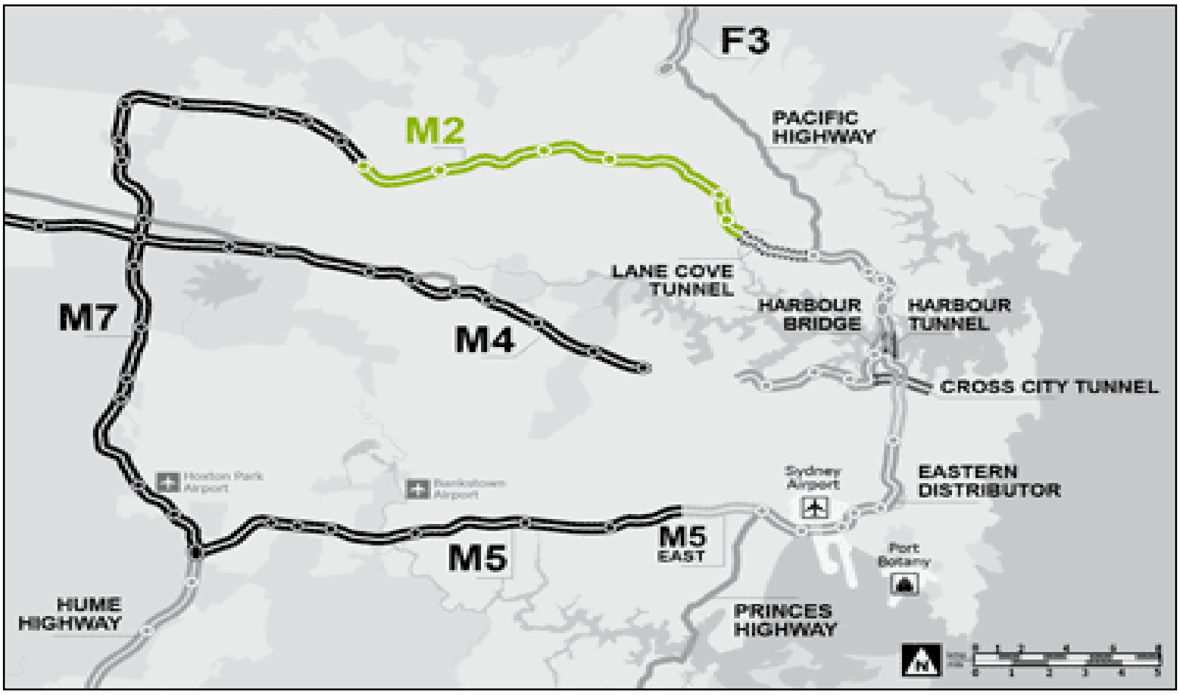

Figure 2-1: Tollroads in Sydney

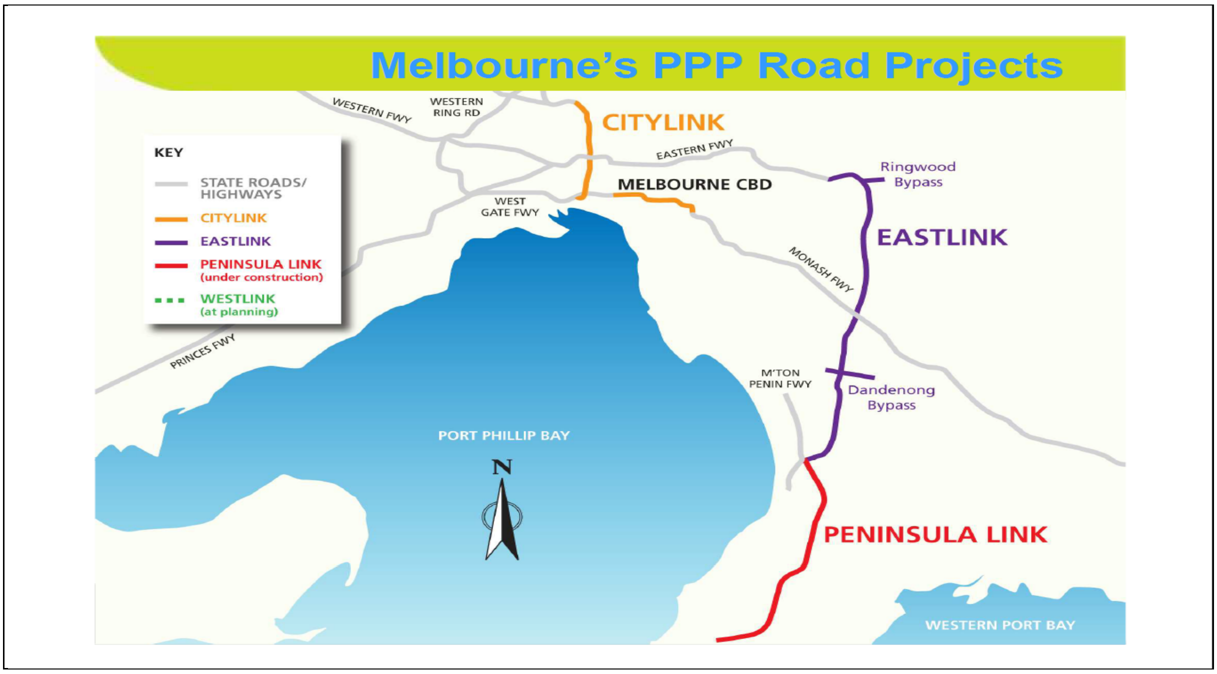

Figure 2-2: Tollroads in Melbourne

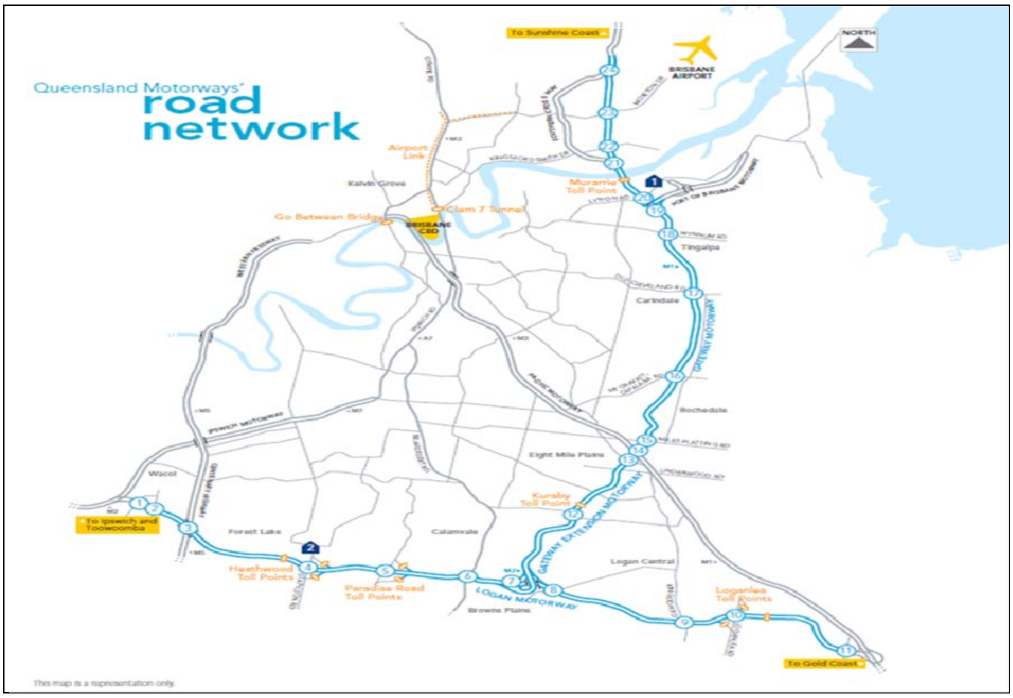

Figure 2-3: Tollroads in Brisbane

(source: Queensland Motorways www.qldmotorways.com.au)

Proponents of the PPP scheme have advocated that it aims to achieve optimal risk allocation by transferring risk to the party that is best able to manage it, thus delivering VFM to the general public. What has not been widely recognised is that initially PPPs were launched as an experiment to pave the way for increasing private participation in road service operations. However, the notion of optimal risk allocation has not been adhered to. Instead, in each case studied, the strategy of risk allocation was formulated to secure specific project interests (e.g., off-balance sheet financing, recourse to private finance, etc. See details in Table 2-1). Many early experiments were disparaged for artificially constructing new lines of financing for much-needed infrastructure while not marring the balance sheet (Walker and Walker, 2000; Hodge, 2005). Recently, a couple of spectacular failures have sparked questions of concealed objectives and VFM for whom.

The organisation of this chapter is as follows. The next section reviews the literature on PPPs in the context of road infrastructure. Section three develops a framework to analyse how key tollroad parameters are adjusted to suit a risk-sharing rationale with respect to the interests of government, the project and the SPV. Section four describes the evolution of PPPs in road transport and presents a number of case studies in Australia. The conclusion of findings is reserved for the final section.

2.2 Literature on PPPs in Road Infrastructure

Research on PPPs is highly skewed toward social infrastructure. Most of the studies challenge the extent to which VFM has been delivered through private finance (cf., NSW PAC, 1994; Gaffney et al., 1999a; Broadbent and Laughlin, 2003; English, 2005a; McKee et al., 2006), question the affordability of the scheme to the community (cf., Gaffney and Pollock, 1999; Edwards and Shaoul, 2003; Ismail and Pendlebury, 2006), and contend that the *ex ante* appraisal process is biased toward the PPP option (cf., Gaffney et al., 1999b; Froud and Shaoul, 2001; Heald, 2003; Demirag et al., 2004; English and Walker, 2004; Shaoul, 2005; Broadbent et al., 2008).

In other related PPP literature, two of the early works that consider PPP tollroad developments across countries are Fishbein and Babbar (1996) and Lockwood *et al.* (2000). In their 1996 study, Fishbein and Babbar analysed key attributes of eight private tollroads in four continents. They found that the financing structure of these road concessions was primarily a mix of private equity and debt. Seven of the eight projects were highly leveraged, with debt to equity ratios ranging from 50-100 per cent. Although inconclusive about the extent to which the right mix of equity and debt would balance risk sharing, Fishbein and Babbar found discernable linkages between the sources of funding and specific project objectives. In one case, the British Government chose to gear the Dartford Bridge with 100 per cent private debt in order to limit the required toll rates and accelerate the return of ownership to government. In other cases, recourse to private equity was considered to be the impetus to motivate the private proponent to maximise the road's long-term financial performance, rather than short-term earnings from constructing the property. Fishbein and Babbar alluded to the interdependence between the project's attractiveness to private equity and government's willingness to allow higher returns to the SPV.

Lockwood *et al.* (2000) made similar remarks on a project's ability to attract private capital. They reported that traffic demand, public-private risk sharing arrangements and the level of government financial support played important roles in shaping a project's financial attractiveness to private capital. The degree of government financial support varied according to the project's internal rate of return (IRR). A project showing a promising return could be privately financed with minimum government support. One implication of their findings, manifested in later developments, is that under the demands of competition private proponents are pressured into producing biased traffic forecasts in order to demonstrate that their proposals have the greatest potential to generate the highest and quickest project return. Fishbein and Babbar (1996) also warned that public resistance to tolling could hinder future growth, whereas Lockwood *et al.* (2000) cautioned that unresolved issues related to risk sharing and conflict reconciliation between the public sector and the private sector could deter future partnership efforts.

Both papers favour the DBFO option using private finance. They provide useful insights into the development of PPP tollroads at the international level, and hint that misallocation of risk and erroneous traffic forecasts are the causes of common problems repeatedly found in numerous projects.

In a similar vein, Debande's 2002 study examined privately financed toll infrastructure in the United Kingdom (UK). While he was also supportive of the scheme, he went beyond a simple comparison of key attributes across projects and flagged the potential distortion of recourse to private finance. He argued that the premium of private capital was indeed costly. Projects worth investing in needed to generate sufficient social benefits such as stimulation of economic growth to compensate for these additional costs (Debande, 2002, p. 361). Debande took a more integrated approach to investigate issues relating to risk transfer. Urban tollroads generally constituted parts of an integrated road network, thus the extent to which traffic demand risk was transferable depended on users' accessibility to alternative free services. If access to alternative routes was relatively convenient, the price of transferring traffic demand risk to the private proponent would outweigh the potential benefit because the private sector would impose prohibitive measures to mitigate the risk of losing out to low-price competing routes. Another related matter concerned with social significance was that if tollroads were a vital arterial component of the network, the effectiveness of market discipline imposed on the private sector partner would be greatly reduced since the government could not afford for it to fail. His study concluded that gains from relying on private finance were concentrated in the design and construction phase, and there was no real transfer of traffic demand risk in road concessions.

Results from Debande's findings are not unique to the UK. This is confirmed by two Australian studies, Mills (1991) and Arndt (1998). Focusing on *ex ante* contractual mechanisms, both studies scrutinised the risk sharing arrangements between the two sectors.

Mills found that the contractual arrangements of the SHT, the first PPP road in Australia, left the government fully exposed to all traffic risk. The tunnel company only bore limited construction risk; other risks were retained by the government and hence the taxpayer, and some of the operating risks were shifted to users. Mills was not convinced that the project could be justified on the grounds of economic efficiency because, in his opinion, no net welfare gain would be secured through introducing private provision into public infrastructure delivery.

A proposition often argued for private provision of public infrastructure insists that private capital adds a welfare increment through the creation of new assets that would otherwise be delayed. This was the justification for the SHT as well as the MCL, the first private tollroad in the state of Victoria (VIC). Its risk profile showed some promise of risk sharing between the two sectors, but through the conditions embedded in the payment mechanisms, the state government remained indirectly exposed to traffic flow and other risks that it had tried to transfer out (Arndt, 1998). Nonetheless, the MCL agreement showed promising advancements over any previous Australian tollroad projects. It shifted more risk to the private partner and created more symmetry in risk-sharing among the parties concerned. Arndt was optimistic about the growing trend over time, considering the MCL as a step toward a clearer, fairer and more rational risk allocation paradigm.

Neither Mills (1991) nor Arndt (1998) examined the *ex post* operational performance of the PPP tollroads, therefore the discrepancy (if any) between the actual outcomes and their analyses remains an open question. Shaoul et al. (2006) undertook an *ex post* financial study analysing empirically the VFM proposed by the first eight shadow tollroads[12] developed in the UK. The result confirmed Debande's (2002) finding that the cost of transferring risk to the private sector was excessive. The authors were sceptical as to whether these projects could deliver the anticipated risk transfer. While the paper was highly cynical about the Private Finance Initiative (PFI) scheme as a whole, the conclusion was largely based on conjecture,

[12] There are two shadow toll schemes. The biggest shadow toll scheme was launched by the Highways Agency in the UK, in which no charge is directly levied on motorists for using the private tollroads. The private operator is compensated by the government agency through shadow toll payments that are calculated based on the volume of traffic (NAO, 1998). The other shadow toll scheme is the "cashback" scheme currently implemented in Sydney's M5 motorway, in which motorists of NSW will get a refund from the state government for the use of private tollroads they paid at the point of travel. The scheme is funded from consolidated revenue (RTA, 2007, p. 23). After the government removing the toll price from M4 when the ownership conversion occurred in February 2010, the resultant cease of "cashback" for travellers using the M4 has since saved the state government substantial amount of cost (comments from one of the officials in NSW Treasury).

and did not explain the significant gap between the financial costs of a PFI road and a publicly financed road. These limitations were largely due to the expedient opaqueness of estimates in the business cases used to support the PFI in preference to public finance.

Brown (2005) echoed the findings of Shaoul *et al.* (2006) and Debande (2002). She made it plain that early Australian private tollroads mispriced the level of risk that the private sector assumed. These early partnerships increased the cash flows available, and lowered the risk of returns, to private equity. Revenue share for governments was possible only when actual returns had been greater than some hurdle rates based on IRR to private investors. These hurdle IRRs, which were determined based on inflated traffic estimates, were found to be unlikely to be realised in the early years of the concession period. Effectively, governments reduced the revenue risk for the private operator. In more recent developments, governments purchase a series of call options on the toll revenue with the price of the lease granted to the private sector over the land on which the tollroad is constructed (Brown, 2005, p. 435). These call options enable governments to share some portion of upside gains while at the same time transferring out downside risks.

Reinforcing the linkage between risk allocation and specific government objectives, Aziz (2007) raised a further concern about the effectiveness of payment mechanisms in achieving government objectives and in implementing risk allocation strategies. In his analysis of the DBFO transportation projects awarded between 2004 and 2006 in British Columbia in Canada, Aziz showed that there was a strong association between the design of payment mechanisms and specific government objectives. The payment mechanisms he contemplated range from usage-based (such as user tolls) to a performance-based system (such as availability and safety performance payments). Each of these payment systems was designed to achieve various government risk transfer objectives. The usage payment reflected the transfer of traffic demand risk to the private proponent, while the performance payment represented a low-risk premium and better VFM for the public sector. Without empirically investigating the effectiveness of the observed payment mechanisms in achieving government objectives, Aziz extended the overarching principle of purchasing services in PPPs and proposed a hybrid payment system that involved payments for capital investment.

Public perceptions that citizens have not benefited from project upsides have been refuted by Forward (2006), who noted associated improvements to road-based public transport. For instance, all PPP tollroads in Sydney provide extra lanes for high-occupancy vehicles and permit government buses to travel for free. Generally, tollroads offer the travelling public real travel time savings and private investors an investment that achieves long-term commercial rates of return. In Sydney, private capital has also made a significant contribution to the community precinct around the Art Gallery of NSW and a $60 million dedicated bike lane on the M7. Forward (2006) emphasised that long-term PPPs were not just about building an asset, they were essentially about service provision. Therefore, the concessionaire’s ability to meet their own traffic and revenue forecasts was contingent on their long-term commitment to the provision of the service. Quoting the CCT experience, he reasoned that the current risk-shifting paradigm was inadequate to handle situations where the concept of partnerships fell out of the relationship. He advocated a proactive risk management approach that built around an alliance relationship rather than conflict, and that unbundled finance and design/construction was more suitable for long-term service provision. Forward noted that a newly emerged issue related to the scope of recent concessions, where greater attention has been given to urban design, has raised doubt about whether the additional cost should be borne by the project or the public sector.

PPPs are complex institutional arrangements involving many players from diversified fields and thus bringing more risks to the project. Many factors contribute to the success or failure of PPPs. Mohsin and Zhang (2011) attribute a number of reasons to the failures of PPPs worldwide. These include the political and bureaucratic conflicts, the lack of competitive tendering resulted in poor choice of unsustainable concessionaires, which also reflected the inexperience of public sector agencies; the inadequate *ex ante* economic and financial assessments; poor planning at policy level as well as at project level.

Overall, it is evident from the literature that risk-sharing arrangements in PPP road infrastructure contracts are aligned with the specific objectives governments want to achieve through project implementation, and that government objectives may vary across jurisdictions, time and projects. There is also evidence suggesting that erroneous traffic forecasts have significantly lowered the possibility of the public sector sharing upside gains.

To contain this research within a manageable scale, analysis carried out in the remaining sections of the chapter is restricted to the Australian context. The following section will first clarify the forms of DBFOs in Australian road infrastructure. A framework will then be developed for examining how PPP tollroads are rationalised in the pre-contracting process and for identifying the key adjustable parameters that can facilitate project rationalisation.

2.3 Developing a Framework of Project Rationalisation

2.3.1 DBFOs in Road Infrastructure

Australian DBFO roads are categorised into five models[13] according to specific project objectives. At either end of the spectrum are enticement and transport network integration DBFOs. The main objective of enticement DBFOs is to develop the road market for private provision. They offer the private sector generous rewards, including risk underwriting, to entice concessionaires to undertake provision of services to road users. The DBFOs that offer efficiency in transport network integration (TNI) represent the latest tollroad development in which revenue risk is removed from the risk-sharing equation in order to facilitate the whole-of-life approach, including design and operation (D&O).

Situated in between on the spectrum are recourse concessions, traffic-demand-management (TDM) and urban design solution (UDS) DBFOs. Recourse concessions target private financing. On the surface, project finance for this model relies primarily on the expected cash flow and is typically on a non-recourse or limited recourse basis. Recourse is limited to the SPV and its assets, with lenders having no financial recourse for repayment of their loans against the public-sector contracting entity (Debande, 2002, p. 357). In reality, however, a special payment mechanism is often negotiated between the two sectors to ease the burden of debt repayments on concessionaires.

In TDM DBFOs, after constructing the asset, a private sector firm is granted the right to operate the facility and to charge motorists a fee. Early TDM DBFOs were masqueraded as risk-free for government; however, further scrutiny revealed that government had committed to allowing returns on private equity to take precedence over VFM, and risk was transferred by shifting the burden to road users. In later developments, however, more attention has been given to consumer care (e.g., the performance of MEL's operator is evaluated against scores in consumer satisfaction surveys), and proper pricing mechanisms have been applied to manage traffic demand (e.g., the time-variable tolling implemented on MCL).

DBFOs that are part of a UDS signify a significant departure from previous DBFO models. They become a vital part of town planning at a much broader level as private tolling has

[13] These are not static models; they are simplified for analytical purposes. The fact that each tollroad is unique makes it impossible to construct a static model that generalises the contractual arrangements for all tollroads involved.

served as a convenient interface for government to achieve a better urban design outcome in the long term.

Key attributes of these five DBFO models are provided in Table 2-1. The Table indicates that gradually, risk-sharing has moved toward the approach in which government shares more upside gains, while the downside risk has been passed on to motorists and the public community.

The first four DBFO models are mostly 'real' (as opposed to shadow) tolled. Key features of projects identified in Table 2-1 are presented in Appendix B. The real toll program increases the funds available to government in two ways: the initial capital is sourced from private equity and debt, while user charges pay for the cost of private capital, return to investors and the costs associated with running the infrastructure. The real toll program can be further categorised into three streams.

Table 2-1: DBFO Tollroad Structures

Model / Attribute	Stream 1: government-borne traffic/financial risks		Stream 2: risk/revenue sharing		Stream 3: availability model (payment independent of revenue risk)
	Enticement (Model 1)	**Recourse (Model 2)**	**TDM (Model 3)**	**UDS (Model 4)**	**TNI (Model 5)**
Primary project objectives	Paving way for private participation in operating transport infrastructure; off-balance-sheet financing	Having recourse to private finance	Transferring traffic risk; managing traffic demand	Achieving long-term urban design outcome; no net cost to government	Transport network integration
Traffic/revenue risk	Government	Shared	Concessionaire	Concessionaire	Government
Traffic projections	Under-forecasted	Over-forecasted	Over-forecasted	Over-forecasted	Under-forecasted
Financial risk	Unlimited (to government)	Potentially unlimited to government	Motorists	Motorists	Concessionaire
Design & construction risk (D&C)	Government	Concessionaire	Concessionaire	Concessionaire	Concessionaire (whole-of-life approach in D&O)
Operation & maintenance risk	Primarily with government	Shared	Concessionaire	Concessionaire	Concessionaire (whole-of-life approach in D&O)
Network risk	Government/Community	Government/Community	Government /Community/ Concessionaire	Government/Community	Government/Community
Project finance	Independent of project's expected cash flows[(a)]	Dependent on project's expected cash flows	Independent of project's expected cash flows	Dependent on project's expected cash flows	Independent of project's expected cash flows (availability model)
Toll variations[(b)]	Regulated	Regulated/Negotiated	Regulated/Negotiated	Regulated/Negotiated	N/A
Users' demand elasticity to toll	Low[(c)]	Medium to high	High (when free competing routes exist)	High (when free competing routes exist)	N/A (no toll, LMA pays concessionaire quarterly service payments
Government financial contribution[(d)]	Yes (interest-free loan/revenue guarantee)	Yes (fixed-sum payments and cashback)	Not directly	Not directly	Yes (NPV AU$849m)
Government guarantee to private equity return	Yes	Yes	Not directly	Not directly	Indirectly; minimum revenue risk to concessionaire
Revenue sharing	No	Yes (but highly unlikely because required returns on private equity are unrealistically high)	Yes (but highly unlikely because required returns on private equity are unrealistically high)	Yes (but highly unlikely due to erroneous traffic forecasts)	No (abatement conditions apply to service payments)
Traffic-volume based payment	Toll collections + government top-up fund pay for project costs and return on private equity	Principally, concessionaire pays land rent for the concession to undertake the project; rent payable depends on actual traffic volume	Concessionaire pays land rent for the right to charge and retain toll; rent payable depends on actual traffic volume	Concessionaire pays land rent for the right to charge and retain toll; rent payable depends on actual traffic volume	None
Payment options for rent	N/A	Cash or subordinated, non-interest-bearing promissory notes	Cash or non-interest-bearing concession notes (some with no clawback, i.e. MEL)	Cash only (no evidence of alternative form)	N/A
Tollroads (year contract executed) [(e)]	SHT (1987)	M4 (1989); M5 (1991); M2 (1994); ED (1996)	MCL (1995); M7 (2003); LCT (2003); MEL (2004)	CCT (2002)	Peninsula Link (2010)

Source: CityLink (1995); Debande (2002); EastLink (2004); NSWAGO (1994, 1995, 1997, 2000, 2002, 2003, 2005, 2006a, 2006b, 2007); RTA Contract Summaries (1998, 2001, 2003a, 2003b, 2004, 2007); VAGO (2011)

(a): Toll revenue and government contribution/guarantee to ensure repayment of all project costs plus required return on equity.

(b): Tolls are first proposed by private operators and must be agreed upon by government through lengthy negotiation. Toll price adjustments normally follow Consumer Price Index movements (or Average Wage Earning Index in the case of ED) and must be subject to governments' agreement, with only one exception: RTA sets the toll for SHT.

(c): Sydney Harbour Bridge is a close substitute for the SHT. By agreement with the SHTC, toll pricing of both the government-owned bridge and the tunnel is regulated by the government and must charge the same level of toll, thus price elasticity of the SHT is expected to be low.

(d): Details of government financial contributions for each project are listed in Appendix B.

(e): Acronyms: CCT (Sydney Cross City Tunnel); ED (Eastern Distributor); LCT (Lane Cove Tunnel); LMA (Linking Melbourne Authority); MCL (Melbourne CityLink); MEL (Melbourne EastLink); RTA (Roads and Traffic Authority, NSW); SHT (Sydney Harbour Tunnel); SHTC (Sydney Harbour Tunnel Company)

2.3.1.1 *Stream 1: Government-borne traffic/financial risks*

This stream involves government taking on explicit traffic demand risk and financial risk. Government is contracted to provide financial support in the form of interest-free loans and/or revenue guarantees. For example, the NSW Government is the sole bearer of traffic demand risk of the SHT because the revenue to the private consortium has been guaranteed by the Ensured Revenue Stream (ERS) Agreement. The private concessionaire is required to pay base and incentive rents, and payments of base rent can take the form of promissory notes. Their redemption can only be triggered when private investors have earned an agreed minimum after-tax real rate of return (RTA, 1998; NSWAGO, 2000).

2.3.1.2 *Stream 2: Risk/revenue sharing*

In the second stream, government gives no direct payment to the private operator and the private operator has no financial recourse to government (NSWIIG, 2005, p. 15), hence revenues depend on the volume of traffic and the level of demand by users (Debande, 2002, p. 367). It appears that the traffic demand risk is borne by the private sector alone. However, with user charges as the sole source of rental revenue to government,[14] and with rents payable in cash only when actual traffic exceeds some predetermined threshold, this condition effectively places government as the co-bearer of the traffic demand risk. Furthermore, government can exercise its regulatory power to change traffic demand patterns, which may result in windfall gains to the SPV. In Melbourne, the $151 million upgrade of the publicly owned Tullamarine-Calder intersection, which includes a new ramp that separates traffic travelling toward the city, has generated a minimum $11 million windfall profit to the MCL's private operator, Transurban. The Victorian government is entitled to an equal share of the windfall gain, which makes the total estimated minimum gain $22M (Transurban, 2005; VAGO, 2007, p. 46).

In principle, the private operator is contracted to pay rent to the government for the land leased, and the right of operating the asset and charging road users. Rent payments comprise two components: (i) a base component of nominal value for leasing the land; and (ii) an incentive rent, which is the public sector agency's share of toll revenues. The incentive rent is payable to the government only when the actual revenue receipts are more

[14] In recent motorways, the private consortium is required to pay rent to the RTA for the right to levy tolls and retain toll revenues for its own benefit.

than five per cent of the projected level. This predetermined traffic threshold is estimated in the Base Case Model prepared by the private consortium prior to the financial close (CityLink, 1995; RTA, 1998; NSWAGO, 2000; RTA, 2003a; RTA, 2003b; EastLink, 2004). Accordingly, accuracy in traffic forecasts is vital not only to the project's commercial viability but also to the government's cash receipts. A government's share of incentive rent increases in proportion to the percentage of excess revenue. The excess falls into four bands, ranging from 5-10 per cent to 30 per cent plus in NSW, and to 100-105 per cent plus in VIC. At the lowest band of 5-10 per cent, the government's share of the excess revenue starts at 10 per cent. This is capped at 25 per cent in NSW (RTA, 2003a, 2003b, 2004) or some agreed fixed value[15], and 70 per cent in VIC (CityLink, 1995; EastLink, 2004). The banding concept is consistent with economies of scale prevailing in road infrastructure where the marginal cost of providing road service is negligible. Incentive rent may pressure market bidders to inflate traffic projections in order to present government with an impressive level of cash flows.

2.3.1.3 Stream 3: Availability model

Compared with the other two streams, this stream differs significantly in terms of how risks are shared. Revenue risk is not shared between the two sector parties: instead, private investors will earn their financial returns through service payments over the concession period.

Under this model, also known as the availability model, the SPV designs, builds, finances and operates the project for an agreed period of time. The government makes payments to the SPV based on road availability (which may vary by time of day and location) and performance against a set of key performance indicators (with respect to operations, asset maintenance, reporting, environmental management, etc.). No charges are imposed on users of the road under this model, and abatements are subject to increase for repeated poor performance.

Although this model has been quite popular in other countries (e.g., the UK and Spain), it was only considered by governments in Australia during the nadir of the GFC as this

[15] The ED Project Deed specifies that the operator is required to pay three cash payments on the first, second, and third anniversaries of the date on which the ED opened to traffic. Each of these amounts is to be equal to the (if any) actual toll revenue in the preceding year that exceeded the forecast toll revenue for that period, up to a limit of $6.5 million (RTA, 1998, p. 23). No such cash payment had been realised, showing that actual toll revenue and hence traffic volumes were lower than forecast. Fixed-value payments are also specified in the Concession Deed of the MCL and MEL (see Appendix B for details).

model was regarded to be more likely to entice a higher level of participation from the private sector (VAGO, 2011).

2.3.2 A Framework of Project Rationalisation

Warnings in de Palma *et al*. (2007a, p. 18) flagged some drawbacks of private involvement, such as contracts must allow private operators to earn an adequate rate of return, and risks related to demand uncertainty, cost overruns and other contingencies must be dealt with. The preferred mix between public and private organisations depends on factors such as the scope for competition, uncertainties, asymmetries of information about demand and costs, the adequacy of regulations, and so on. These warning signs have emerged in the analysis in the preceding section: for the purpose of reaching agreement in risk-sharing arrangements that satisfy the interests of government and the SPV, the following six parameters must be agreed to by the two sectors: levels of toll and toll escalation options, concession term, project scope, traffic demand management to alleviate network risk for the SPV, financial contributions by government and conditions for changes to the above parameters.

Under Australian statutory requirements, the concept for any public capital work must be tested and community approval must be sought through the environmental impact assessment process (EEA VIC, 1978; EP&A NSW, 1979; EP&A Regulation NSW, 2000). In this pre-defined process, the key documents – the Environmental Impact Statements (EISs)[16] – identify and communicate all environmental, economic and social factors related to the project. Road authorities are responsible for demonstrating in the EISs: (a) the need for the project (e.g., population growth, land zoning and strategic planning) and project objectives and scope, which may include procurement options; (b) a brief summary of intended risk allocation; and (c) justification for the preferred option (e.g., the outcome of community consultation is in favour of the selected option) (Arndt, 2000; RTA, 2001; VicRoads, 2006).

Once the project is put to the market for tendering, the SPV will produce its own traffic estimates based on the information provided in the EISs[17]. The product of the expected traffic demand and toll pricing suggested in the EISs will yield revenue and cash flow

[16] It is also called Project Environment Protection Strategy in the state of Victoria.

[17] I am grateful to a number of private-sector participants for information regarding the internal operation of project appraisal commonly adopted in private industry.

forecasts. The estimates will then be presented to the market in order to seek project finance. In determining the price they charge for financing the project, capital providers will, of course, consider the size of the risks faced by the SPV and risks that are not contractually diversified (Blanc-Brude and Strange, 2007). Cost of capital together with expected operational expenditure and other risk assessments are fed into the Business Case Model to calculate the project's NPV. This risk-adjusted NPV is used to determine the project's IRR.

If the return does not exceed the hurdle rates of IRR, the SPV will re-estimate traffic growth and seek to bargain with the road authority for favourable terms in order to minimise the risks they face and maximise toll revenue. Assertions made in a number of reports released by the Audit Office of NSW (see the next section) suggest that traffic estimates have been fabricated to overly optimistic levels in order to raise project finance at a lower cost and to win the bid.

The desired outcome can be negotiated in a number of different ways: (a) increase toll pricing and/or change toll escalation formula; (b) extend concession term; (c) change/expand the project scope (e.g., allow a new ramp to be built that feeds traffic into the tollroad, and other concessions such as development over roads/next to roads); (d) impose prohibitive traffic demand management measures in surrounding areas (e.g., lane closures on existing routes or restrictions on modifications to the public transport network); and (e) increase financial contributions by government.

The extent to which these parameters are amendable depends on a government's strategic planning considerations. They can be very flexible when a road project is captured by other planning issues, such as keeping the toll levels to the target desired by government, urban design considerations or the concept of no net cost to government (e.g., the CCT, cf. NSWAGO, 2006a). Furthermore, traffic volume, which is notoriously difficult to forecast, is crucial to not only the operating cost but also the financial viability of road projects (Hensher and Goodwin, 2004). Given that neither the public sector nor the private sector has control over volume risk, the principle of DBFO cooperation is to shift a proportion of this risk to the private sector. To a very large extent, the traffic flowing into a tollroad can be significantly affected by a government's town planning decisions concerning the rest of the network, the provision of competing toll-free public transport, and land use in areas feeding into the road. Road closures and/or suppression of competing services are often negotiated as a protection for private companies against network risk (and in some cases, they are complementary to the purpose of keeping the toll price at the agreed level), hence shifting the cost to the general public (Quiggin, 2005, p. 18).

Figure 2-4 depicts the framework that illustrates how risk-sharing arrangements are agreed upon to rationalise a tollroad project. The figure synthesises my understanding from reading the literature and interviews with stakeholders in PPPs. The left panel shows the factors that are perceived by stakeholders of PPP tollroads to be best handled by government, whereas the right panel lists the economic factors that ought to be better left to the market. The shaded rectangle overlapping the two panels contains the variables that can be influenced by either party. The framework will guide the analysis and case studies in the following section in order to present readers with a coherent flow reasoning.

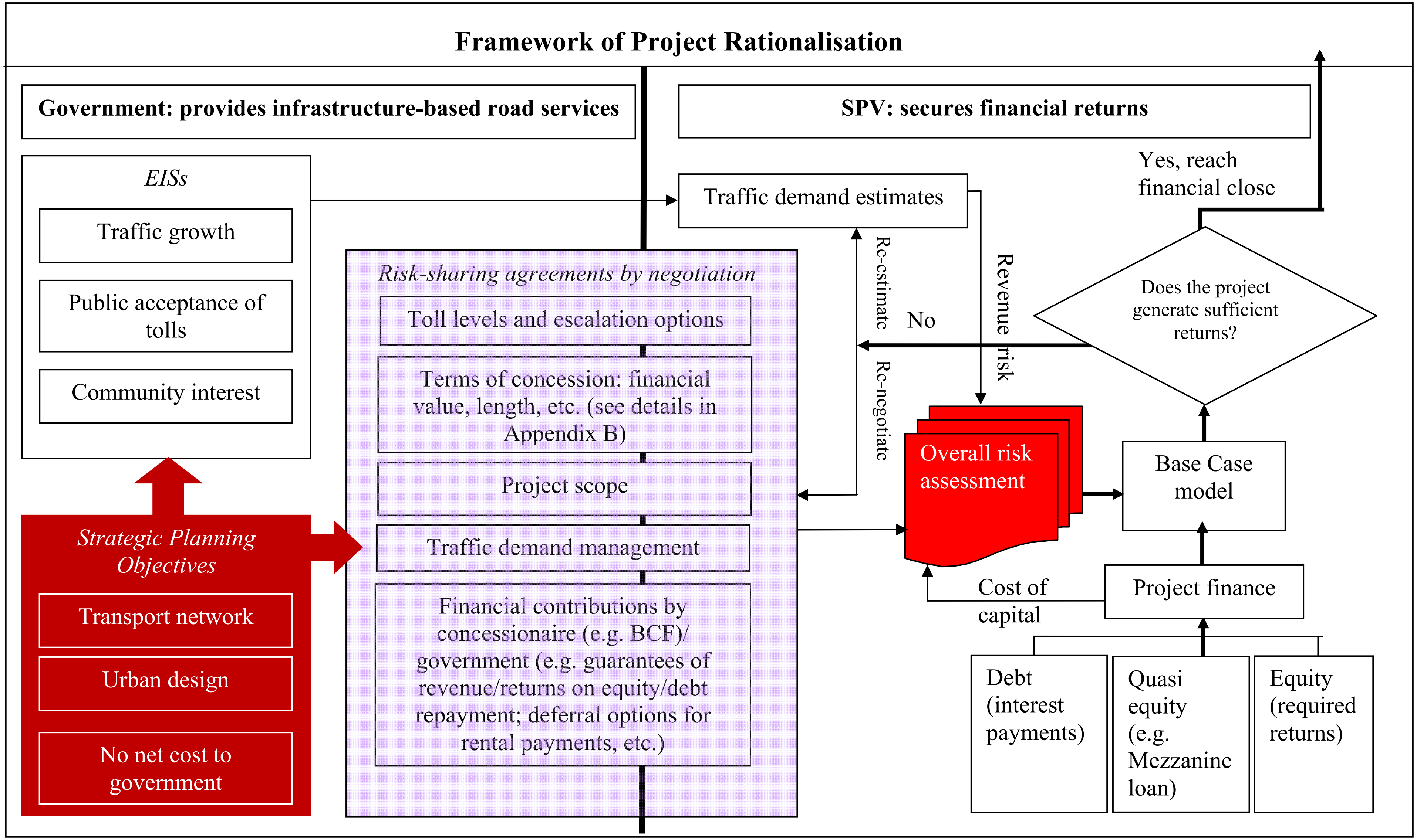

Figure 2-4: Framework of Project Rationalisation

2.4 Risk Allocation, Performance of DBFO Tollroads: Case Studies

Risk-sharing in DBFO tollroads has gradually moved in government's favour, with risk transfer to concessionaires being absent in early DBFO projects. Some early experiments, e.g., the SHT and the M2, are indeed risk-free investments to private proponents. More recent projects incorporated a substantial reduction in the scale of guarantees provided, yet implicit promises to protect the private sector against downward traffic demand risk and to warrant return on private equity still exist.

In many instances, risks of design and construction (D&C) have been satisfactorily transferred to the private sector (Mills, 1991; VAGO, 1996a; Arndt, 1998; NAO, 2003). In particular, road projects that involve the highest proportion of the construction component compared with operations and maintenance (O&M) costs generate the greatest VFM (Debande, 2002). However, the lack of clarity as to who should be the bearer of the remaining risks makes it difficult to disentangle the lines of responsibility. PPPs have also given rise to a host of new dimensions of risk regarding public accountability, governance and reputation. The remainder of this section will examine in detail the five models identified in Table 2-1, how risk-sharing arrangements were formulated to rationalise project objectives, as well as the actual performance of the five DBFO road models.

2.4.1 Model 1: Enticement

The primary objective of this model is to entice private involvement in road operations to pave the way for a private sector entity being the off-balance-sheet-financing vehicle in the provision of infrastructure-based road services. At the time when private tollroads were a fairly new concept and it was difficult to perceive associated risks, risk undertakings by the private sector were guaranteed by governments. Not only were the private companies given the right to charge the public for the use of the facility, they also had recourse to public funding when actual cash flows of the project were lower than expected. In the case of the SHT, for example, the private sector had recourse to public funds based not on services provided (Arndt, 1998), but calculated on the degree of departure of actual toll receipts from projected toll revenue (NSWAGO, 2007). Finance of the project came from public sources in several forms: government interest-free loans, fixed financial contributions and revenue transfer from existing government-owned infrastructure. Construction and operating costs of the SHT came from the toll revenue of the Sydney Harbour Bridge (Mills, 1991).

Case Study: Sydney Harbour Tunnel (contract executed in 1987)

> *It appears to be a private sector project when virtually all of the post-construction risks remain with the State.*
>
> NSW Auditor-General Office (NSWAGO, 1995, p. 36)

The contract was entered into by the Department of Main Roads NSW (later changed to the Roads and Traffic Authority or RTA; and under a recent restructure by the newly elected government in 2011, it has become part of NSW Transport Roads & Maritime Services) with the Sydney Harbour Tunnel Company or SHTC (Mills, 1991). One of the project criteria was that the tunnel be financed, constructed and operated "as a private venture facilitated by a lease of public property for a fixed period" (NSWAGO, 1994, p. 250).

The central financing instruments were the $223 million interest-free loan (the Net Bridge Revenue Loan) provided by the RTA (NSWAGO, 2003, p. 217) and the $497 million 30-year inflation-indexed bonds issued to the market by the SHTC (NSWAGO, 1994, p. 263). Interest foregone on the state loan was estimated to be a minimum of $1,150 million (1994 dollars) (NSWAGO, 1994, p. 251). Repayment of the RTA's loan is due in 2022 and is subordinate to all other obligations of the SHTC (NSWAGO, 2003, p. 217). Continuously declining toll collections and rising operating expenses have impinged on the company's ability to repay the authority. The RTA has underwritten the principal outstanding on the bonds for a price of $3.5 million, irrespective of the actual usage of the tunnel (NSWAGO, 1994, p. 251; Arndt, 1998, p. 22, p. 22). The NPV of this underwriting liability was estimated at $345 million as of 30 June 2006 (NSWAGO, 2006b, p. 128).

Few DBFO projects do not transfer risk of cost overruns on construction, the SHT being an example of one that failed to do so. The entire toll revenue of both the Sydney Harbour Bridge and the tunnel was used to support the tunnel's construction (Mills, 1991, p. 282). Delay in opening of the tunnel did not defer revenue flowing to the SHTC, as revenue was guaranteed to the company starting from a fixed date (10 October 1992) irrespective of whether the tunnel was in use by that time (NSW Government, 1987, Schedule 5). During the contract negotiations, it was evident to all parties that user tolls would not be sufficient to cover the costs of the tunnel. Amendable conditions listed in the shaded rectangle in Figure 2-4 were called on. Accordingly, the RTA agreed to pay an ERS to meet all SHTC's risk exposure and to provide SHTC with financial returns irrespective of actual toll levels or actual tunnel users (NSWAGO, 1994). As such, not only did the state government directly contribute to the cost of construction, but it has also underwritten the revenue stream for the SHTC. The ERS obligates the government to top up these payments in the event that actual toll receipts fall below the predetermined level, as it has agreed to make payments to "enable the operator to meet financial obligations in connection with the operation of the Tunnel and the payment of principal and interest upon money borrowed by it for the design, construction and operation of the Tunnel" (NSW Government, 1987, Schedule 5). As a result of the continuously widening gap between toll collections and operating expenses incurred by SHTC, the ERS paid by the authority has amounted to $176.7 million (nominal value) for the four-year period of 2004-2007 (NSWAGO, 2007).

One of the adverse effects of the government guarantee was that it offset the benefits of packaging the construction and O&M of the asset into one bundle. The concessionaire had few incentives to perform efficiently in the post-construction phase because O&M risks, such as road conditions and slow clearance of vehicle breakdowns, did not constitute a threat to SHTC's cash flows as revenues were independent of toll receipts. The absence of a performance-based payment was considered to have the effect of incentivising the company to minimise the level of expenditure on maintaining the tunnel's condition (Mills, 1991, p. 287).

The financial package offered by the NSW government was rated as unusually attractive by international investors (Tiong, 1995). The project expected a real IRR of 15.75 per cent per annum, as indicated by the interest rate on the SPV's $40 million shareholder loan (NSWAGO, 1994, p. 263). The private equity investors only contributed $7 million – equivalent to one per cent of the project's value (Mills, 1991). The government-underwritten bonds had a maturity longer than the usual maturity of 10 to 20 years in the Australian capital market (Tiong, 1995, p. 187); meanwhile, the risk-free inflation-indexed yield to private investors was as high as 6.8 per cent (NSWAGO, 1994, p. 263). This estimate on the risk-free return does not include the state's liability to cover the private proponent's tax payable to the Australian Taxation Office (ATO). In 2003, a $24 million liability was added to the state's bill (NSWAGO, 2003, p. 209). The liability covers SHTC's past and future taxes as the result of RTA's failure to successfully negotiate with the ATO for an allowance for the depreciation deduction by SHTC.

In an extraordinary finding, the Audit Office of NSW discovered that the whole contract had been packaged to fulfil a concealed strategic objective (NSWAGO, 1994). At the time the contract was negotiated, state governments were subject to the global limits of borrowing set by the NSW Loan Council.[18] The private firm SHTC was in substance a financing vehicle through which the Department of Main Roads NSW was able to remove the *visible* risk of over-borrowing from its balance sheet:

> *The arrangements were consistent with intentions to avoid Loan Council restrictions and they suggest the Authority did not wish these arrangements to be known to Members of Parliament and the public which ultimately bore the risks by the Authority (NSWAGO, 1994, p. 293).*

The lesson learnt from the SHT seems to have had some influence on later PPP tollroad developments. Subsequent DBFO tollroad projects, e.g. the M2 and the ED, have taken into consideration making financial rewards commensurate with traffic demand risk.

2.4.2 Model 2: Recourse

Having recourse to private finance is the main intention that defines the risk allocation profiles of this model. With the growing private participation in essential infrastructure, governments appear to exercise greater precision in balancing risk-benefit sharing. Favourable contractual conditions negotiated in project deeds entitle the state to benefit from upside market movements through revenue sharing above an agreed level of return. However, the occurrence of certain Material Adverse Events (MAEs), e.g., development of a mass transit route in a neighbouring region (cf. NSWAGO, 2000) under which the concessionaires' capacity to earn toll revenue may be adversely affected, will still trigger contract renegotiations and potential financial compensation by a government. Traffic demand risk no longer seems to be the sole responsibility of the government as it is contracted to be shared between the two sectors. There are no direct payments or guarantees from governments to private operators, although there is direct financial support from the NSW government to M4 and M5 motorists by way of a cashback scheme, which has significantly encouraged patronage. Moreover, private operators are required to pay land rents for the concession right to levy tolls. Projects of this kind include the M4, M5, M2 and ED in NSW.

[18] Readers are referred to Walker and Walker (2000) for a full history of the global limits of borrowing.

The financial benefit to government is second to that of the concessionaires. Receipts of land rent in cash are subject to the condition that required return to private equity has been realised. These annual post-tax real rates of return are 12.25 per cent and 10 per cent for M2 (NSWAGO, 2000) and ED respectively (RTA, 1998). The capacity to earn an IRR relies on the accuracy of traffic forecasts estimated in the Base Case Model. None of these land rents has been paid in cash, suggesting that optimism in traffic projections persists across time and projects.

<u>Case Study: M2 Motorway (contract executed in 1994)</u>

> *These lease arrangements for the M2 are a first, and allow the true costs of the M2 to be more accurately reflected than occurred in earlier projects.*
>
> NSW Auditor-General Office (NSWAGO, 1995, p. 89)

The M2 sets a precedent in the Australian privately financed road market. The above quote refers to the land rent[19] payable by the concessionaire for the right to levy tolls, but with the option of payment deferrals identified in the last box within the shaded rectangle of Figure 2-4. The amount represents the value of the right as perceived by the market. The present value of this rent payable was estimated to be $1.1 million in 1995 (NSWAGO, 1995, p. 13). It is questionable that this value is realisable, since it was agreed by both contracting parties that cash payments would not commence until 2028 (NSWAGO, 1995, p. 86), or may not commence at all during the entire length of the concession if returns to private equity fall short of an agreed threshold.

The M2 project contains several favourable features for the private proponent, such as a safe return in a highly risky investment that is enabled by rent payment deferrals, free use of land owned by the RTA, indemnity from the RTA against any future increases in cost, and an exemption from state land tax. It is however, a marginal improvement over the SHT as the private operator has no recourse to the state when traffic income falls below projections.

[19] The term “rent” is not to be misinterpreted as the payment for leasing the land on which the motorway is running: it is a payment for the right to levy tolls. To avoid confusion, when discussing payment/value of the right to toll, this thesis uses the term adopted by the RTA and calls it “land rent” or “rent” whereas “land lease” refers to payments for leasing the land from government.

Hills Motorway Limited (Hills)[20] was chosen as the finalist for this project on the basis that the proponent was the only one offering to undertake the project "without any requirement for RTA's [direct] financial contribution or any RTA underwriting" (NSWAGO, 1995, p. 49; emphasis added), i.e., it satisfied one of the strategic planning objectives identified in Figure 2-4 (see the red box located at the lower left corner).

Negotiable terms identified in Figure 2-4 were generously offered to Hills to ensure this criterion was adhered to. The concession is 45 years in duration, after which ownership of the motorway transfers to the government at no cost. It can be ended as early as in 36 years if the motorway returns private investors a post-tax annual profit of 16.5 per cent (NSWAGO, 1995, p. 22). At financial close, the annual pre-tax cash return to equity was estimated at 18.5 per cent per annum vis-à-vis six per cent[21] return to the RTA (NSWAGO, 1995, p. 12).

The value of rent payable by Hills equalled $887.4 million in nominal dollars (NSWAGO, 1995, p. 86). Until the project realised a real post-tax return of 12.25 per cent per annum, Hills had the discretion to pay rent in either cash or non-interest bearing promissory notes subordinated to all other debts of the project. Until then, the RTA had no right to present any of the notes for cash payment. Although Hills required no financial support from the RTA, the government had contributed $120 million to the project in land acquisition and $66.5 million in an upfront capital payment (NSWAGO, 1995, p. 49; Walker and Walker, 2000, p. 218; NSWIIG, 2005, Appendix 2). The foregone benefit arising from deferment of cash receipts has added another $28.4 million (NPV estimated by the NSW Auditor-General Office, see NSWAGO, 1995, p. 86) to the bill for NSW taxpayers, bringing the price to $215 million.

To make a high return to equity plus rentals to RTA appear to be possible, Hills' financial model had to be built on a number of risky assumptions. Its traffic projections were substantially greater than the maximum flow identified in the EISs. The revenue estimates assumed a $2.00 toll compared with a $0.70 toll in the EISs (NSWAGO, 1995, p. 12). These assumptions signify the exposure to high market-risk and the reduced likelihood of obtaining the required rate of return. The expensive toll is evidence that the cost of assuming market risk has been priced into the toll, thereby passing the financial risk to motorists.

[20] Hills was acquired by Transurban in 2005, which now owns and runs the M2.

[21] The six per cent return has not considered the value of land contributed by the RTA (NSWAGO, 1995, p. 88). The inclusion of the land value will of course further deteriorate the return to the RTA.

In spite of the overly optimistic expected rate of return, one piece of information discloses that the forecasted real rate of return after tax given in the Base Case Model will never exceed 11.78 per cent (NSWAGO, 2000). Contract documents also reveal that Hills expected a $408.6 million financial contribution from the government in the form of RTA promissory notes to be issued between 1998 and 2025 (Walker and Walker, 2000, p. 217). Nevertheless, the RTA entered into the contract knowing the possibility of receiving cash returns from the M2 was almost zero.

As the source of revenue to Hills is toll collection, the poor traffic performance suggests that the government will never be able to redeem these notes. The actual Annual Average Daily Traffic (AADT) in 2004 was 72,944 (NSWIIG, 2005), barely reaching 85 per cent of the 85,094 forecast estimate in the Base Case Model (NSWAGO, 2000)[22]. The NPV of these promissory notes, as of 30 June 2007, was $4.276 million (RTA, 2007, p. 129). There appears to be an incentive rent payable to the RTA (NSWAGO, 1995, p. 89) but the circumstances under which the incentive component can be realised are unclear.

In the case of the M2, the risk allocation was asymmetric. While risks of inflating costs to Hills were very well considered and corresponding government concessions had been sought in agreements, there was no provision for sharing upside benefits between the two sectors (NSWAGO, 1995, p. 36). In 1999, Hills restructured the M2 debt facilities, resulting in more funds being available for early equity distribution (NSWAGO, 2000), but there was no renegotiation for the early cash repayment of promissory notes. In the absence of an obligation requiring negotiation to return government better outcomes in circumstances favourable to Hills, such as the 1999 debt restructuring, RTA must indemnify Hills for any future increases in state and commonwealth taxes, and council and water rates (NSWAGO, 1995, p. 66). The project was camouflaged to portray that Hills would carry all downside traffic risk[23], but it is highly unlikely that the state can escape this risk given that the demand for traffic is a vital component of land rent receipts. A significant proportion of O&M risk

[22] Patronage seems to be improving since the opening of the LCT. The M2 AADT presented in Appendix B was the latest figure reported by the new equity owner, Transurban. It appears that the actual AADT has exceeded the original forecast of 90,200. It is unclear whether this will trigger the cash redemption of the promissory notes.

[23] When the 1995 Audit Report asserted that the RTA was the co-bearer of traffic risk, the RTA disputed the assertion and argued that Hills had confirmed its status as the sole bearer as evidenced in the Project Prospectus issued by the company: “The Company carries the risk that traffic volumes and revenue are lower than those projected” (NSWAGO, 1995, p. 19).

rested with the RTA, with only the risk of major repairs shifted to Hills (NSWAGO, 1995, p. 44, Table 1).

Hills was protected against network risk in two dimensions (NSWAGO, 1995, p. 41). One was to inflate the expected risk-adjusted rate of return by increasing tolls from planned levels, so private ownership resulted in a higher toll for motorists. The second was to seek restoration under the MAE regime; if the government modified the public transport network in the North West region of Sydney and adversely affected the capacity of Hills to collect tolls, the state was required to repay all debts owed by the company and was also liable for financial compensation to equity investors for the notional return (NSWAGO, 1995, p. 67). These contractual conditions and the rhetoric of non-recourse to government have exposed the government to potentially unlimited financial risk.

This leaves improved traffic conditions in Sydney's North West region as the only project benefit to NSW citizens. In this light, Hodge described the NSW government as "prone to making bad business deals for the sake of delivering conspicuous infrastructure projects" (Hodge, 2005, p. 323). Greater value arising from better traffic flows began to be realised after recent work connected the M2 with the LCT. In hindsight, PPPs have delivered the two connecting urban DBFO tollroads, and together they bring the state government a step closer to achieving an integrated road network in Sydney. It is difficult, however, to assess whether this benefit will outweigh the state's exposure to financial risk.

2.4.3 Model 3: Traffic Demand Management

Examples of PPP tollroads related to the third model of TDM include the MCL and MEL in VIC, and the M7 and LCT in NSW. Concessionaires are required to pay a fee for the right to operate a road facility and charge users a toll. By this time, the market for private infrastructure had evolved to a relatively mature state, with users more accustomed to paying for the use of specific roads. Private tolling has engendered a network-wide charge based on the user-pays principle as a traffic demand management instrument. Added to this endeavour is the application of the fully automated electronic tolling system. Variable tolls that are adjusted according to peak/off-peak use and/or distance, and widened bus lanes on surface roads to encourage the use of high occupancy vehicles have been implemented in these road projects to manage traffic flow and to maximise revenue to private operators.

<u>Case Study: Melbourne CityLink (contract executed in 1995)</u>

This partnership deal was essentially a two-way affair rather than also including citizens' interests directly.

Hodge, (2005, p. 321)

The MCL is the first private tollroad in VIC. In 1995, with no publicly available economic and financial evaluation having been undertaken prior to the project's commencement (Brown, 2003), the Transurban consortium comprising Transfield Holdings Pty Ltd and Obayashi Corporation successfully bid to undertake the $2.1 billion MCL project in conjunction with the state government. The project involved the expansion and connection of three of Melbourne's major freeways (Tullamarine, West Gate and Monash). The private road links Melbourne Airport, major port facilities, the industrial centres south-east and west of the city and bypasses the central business district (VAGO, 2007). CityLink was incorporated to act as the project vehicle for the development.

Under the established arrangements, Transurban is expected to operate the MCL for a period of 34 years. The concession term can be terminated as early as in 25 years and six months, or extended to warrant Transurban a post-tax real rate of project return of 17.5 per cent (VAGO, 1996a). The tolls were set to maximise revenue (Lay and Daley, 2002). As a condition to reduce traffic risk for Transurban, the Victorian government agreed to implement certain traffic management measures involving specific changes to the existing road network in the vicinity of the MCL (known as *Agreed Traffic Management Measures*). Removal of any of these agreed measures would trigger renegotiation under the MAE regime, as Transurban rationalised the project (see Figure 2-4) based on traffic and revenue projections under the assumption that these measures will be implemented (VAGO, 1996b). The government must ensure future transport policies will not jeopardise the MCL being the central component of Melbourne's transport network (VAGO, 1996a), so the revenue stream to the private operator can remain stable. Such a condition has hamstrung the government's flexibility for network redevelopment. This is manifested in the $37 million MAE claim lodged by the private operator alleging that the Docklands area on which parts of the link is constructed has resulted in the loss of revenue (Hodge and Bowman, 2004; Brown, 2005).

The concession deed confers on CityLink the right to design, construct, commission, operate, maintain, repair and impose tolls for the use of the facility in exchange for the payment of concession fees of $141.8 million. These payments are required to be made in three tranches (see Appendix B), with attached payment options providing a great degree of flexibility.

First, the obligation to pay the concession fees can be discharged by the issue of non-interest-bearing concession notes to the state (CityLink, 1995). Concession notes must be redeemed at the end of the concession period. Provision for their early redemption is subject to the realisation of an annual post-tax real return to private equity of 10 per cent, provided it does not mar CityLink's ability to repay senior debt (CityLink, 1995). This deferment option, which was estimated to have a value of $780 million in Brown (2003), has significantly enhanced returns to private equity.

Second, in 2005 and 2006 the Victorian government struck two concession note buy-backs with Transurban in order to source funds to upgrade two public roads connecting the MCL. In June 2005, VicRoads (the Victorian road authority) and Transurban agreed to encash a number of the concession notes with a face value of $305.3 million for $151 million cash (VAGO, 2007, p. 24). The proceeds were used to fund the upgrade of the Tullamarine-Calder Interchange and to share extra revenue associated with the roadworks, including an $11 million upfront payment to VicRoads. In May 2006, VicRoads further agreed with Transurban to encash its remaining interest in the concession notes (which had a face value of $2.884 billion, VAGO, 2007, p. 25), and to use the proceeds to partly fund the upgrade of the West Gate and Monash Freeways. As part of this deal, Transurban also agreed to upgrade the Southern Link section of the MCL located in the middle of the freeway corridor, at an estimated cost of $166 million. Any extra revenue generated by the roadworks will be shared between VicRoads and Transurban (VAGO, 2007).

The decision on the two encashment transactions was justified by VicRoads on the basis that they would minimise the risk of a decline in value of the concession notes over time. The benefits arising from these two risk-mitigating encashment deals were confirmed by the Victorian Auditor-General Office (VAGO, 2007, p. 26). However, in the absence of comparative studies performed by the government and documented risk assessment, the VAGO was unable to draw any conclusions as to whether the encashment options were the best alternative to fund the two upgrade projects.

Although substantial commercial risks have been transferred to Transurban, other risks that are beyond the control of both the government and the private sector are to be shared between

Transurban and users of the MCL (VAGO, 1996a). A risk regarding public governance surfaced. At the time of the proposal, the MCL was highly controversial because the private tollroad replaced two existing untolled freeways (Lay and Daley, 2002). The Kennett government exercised its legal power to 'crash through' this private road project with the enactment of *Agreement for the Melbourne City Link Act* (Hodge, 2005, p. 320). While there was no separate provision for the protection of consumers, under the Act the concession term can be extended to 54 years in an effort to ensure profitability for the consortium (Hodge, 2005).

Nevertheless, the MCL has set a milestone for Australian tollroads. It is the first fully electronic tolled road in the country; it has established that there is growing acceptance that tolling can be used for congestion management; and there is potential for a wider road pricing application. The replacement of toll booths by an automated tolling system and introduction of a variable tolling scheme to better manage traffic congestion have been extended to subsequent tollroads, including the M7 and MEL. Despite the criticisms, MCL has proven a success in terms of achieving its transport objectives and take-up by the community (Lay and Daley, 2002).

2.4.4 Model 4: Urban Design Solution

Insofar as the scope of a road project extends beyond accomplishing transport tasks, there exists the potential for conflict between the public and private sectors, as the unfolding experience of Sydney's CCT demonstrates.

<u>Case Study: Cross City Tunnel (contract executed in 2002)</u>

> *It can be considered as a piece of social infrastructure*[24] *rather than transport infrastructure designed to satisfy a demand for travel time savings.*
>
> Paul Forward, (2006, p. 268)

The CCT is unique because essentially the project was a forced solution by urban planners. The tunnel was intended to be an urban design solution to reduce traffic on city streets and to improve urban amenity along William Street. The project was rationalised according to the framework in Figure 2-4 by varying negotiable terms (i.e., project scope, toll levels and

[24] The social infrastructure Forward was referring to is different from the social infrastructure described in Chapter 1. Forward (2006), *inter alia*, referred to the CCT as economic infrastructure embedded with significant social dimensions that went far beyond benefits accrued to motorists.

escalation options, and Business Consideration Fee or BCF) to satisfy one of the government's strategic planning objectives (i.e., no net cost).

Originally, the concept of the CCT was a short tunnel with portals on the western side of the Kings Cross Tunnel and underneath the Australian Museum. The objective soon changed to a longer tunnel that would improve William Street and surrounding areas. Subsequently, the private bidder, Baulderstone (a member of the winning consortium – the CrossCity Motorway, or CCM), submitted a revised, non-compliant bid in which the portals were extended to the eastern side of the Kings Cross Tunnel and an extra lane was added to feed onto the Harbour Bridge. This concept changed the project to a longer and more expensive tunnel. The government had to lift the toll cap twice to allow for the additional works to be funded (NSWAGO, 2006a). The first was to change the toll escalation formula (originally toll variation was linked to Consumer-Price-Index increases), the impact of which will see the toll being 35 per cent greater than originally planned by 2018. The second change allowed CCM to raise the base toll by 15 cents (30 cents for heavy vehicles). The combined effect of these two deals resulted in an increase of up to 51 cents to the toll on tunnel opening (NSWAGO, 2006a, p. 6). The impacts of these two deals on tolls are summarised in Appendix C.

The DBFO contract was awarded to CCM in 2002 not only because its design would provide a better urban solution, but also because it would comply with the policy that these projects had to be built at no net cost to government. CCM offered the RTA the highest upfront payment in the form of a BCF, while other bidders sought a payment from the RTA (NSWAGO, 2006a, p. 24). To showcase its capacity to earn greater revenue sooner and to offer the upfront payment (JSCCCT, 2006a), CCM modelled highly optimistic traffic forecasts that exceeded the ceiling capacities in its competitors' and the RTA's estimates (NSWAGO, 2006a, p. 5). Against the RTA's advice, CCM insisted on those numbers because it felt that the longer tunnel would attract greater traffic volume[25].

The two agreements between the RTA and CCM to lift the toll cap enable the government to adhere to the principle of no net cost to government by passing the project's financial risk on to motorists. Ferocious public resistance to the expensive toll and associated road closures resulted in low patronage, and the tunnel was placed in receivership in December 2006, a year after its opening. In 2007, the tunnel was sold to another private consortium for $700 million,

[25] Discussion with some of the stakeholders who directly engaged in the CCT project has revealed this piece of information.

by which time, actual patronage had been under one-third of CCM's original estimates (Clegg and Poljak, 2007). Resistance to excessive tolls and associated road changes signalled strong public disapproval of the CCT.

The government argued that the traffic demand risk, and therefore revenue risk, had been allocated out too, as reflected in the drastic 2006 devaluation of $102 million in CCT's holding by CKI (the equity holder of CCT) (JSCCCT, 2006b, p. 67). What the government did not realise at the time was that the risk of choosing an inexperienced operator would tarnish its reputation and distort the PPP policy framework. As a consequence, the government backed down from its support for the project. Extensive media exposure about the tension between the government and CCM brought the two parties into disrepute. Considerable public resources were spent on a number of parliamentary inquires and an independent report commissioned by the government (known as the Richmond Report) to re-evaluate the merit of the PPP policy framework.

The CCT fiasco has raised a new dimension of concern over the financing of a piece of road infrastructure that was intended for purposes beyond a simple transport task. It is questionable whether the user-pays principle should be extended to finance road infrastructure that is intended for future urban design planning, and from which a substantial proportion of benefit does not accrue to motorists.

2.4.5 Model 5: Transport Network Integration

This final model considers a much broader planning perspective with no direct cost charged to users. Its primary outcome is the delivery of a major integrated transport route to achieve a continuous and balanced road network, with sufficient capacity in the subject corridor to meet future travel demands in accordance with government's growth projections and policies.

<u>Case Study: Peninsula Link in Victoria (financial closure in 2010)</u>

> *[T]he specific characteristics of Peninsula Link – a low risk project being delivered in Victoria...the PPP was expected to be...more flexible to fund, allowing government to spread the costs over time.*
>
> VAGO, (2011)

The Peninsula Link is the first road project in Australia procured via the availability payment option. With quarterly payments contingent on the road being available for use, this PPP was expected to be cheaper and allow government to spread the costs over time.

The project is a 25-kilometre long, four-lane freeway that includes 38 bridges, nine interchanges, 22 kilometres of shared use path, 37,000 square metres of noise walls and four million cubic-metres of earthworks. Southern Way (the SPV) has contracted to finance, design and build Peninsula Link and then operate and maintain the project over the 25-year operating phase.

The SPV is responsible for risks related to construction, asset handover, cost and time overruns of D&C and O&M activities, technical obsolescence and cost of finance.[26] The State of Victoria retains traffic risk and risks related to land acquisition, project approval and changes in state policy or law. Risks related to *force majeure*, insurance and changes in policy and law at the federal level are shared between the two parties.

At the time the government decided to procure the project through a PPP option in February 2009, the world was experiencing the impact of the 2008 GFC. It was difficult for the private sector to rationalise the project based on the model identified in the right hand side panel in Figure 2-4 because the financial sector was the most affected industry during the crisis.

Under such a climate, the project risk allocation has incorporated the specification of responsibilities for financial risks related to events like the GFC. The state retains the risk of increased interest rates payable on project debt in cases where market disruption causes the cost of funds above a specified percentage of senior debt to increase above market rates. Equity bears the first portion of this risk up to a defined cap, and the state has the right to recover from future refinancing gains any extra costs so incurred. However, the state is obliged to provide liquidity support (as lender of last resort) in the event that any hedge counterparty exercises a right to break the long-term swaps entered into at financial close, and Southern Way is not able to fund the break costs incurred. Any such liquidity support must be repaid in full by Southern Way (with interest) prior to making any distributions to equity. Southern Way must also satisfy a series of conditions in relation to the circumstances of the swap being broken prior to being entitled to the state's liquidity support (Partnerships Victoria, 2010).

[26] The state is entitled to a specified share of future refinancing gains but is not exposed to any future refinancing losses.

The project's risk allocation has presented a low-risk project to the market but at the same time has created a number of inherent risks for the government. The traffic risk retained by the state means that it will be responsible for higher maintenance costs if traffic levels exceed expectations. This is very likely to occur according to Victoria's Auditor-General, who has suggested that forecast traffic volume was underestimated in the procurement process. The whole-of-life approach exposes the state to residual value risk where at the end of the contract the asset's worth or resale value is different to what was expected. Peninsula Link's contract to build, operate and maintain the freeway includes requirements for measuring performance directly related to the operation of the freeway. However, the contract does not provide for measuring objectives against outcomes beyond the direct operation of the freeway, such as decongestion on the road network surrounding Peninsula Link.

The project is scheduled to open in early 2013. Only time will tell whether its risk allocation can facilitate the realisation of the project objectives.

2.5 Chapter Conclusion

After two decades of development, the practice of private provision in road infrastructure has progressively evolved into a more risk-balanced approach. Yet, based on the overall empirical findings, which have too often not been favourable from the perspective of taxpayers, it is doubtful that to date, DBFO roads have delivered true VFM to motorists or the community.

Within our analytical framework of project rationalisation, we discovered that risk allocation, associated payment models and pricing mechanisms were formulated to attain specific political objectives and to maximise return to private capital. The concept of bundling asset creation with whole-of-life asset management has failed to deliver the proposed outcome of maximising VFM through cost savings to taxpayers over the asset's life cycle. Sophistication of incentive payment mechanisms has yet to motivate risk-undertaking by the private sector. This is due to the fact that the design of financial mechanisms does not contemplate optimal risk allocation, but is tailored to the interests of the contracting parties. The concept of sharing cost and risk with the private sector has been rationalised by passing on risks and costs to motorists and the community. Private provision has conveniently provided governments with strategic flexibility to escape parliamentary and public scrutiny (NSWAGO, 1994, pp. 292-293; Hodge, 2005).

As seen in several of the case studies, erroneous traffic forecasts are the norm across projects and time. It has been documented elsewhere that traffic forecasts are produced to justify a course of action that, for political reasons, has already been chosen (Wachs, 1990). Traffic projections are devised by both sectors with the view of having the contract awarded and fulfilling the strategic objective of the public sector agency. Ample evidence indicates that forecasts have been fabricated not to show the most likely outcomes, but rather to satisfy political intent (Flyvbjerg *et al.*, 2006) and/or to deceive investors in order to raise finance from the market (Flyvbjerg *et al.*, 2002). This practice has translated into poor VFM for both the community and private equity investors who have suffered from the loss in value in these mega projects. For instance, CCT investors received only 20 per cent of their original investment when the concession was sold to another consortium (Clegg and Poljack, 2007), and investors in the LCT suffered substantial loss on their investment due to a drastic write-down of the value of the infrastructure asset (West, 2008); it was placed in receivership in early 2010.

The responsible public agency's objectives that formed part of these contracts may have distorted the assessment of traffic volume predictions. There is a strong link between the capacity of a proponent to offer a least-cost deal to the responsible public agency and the traffic predictions that underline a proposal. For example, the consideration of no recourse to government in Sydney's M2 has taken precedence over other criteria (NSWAGO, 1995, p. 49). In some cases the tendering process provided poor incentives to private companies, resulting in them being over- or under-optimistic in predicting traffic growth in order to win the concession, further compounding the factors leading to erroneous traffic forecasts. The CCT tendering model invited all bidders to bid on either the development cost or the BCF (JSCCCT, 2006b, p.73). This was seen as providing "a perverse incentive to bid on high patronage" (comment from a tenderer, NSWAGO, 2006a, p. 61). A typical *ex post* solution has been the reversal of volume risk back to the public sector, either through concession period extension or permission to lift the toll cap. This discovery has powerful implications for the source of risk, which will ultimately influence the outcome of risk allocation in any project, and may have a decisive impact on the risk preferences of contracting parties.

The case studies reveal that implementation of PPP tollroad projects is time- and context-specific. Ostensibly, learning effects have accumulated over projects and time. Although there has been noticeable progress in relation to *ex ante* mechanisms, few offer an optimal solution. The planning and evaluation process often narrowly focuses on the commercial and engineering aspects and neglects the community and social dimensions. In effect, PPPs are stakeholder projects that have strong vested interest from the community due to their wide societal impacts. PPPs present a unique compounded agency situation where the public authority is an agent for consumers and the private proponent is an agent for the authority; hence, indirectly the private proponent becomes an agent for the consumers (Trailer *et al.*, 2004, p. 308). Very often, it is the prime principal (the consumer) who is ignored in these binding relationships. In these three-dimensional relationships, the principal (the public authority) who delegates responsibility to the agent (the private proponent) is not the direct recipient of the delegated services. On another dimension, the consumers, who are the most affected group, and the public authority are not actively engaged in or adequately informed about any sub-delegation. This process is often discredited as being in conflict with democratic accountability (cf., Walker and Walker, 2000; Broadbent and Laughlin, 2003; Watson, 2003; Demirag et al., 2004; Mulgan, 2006; NSW PAC, 2006).

The lack of community involvement in contract negotiations would have had the illusory effect of not considering end-users to be stakeholders. This may have overshadowed the imperative of public acceptance and affordability. One of the greatest impediments to successful tollroad projects is the public's resistance to paying tolls, especially where there are existing alternative roads on which travellers are accustomed to travel free of charge, or they perceive the roads have been paid for through tax revenues (Fishbein and Babbar, 1996, p. 30). Internationally, user affordability and public acceptability of road pricing have been two of the greatest barriers to tollroad implementation (cf., Fishbein and Babbar, 1996; Laird *et al.*, 2003). Of particular concern is the equity issue of charging the public and the consequent effect on low income earners (cf., Starkie, 1990; Fishbein and Babbar, 1996; NSW PAC, 2006).

Increasing community engagement to enhance public accountability in the procurement process will promote better outcomes. Linking the payment mechanisms to the users' level of satisfaction with the service provided is one way to further community involvement. Currently, two DBFO transport projects in Canada (Sieera Yoyo Desan Road and Canada Line Transit) are implementing user satisfaction payments (Aziz, 2007), where part of the operator's income is adjusted over time, based on the results of user surveys. The concession deed of MEL also incorporates built-in payment mechanisms linked to consumer satisfaction. These mechanisms are supported by a quantitative program with specific targets (examples are all customer service calls being answered within 20 seconds, or a 90 per cent success rate in accident response times of less than 10 minutes) and a system that ultimately results in potential toll credits to users for non-performance (Eastlink, 2004, pp. 364-374).

Tollroads represent part of an integrated network, and it is inevitable that their scope will be extended beyond a simple road solution. As recent experience suggests, based on the user-pays principle they can be a useful device to manage congestion and can be a solution to town planning issues (Hensher *et al*., *forthcoming*). It is important that governments understand the risks associated with the intended project objectives in order to negotiate appropriate and equitable risk-sharing arrangements with private partners. To this extent, the present risk-shifting approach has proven inadequate. A proactive risk management paradigm that adheres to the rationale of risk allocation (as opposed to risk shifting) is required for a sustainable private tolling regime.

In summary, this chapter has shown, through the review of the PPPs literature and case studies, that risk sharing lies at the heart of the PPP procurement policy, and current practice is far removed from being able to realise this policy rationale. These findings open the door to research opportunities to investigate risk allocation issues in the road sector. To purse this trajectory, we first need to identify the main risks involved in PPP roads. This is the task we set for the next chapter, through understanding each stakeholder's view of current risk allocation practices and their perception of each party's ability to manage risks.

CHAPTER 3: TOWARD THE BETTERMENT OF RISK ALLOCATION – INVESTIGATING RISK PERCEPTIONS OF AUSTRALIAN STAKEHOLDER GROUPS IN PPP TOLLROAD PROJECTS

3.1 Introduction

In the previous chapter, we established the imperatives of risk-sharing issues in PPP road infrastructure and identified that specific project objectives are one of the underlying factors steering risk allocation in projects. Numerous studies (cf., Ball *et al.*, 2003; Grimsey and Lewis, 2005; Corner, 2006) have asserted that the *raison d'être* for risk sharing is VFM, and risk transfer from the public sector to the private sector is prominent in PPPs (Li et al., 2005a). On the other hand, a common concern shared among market players is that the ethos of optimal risk allocation that risk should be assigned to the party best able to manage it, has not been adhered to (see, for example, two studies that surveyed PPP participants: NAO, 2001; Grimsey and Lewis, 2005). The findings and concerns in the literature reinforce the imperative of understanding risks and contracting parties' ability of managing risks; these issues are the focus of investigation in the remaining of the thesis.

Road infrastructure is one of the most active markets of PPPs in Australia, possibly because of its high levels of capital consumption and its relatively low political sensitivity[27]. The case studies in Chapter 2 have shown that private capital is primarily exploited as a funding mechanism to solve a transport network problem, be it building a missing link or upgrading a vital arterial route. PPP road concessions resemble a sale-and-lease-back finance lease whereby a government sells to a private consortium a *usus fructus*, i.e., the right to generate income from ownership (Buitelaar *et al.*, 2007). The price, or upfront payment, covers the right to finance, construct and operate an infrastructure asset and profit from the sale of ancillary services generated from that asset. In most cases, the private operator is given the

[27] Roads are subject to political visibility to a much lesser degree compared to other modes of transport such as rail, bus and ferry where there is a strong presence of labour unions, and other public services like schools, public health services and prisons where service delivery is mainly subsidised by taxpayers. This fact may have contributed to the mismanagement of public perception in various tollroad projects.

power to charge users directly, but (generally) has no financial recourse to government. In this regard, tollroads are unique in the way that financial risk is transferred to the private sector, with the cost of risk transfer borne by road users, and in the way in which government separates the financier and provider roles from its roles as the central planner and regulator.

The bundling concept in PPPs incentivises the private entity to be innovative in the financing package and in the design and construction, thus facilitating cost savings over the asset's whole-of-life operation and maintenance. Concession periods range from 30 to 99 years in order to enable the private concessionaire to recoup the cost of capital and earn a required rate of return. In theory, these transport concessions should shield government from traffic risk, financial risk and O&M risk; hence, better *financial* VFM rather VFM to taxpayers.

The extant literature suggests that the public sector and the private sector do not share a monolithic set of interests (Meyer and Miller, 2001), objectives (Li *et al.*, 2005a) or expectations (Demirag and Khadaroo, 2008), the implication being that different parties have different perceptions of risk and their capabilities of risk management also differ. These (mis)perceptions can strongly influence the manner in which partners take on and price risks (Ball *et al.*, 2003; Blanc-Brude and Strange, 2007). A number of empirical studies have confirmed that perceptions held by different partners about risks, and about the motives and behaviour of opposing partners, create significant complications in negotiations about risk allocation, which can undermine the success of PPP projects (Arndt, 2000; Asenova and Beck, 2003; Li *et al.*, 2005b; Weihe, 2008). These observations raise an interesting question about the eventuality of equitable risk sharing between public and private sector partners. Despite criticism of inequitable risk-sharing outcomes (cf., NSWAGO, 1994; NSWAGO, 1997; NSWAGO, 2000; Shaoul *et al.*, 2006; Pollock *et al.*, 2007), PPPs are here to stay. Not only do they provide an additional source of funding, but they also extend efficiency gains from market competition to infrastructure-based public service delivery. Accordingly, if risks and expectations are managed properly, in a true risk-sharing partnership spirit, a better risk allocation model is likely to eventuate.

The initial purpose of this chapter is to follow up the question raised in Chapter 2: in PPP tollroad contracts, what are the risk attributes that cause most concern for (a) the public sector and (b) the private sector. After reviewing the literature on issues of risk-sharing and VFM in PPPs, we identified a knowledge gap that suggests that studies of risk allocation should investigate risk perceptions held by stakeholders. Such discovery leads us to the agenda guided by Research Question One: *To what extent is the outcome of risk allocation between the public and private sectors influenced by risk perceptions of different stakeholder groups?* We will explore this research question through the investigation of risk attributes pertaining to PPP tollroads.

The findings herein are the outcomes of a series of unstructured in-depth interviews with stakeholders in Australia who have been either directly or indirectly engaging in PPP road projects. The next section discusses the extent to which VFM can be materialised through risk sharing in PPPs, by examining the empirical findings in the extant literature. Section three explains the research methodology. Section four investigates the two sectors' capability of risk management, and the role that risk perception plays in allocating risks as understood by the stakeholders being interviewed. Section five concludes with the findings, and sets the scene for future inquiry.

3.2 Value for Money through Risk Transfer: An Empirical View

Discourses on achievement of VFM through risk transfer in PPPs are largely unsettled. Many empirical investigations in Australia and the UK show that VFM gains from risk transfer are concentrated in the following dimensions: cost savings to the public sector agency (Hall, 1998; NAO, 1999; AALSE, 2000; Ball *et al.*, 2003; Pollitt, 2005; Allen Consulting, 2007), project on-time delivery (Lay and Daley, 2002; MacDonald, 2002; NAO, 2003; Fitzgerald, 2004), and bringing forward planned capital expenditure, thus enabling the community to have access to the facility sooner (Malone, 2005; Allen Consulting, 2007).

It is arguable that savings arising from transferring the risk of *optimism bias*, i.e., cost and time-overruns (Flyvbjerg, 2005) are unique to PPPs, as a fixed-price construction contract yields the same benefit. The novelty of PPPs is premised on surrender to the private sector partner the right to control the asset, and the bundling of whole-of-life-cycle costs. These features create incentives for the private partner to develop innovative financial packages and to invest in high quality at the D&C stages in order to lower operation and maintenance cost (Li *et al.*, 2005a).

Innovations in design and technology promoted by ownership were cited in Fitzgerald (2004), who examined a number of PPP projects in VIC. These innovations, together with the whole-of-life approach to maintenance, have translated into significant VFM. A similar conclusion was reached by Blanc-Brude *et al.* (2006). In testing 304 PPP roads in Europe, they argued that ownership provided a spur to better risk management and hence greater cost efficiency and productivity.

However, questions arise regarding the likelihood of VFM after governments have been charged excessive premiums. Evidence from Chapter 2 confirms that the market discipline depicts a propensity for the cost of finance to be in part influenced by how risks are negotiated and allocated between the public and private sectors; and that any unallocated risks will be effectively priced. It is therefore expected that the private sector would profit from the risks offloaded by the public sector through risk premiums (Blanc-Brude and Strange, 2007), and these premiums represent the excessive profit margin added by the private sector to cover unfamiliar risks. For instance, the Highways Agency that let the first tranche of shadow tollroads in the UK was charged an excessive premium for the new financial risk created in respect of the predicted traffic volume (NAO, 1998). As noted previously, PPP projects tend to shield governments from the risk of *optimism bias*, yet it is ambiguous whether the risk transfer has yielded any VFM. Based on a large sample of PPP road projects in Europe procured between 1990 and 2005, Blanc-Brude *et al*. (2006) reported that although PPP roads were generally delivered on time and under budget, they were on average 24 per cent more expensive than traditionally procured roads, suggesting that the public sector was paying expensive premiums to transfer out the risk of *optimism bias*.

An inherent risk of PPPs lies in the risk allocation process. Chapter 2 has demonstrated that risk allocations are the outcome of negotiations between direct participants – the private proponent and the public sector agency, where the latter also negotiates on behalf of the end users (Li *et al.*, 2005a). It has been recognised in Chapter 2 that in this compounded agency relationship, end users have a significant stake, therefore both government agencies and private consortia need to understand the desire of this major stakeholder group and determine what level of service, and at what cost, is more desirable (Arndt, 2000, p.39). But concerns arise in regard to governance risk, and the risk of government failing to assume social responsibility and be accountable for the welfare of end users (cf. Demirag and Khadaroo, 2008). Hodge (2004) argued that the real risk issues within PPPs are governance risks, which are hard to quantify. Based on empirical observations of risks associated with MCL, he contested that while commercial risks that had been transferred to the private sector were well managed, the governance risks were poorly handled by the government. The lack of transparency on MCL's concept and clarity about the financial arrangements, together with insufficient consideration for the public interest, led to the downfall of a *Good Governance*

Charter platform. The MCL case explicates that the government's confusion of its commercial and governance roles could potentially expose taxpayers to commercial and political trade-offs. Moreover, governments often found themselves underestimating the risks of failing to assume social responsibility and taking into account public interest. Johnston and Gudergan (2007) investigated the public resentment for the CCT. In their view, this project demonstrated that while the government has successfully transferred out the financial risk, it failed to recognise that it was unable, in reality, to transfer social responsibility and public accountability. This failure led to a further breakdown in the social contract within the PPP relationship, compromising the long-term contractual sustainability between the two sectors.

In summary, the mixed evidence in the literature implies that the extent to which risk transfers in PPPs deliver VFM remains a subject of discursive debate. Ostensibly, the concern goes beyond the allocation of commercial risk and project risk to the terrain of governance, public interest and social responsibility. It is important, therefore, that the successful allocation of risks is based not only on knowledge of technical rationality (e.g., travel demand and cost of borrowing), but also on expectations and acceptance underlying the public perception of private participation in public infrastructure.

3.3 In-depth Interview Study

Unstructured, in-depth interviews were adopted as a means of investigation. The aim was to qualitatively examine the risk perceptions of different stakeholder groups in relation to PPP tollroads. The acquired knowledge would then be used to establish the links between perceptions of risk, and the required attributes and their concomitant levels – these are summarised in the risk attribute matrix in Appendix D. We favour the unstructured in-depth interview approach because of its power to achieve honest and robust responses (Whitehead, 2002) and to ensure realism in gaining an overall impression of stakeholders' perspectives. The unstructured approach encourages participants to openly express their viewpoints based on their experience in dealing with, negotiating and auditing PPP tollroad projects.

We carried out nine interviews in total. To enable a balanced view, an equal number of interviewees who have been directly engaging in decision-making for PPP tollroads were selected from the public sector (three) and the private sector (three). The three interviewees from the public sector are a former state minister for roads, a former chief executive officer (CEO) of a road authority and a current official of a road authority. The interviewees representing the private sector include a current CEO of an infrastructure group, a current legal councillor of a tollroad company and a team of consultants from an investment bank. The remaining three interviewees held current and past senior positions in state auditor-general offices in Australia. All interviews lasted between 60 to 100 minutes, and were tape-recorded (with permission) to ensure accuracy and to facilitate analysis.

A number of studies in the field of perceptions of PPPs employed a similar research method, but none of these make inferences about the extent to which actual risk allocation is a subject of such perceptions. Nevertheless, these studies provide a useful benchmark for the current investigation. As such, a discussion of these studies and their findings is warranted.

Overall, perceptions by governments that VFM can be realised by bundling life-cycle responsibilities into one package, exploring the private sector's efficiency in design and management and transferring out risks, have fast-tracked the expansion of PPPs in Australia (Malone, 2005). There are doubts about whether the VFM concept is compatible with hard-to-quantify public values (Demirag and Khadaroo, 2008) due to the inherent contradiction between achieving financial VFM and safeguarding traditional values of public administration in terms of equality, transparency, democratic accountability and governance by rule (Weihe, 2008).

At the microscopic level, the nature of PPPs constitutes a barrier to entry for some market participants (Ezulike *et al.*, 1997). For those who can afford to compete, risk assessments have been chiefly based on past experience and intuition, with little attention given to political and reputational risks (Asenova and Beck, 2003; Johnston and Gudergan, 2007).

Arndt's (2000) study is the first to investigate risk allocation in Australian PPPs through in-depth interviews. The richness in the outcomes of his study merits some discussion in detail. First, the ways in which parties perceived risk varied depending on the aims and drivers of those parties, and their ability to control those risks (p. 43). Second, the manner and form of the risk allocation for a PPP project were the key drivers of the financial and contractual structure of the project (p. 58). Third, the level of risk aversion was weakly associated with the firm's accumulated experience in PPPs, but strongly and negatively associated with the intensity of market competition (p. 310, p. 325). Fourth, competitive pressure was the driving force for the evolution of the PPP market, with the danger that governments would use this market force to transfer to the private sector risks that were beyond their capacity to manage (p. 325). Fifth, different types of stakeholders, i.e., debt providers, equity investors and contractors, held markedly different views regarding the importance of various factors in influencing the final risk allocation for a project, and about the most misunderstood risk category (p. 310). Remarkably, the evidence failed to support the proposition that a party's ability to bear risks is a significant influence on its approach to the risk allocation negotiations (p. 325). Rather, the approach was dominated by the respective party's loss aversion, with potential gains not valued as highly as fears of potential losses (p. 326). If this misperception about risks were to persist, risk premiums would not be reduced as much as they could be, and it would be difficult for governments to push for symmetrical risk allocation. This finding paves the way for a new research agenda, in that optimal risk allocation should include an understanding of the risk perceptions of stakeholders.

Following these pointers, in each interview we approached Research Question One in four dimensions: (a) what are the risks that most concern the public sector, and what are those that most concern the private sector; (b) the public/private sector's capacity to manage risks; (c) considerations that drive each party entering into a PPP tollroad contract, and the extent to which these considerations influence their approach to negotiating risk allocation; and (d) the process by which the level of tolls are determined. The same question was repeated for each participant so we could gain an understanding of their own perceptions of risk as well as their perceptions of the other party's risk management ability. In each interview, we took into account the factors identified in the *Framework of Project Rationalisation* established in the last chapter (see Figure 2-4) in order to make sense of each participant's perspective on risks.

The knowledge of stakeholders' perceptions with respect to these four dimensions together with the information of risk-sharing outcomes in recent PPP tollroads obtained from case studies in Chapter 2 will assist us in understanding how perceptions of risk will influence risk-allocation outcomes.

3.4 Risk Allocation and Management

All participants were candid about their views on risk allocation as well as the respective risk-management capability of their own organisation and of the opposing party. Interviewees from both sides agreed that risk assignment and management of risk are important and unresolved issues in PPPs.

The understanding of risk has evolved over these projects. You go back to the Harbour Tunnel, the government took the traffic risk on the Harbour Tunnel. Now up until two and a bit years ago, the government was actually ahead of the game. It was actually receiving more revenue than it had to pay to the concession, well a guaranteed income stream. I understand recently that that's sort of switched around a bit. That the government is now paying extra. So that's a real issue about traffic risk and who takes the risk on that. That's the only project that I am aware of in Australia where the government has actually taken the traffic risk. All the other projects, the private sector takes the traffic risks and as you can see, on some of the projects they get it right and some of them they don't.(Former CEO of a public road authority)

My experience over the last sort of ten years in particular has been that I really believe that when you get into operating at tollroad and you have people in the public sector who see it as everything is largely the responsibility of the private sector, they don't have to think. They just go it's all your risk no matter what. I don't think that's very wise and I think experience has shown that a lot of things get done a lot better when you do work together on them.., well our experience in all the places we do business has been that and sometimes both sides have learnt it the hard way. But you can't just say that's all private sector risk and close your eyes because some of it will actually come back to bite the government.(Legal councillor of a tollroad company)

The participants concurred that perceptions of risk play a decisive role in final risk allocation. Seven participants commented that they felt that the understanding of risk has evolved over time and across projects, and that governments are becoming more sophisticated. Recently, risk allocation has changed markedly in government's favour, to the point where it has gone past being a reasonable allocation of risks to becoming a risk-dumping approach. Neither extreme represents optimality in risk allocation, nor will they deliver an equal partnership in risk-sharing.

There is no doubt that in the 14 years I've been in this business from Citylink to today the risk allocation has changed markedly in favour of governments and against the private sector to the point where I think it's gone past being a reasonable allocation of risk... and that's part of my issue with this taking what I would call a risk dumping or a very heavy approach. If you push too far then people don't understand that that is not actually the real world and it's better to try and not create an environment that just says you take all the risk. It's better to have an environment that says, well sometimes we need to work together to manage the risk. (Legal councillor of a tollroad company)

The risks mentioned most frequently were traffic risk, network risk, financial risk, risks associated with ownership[28], *force majeure*, sovereign risk, risk of unclear project objectives, political and reputational risks, media risk and risk of public misperception.

Figure 3-1 synthesises the risk apportionment position supported by the individuals interviewed.

Risks should be assumed by the party best able to manage them

Public	**Shared**	**Private**
➢ Unclear objectives ➢ Political/Reputational risks ➢ Sovereign risk	➢ Network risk ➢ *force majeure* ➢ Media risk ➢ Public misperception	➢ Traffic risk ➢ Financial risk ➢ Risks associated with ownership

Figure 3-1: Base Line of Principles on Risk Allocation

All participants concurred with the view that the private sector is better equipped to manage commercial risks involving economic decision making, while risks that have embedded

[28] In order to simplify our online experiment, we decided to leave this risk out of the empirical data collection instrument. More detail about the experiment will be given in Chapters 6 and 7.

unquantifiable social and public values and those in the public governance domain are best left with government.

Well the obvious risks and I have no problem with these are things like revenue risk...the whole idea is in our business you've got to be good enough to...estimate the expected revenue...that's a risk that the private sector should take...The private sector primarily takes the risks of things like design and construction. Again, I believe it should. (Legal councillor of a tollroad company)

One thing I would say to you though about some of this stuff is that focus on economics, my own thoughts things that have a social cost you can't quantify and that's great for government to do because ultimately you're never able to, it's not economic decision. It's you know a decision for a whole other pile of reasons. Building a tollroad there is nothing but economics about it. How can you get it done for the least cost? (CEO of an infrastructure group)

I think one of the things is you know the efficiencies of the private sector in terms of the massing and dispersion of labour. I mean the very large construction companies that operate throughout the world. I mean that's truly one of the benefits they provide. They have access to a talent pool that works around the world and they can pull the talent pool together on a specific project that a government agency could not do. (Official of a public road authority)

It is intriguing though, that all parties held reservations about the other party's willingness to undertake risks and to exert effort in managing the allocated risks. The public sector participants acknowledged that the private sector is more acquainted with market discipline, but were disappointed that the private sector's willingness to invest in understanding risks is handicapped by its myopic focus on cost minimisation.

> *Well we had several false openings for the Cross City Tunnel. How could that occur? How could that occur? One must ask...Nick Greiner had to get up and apologise. How could a construction group allow its scheduling to be communicated so poorly to the owners and its management team? Who knows? Who knows?...It was part of the private public deal with the Cross Tunnel that they [the private operator] would communicate with their customer base...If you're planning the opening of something like this, you have to have a co-ordinated approach to your consumers. In terms of you can't really start trying to attract consumers if the tunnel is not going to open for 6-8 months...That was entirely in the hands of Cross City Motorway...But it's up to them how much money they spend on it and when they do it. (Official of a public road authority)*

> *So because it means the private sector has got to run these jet fans and pump the air up through the ventilation stacks and all that sort of stuff that costs them money to do that. So they will try and minimise their operational cost and just do the minimum amount that they have to do. (Former CEO of a public road authority)*

On the other hand, the public sector is perceived to be keen on transferring out (not necessarily to the private sector) as much risk as possible. On a promising note, there is cited evidence suggesting that the public sector's capability to manage risks that fall into the public governance domain can be enhanced with the private sector's commitment to a sustainable partnership. A risk attribute matrix that summaries these findings is provided in Appendix D. Each risk attribute has three levels attached. The high level represents the most risky concerns to each party, whereas the low level indicates possible ways of mitigation. As illustrated in the matrix, contracting parties have vastly divergent perceptions about risks.

3.4.1 Traffic risk

The downside of this risk is that traffic volume will be lower than forecast, resulting in total revenue derived from the project over the concession term varying from initial expectations. PPPs in the road sector work well in certain road contexts. These are typically urban or inter-urban roads with high volumes of traffic where operations are economically sustainable. All participants agreed that traffic risk is the greatest risk in tollroad projects, and is the risk that governments want to divest the most.

> *The big thing is the risk transfer for the government to the private sector on construction and traffic risk. (Consultant of an investment bank)*

> *I still think the low patronage risk is the key risk that governments want to divest themselves of. (Former auditor-general of a state audit office)*

When traffic risk is retained by the public sector, governments may be forced to subsidise revenue shortfalls. This can translate into unlimited financial risk, as in the case of the SHT. From its opening to traffic in 1992, the SHT has cost the NSW government over A$235 million due to declining traffic volume (NSWAGO, 2007; 2008). Even in cases where traffic risk has been transferred to the private sector, it is inevitable that government will bear some of the adverse consequences – the M2 and MCL are examples illustrating this point. In both cases, the concessionaires are contracted to pay land rent to the public authority. However, rents are payable in concession notes, and their redemption can only be triggered when actual toll receipts are sufficient to meet the hurdle rate of return on private equity. Furthermore, recent tollroad concessions, e.g., the ED, CCT, LCT and MEL contain provisions for governments to share upside gains on the condition that actual traffic volume is greater than the pre-specified threshold. No evidence exists that these upside gains have materialised.

Participants from the private sector believed that private tollroad companies have superior traffic modelling techniques because they have better access to information and expertise.

> *The traffic modelling is a very sophisticated and detailed area and an area that we have enormous expertise. (Legal councillor of a tollroad company)*

I think the private sector they are the ones that certainly spend a lot more money on going to the traffic forecasts. They often have access to a lot better data or they can purchase the better data and often they'll engage a wider group of consultants than the government utilises for its forecast. (Consultant of an investment bank)

They considered that private firms are better able to manage traffic risk and did not regard transfer of this risk by government as excessive. They admitted that traffic risk is a great concern during the ramp-up period. A critical domain is identifying the starting point where traffic starts to grow rapidly. They were confident that the pattern of growth would eventuate after users realised the benefits of travel time savings and the comfort of driving on a high quality and less congested facility. Indeed, these factors were identified as the main appeal for commercial vehicles, as manifested by the heavy truck use of the MCL (Lay and Daley, 2002).

You sort of get beyond that ramp up period you get to a sort of steady state level of growth. But in my opinion the biggest risk is choosing that starting point and then from there that fast growth for ramp up as users get used to the new piece of infrastructure and change travel patterns and all that sort of stuff. (Consultant of an investment bank)

Nevertheless, in the opinion of participants from the public sector, the private sector generally takes a less cautious approach in estimating traffic volumes during ramp-up.

The private sector is very bad at estimating the ramp-up. (Former CEO of a public road authority)

But I think that in you know that crazy year there were expectations built up that it would be an overnight success and make huge amounts of money for the private sector and that simply wasn't the case. It will take a much longer ramp up period. Perhaps it was a bit too visionary for its time. (Official of a public road authority)

Recent cases (CCT, LCT and MEL) confirmed that private firms have performed poorly in predicting the periods of time it takes for traffic to overcome the ramp-up hurdle. There are three possible explanations for these erroneous forecasts.

First, a wide range of parameters feed into the traffic model. These include demand elasticity of tolls, expected population and economic growth in the corridor, changes in trip patterns, strength of ongoing growth and the average length of trips. These estimates are generally provided in the project's EIS prepared by governments (see Figure 2-4). The private participants complained that these estimates are often not robust enough, causing errors in their traffic forecast, whereas the public participants were discontented with the private sector's unwillingness to invest sufficient effort to understand the demographic composition of the affected corridor (see examples of CCT and LCT in the next section).

> *Quite often the government might just rely on RTA counts that may be old or not relevant parts of where the project is going to go. (Consultant of an investment bank)*

> *You're trying to sell a product and I think this is where a lot of the tollroad companies...really don't understand their markets – who they're selling to. They have this philosophy that "build and you will come". You've actually got to sell the benefits. You've got to go out and talk to the trucking industry. Talk to them about all the savings they'll make and how you can use it and if you're going to go from here to here, this is how you use it and all that sort of stuff. It's how you promote it. (Former CEO of a public road authority)*

Second, problems exist with the prediction of short trips. This may be due to the fact that users perceive that gains in travel time savings for short trips are insufficient to justify the toll cost; for stated preference studies, short trips generally do not provide enough variability to force trade-offs and estimate models. A further explanation could be that these types of trips are greatly under-reported in travel survey diaries currently used to collect data for model estimation (Stopher and Shen, 2011). Missing short trips were the main reason attributable to the overestimation of traffic on Sydney's M7, where the forecast during the ramp-up period was seen as over-optimistic in terms of the number of vehicles, even though actual long trips have been better than forecast.

But M7 for example, when it's opened it was under forecast in terms of the number of vehicles, what's been missing are the short trips but the long trips have been better and you can see the trend line kind of closing and you know I query whether it's ever going to hit exactly as it's forecasted. But it's actually because it's got a lot more, it's got more long trips. It's hard predicting the short trips. (CEO of an infrastructure group)

Third, many participants asserted that increasing market competition has been the main contribution to over-optimistic traffic forecasts.

It creates a real dilemma in bidding for some of these projects because returns have also become much more competitive to the point where in Australia some prices paid have been clearly well outside what should be reasonable and the example is Cross City Motorway. What happened? Massively overestimated the expected revenue. (Legal councillor of a tollroad company)

This opinion is supported by a number of episodes documented within the literature. Several examples exist where fierce competition and market scepticism in regard to the commercial viability of a project led the private bidder to inflate forecasted traffic numbers in order to win the contract, as in the case of the Eastern Harbour Crossing in Hong Kong (Tiong, 1995), CCT (NSWAGO, 2006a) and MEL (VAGO, 2005). Further, the predicted volume of traffic has a decisive effect on the project's ability to raise finance, since financiers are interested in the project's cash flows (Akbiyikli *et al.*, 2006). This might have motivated project companies in the past to produce optimistic forecasts in order to enhance the project's attractiveness to financiers and equity investors.

As illustrated in Figure 2-4, to reduce traffic risk, which is an important variable in the overall risk assessment to the SPV, private proponents will seek protection, not in a direct financial component, but in terms of the scope of the project, and in terms of the way it integrates with other parts of the network. They will seek to maximise the flow of traffic onto the tollroad by arguing for road closures or against the reopening of closed roads, as occurred in the case of the CCT. This has given rise to a host of network issues.

3.4.2 Network risk

Network risk arises when the contracted road services or method of delivery of those road services are linked to, rely on, or are otherwise affected by certain infrastructure and other services or methods of delivering the contracted road services. Road projects are particularly concerned with access to the existing road network and the feasibility of connecting to future infrastructure (Arndt, 1998).

Network issues affect the profitability of a private tollroad as well as traffic management for the entire transport network. Beesley and Hensher (1990) noted that for private provision in roads to be socially sustainable, the roads need to be part of the broader planning process that considers the whole of the transport network. Arndt (2000) commented a decade later that network risk was the most contentious issue to resolve. He articulated that the private sector recognised the government had to retain the right to operate and manage the transport network at the same time as the private sector had to have enough certainty to justify the traffic predictions and the project's finance on a non-recourse basis (p. 198).

At present, network risk remains the issue that appears to result in the most divergent views. On the other hand, all participants felt that a tollroad, by definition, especially in the urban environment, is beholden to the network around it, which the private operator does not control.

> *But other areas such as say effects that the government can have by policy, by competing routes, or by not providing reasonable access to that road, are things that are not within your control because a tollroad by definition especially in Australia*

and urban environments, is beholden to the network around it which it doesn't control. (Legal councillor of a tollroad company)

The dilemma lies with the conflicting objectives associated with network risk management. From the private sector's perspective, network risk management should provide assurance for the tollroad's profitability, and is best handled by government for the following reasons. Only government has the power to acquire land compulsorily, to enact policies to eliminate competing routes and to facilitate access to the tollroad. From the government's perspective, whoses concerns are the connectivity of the transport network, the mobility of the community being affected and congestion problems at network bottlenecks, any tollroad ought to be a vital part of urban planning.

Private operators will seek to minimise the options for competing free routes in order to increase the prospects of patronage. Public policies on traffic demand management, often as the result of the private operator's persuasive efforts, are typically implemented to mitigate network risk. For example, private operators of urban tunnels would negotiate with government to impose road changes in order to enable the private tunnel to capture surface traffic. It is arguable whether these actions will deliver greater VFM to the whole community; indeed, some of them are more likely to create an adverse effect. Road changes to surface roads above the LCT in Sydney generated a positive social impact. Lane Cove Road is the major arterial route connecting North West Sydney to the central business district (CBD), and a high proportion of the city's working population lives in North West Sydney and relies on public transport. Funnelling private cars into the tunnel frees up the surface road for dedicated bus lanes, and consequently offers significant time savings (up to 20 minutes) to users of high occupancy vehicles such as public buses. On the other hand, changes made to surface roads above the CCT connecting the eastern suburbs to the CBD created a political backlash. Given that the use of public transport by eastern suburbs residents is relatively low, there were serious doubts about the VFM brought about by expanding bus lanes through surface road closure to private cars and channelling them into the tunnel. It represented a demographic variable that was not accounted for in the traffic modelling.

From the central planner's perspective, the public sector believes that private operators only care about the profitability of their particular road, without giving sufficient consideration to network integration.

> *Most proponents of PPPs are not thinking about the wider picture... and sometimes it was very difficult to deal with them because they just didn't understand [that they were only] paying a piece of the big jigsaw and that was the frustration. (Former state minister for roads)*

In some cases, private ownership has restricted government's ability to improve network efficiency. Two examples in VIC support the existence of what Froud (2003) termed the inherent risk of PPPs; that complex contractual arrangements deprive partners of some degree of flexibility. One example is the redevelopment of the Melbourne Docklands area by the Victorian Government. The redevelopment triggered a A$37 million MAE claim that was built in to MCL concession due to the fact that several roads running through Docklands compete with a private road (Hodge and Bowman, 2004; Brown, 2005). Another case is the moribund regional freight network that was privatised by the Kennett government in the 1990s. The private ownership became an obstacle for the later Labor government, preventing it from developing transport links, which was only resolved through the state's buy-back of the network.

Clearly, divergences in objectives are a barrier to a mutually desirable network risk solution. The willingness of government and private operators to work collaboratively in reconciling these differences is the only way to mitigate this risk. Although the power of network planning rests with government, the private operator can make a substantial contribution toward upgrading that part of the network that surrounds their road in order to make it more conducive to users and increase the profitability of the tollroad. Empirically, such willingness seems to bear fruit. The A$150 million upgrade to arterial roads feeding into Sydney's M7 initiated by the RTA was made up of financial contributions from the private consortium and the federal government. The upgrade has not only had the effect of improving patronage for the M7, but also has benefited the local community, with the consequent effect of mitigating the risk of community objection to private ownership.

> *The M7 has been a spectacular success in terms of traffic in Western Sydney was a nightmare before it opened. We actually spent $150 million dollars just part of upgrading arterial. That was part of the deal. So actually promoting that stuff is part of what I think we need to do... It's about trying to combat the negativity and one of the ways we tried to deal with the M7 is to make it part of the community. (CEO of an infrastructure group)*

The philosophy of Transurban, an active PPP proponent, is to work with government to improve the road network for the benefit of both parties. It has invested in a billion dollar upgrade on the West Gate Freeway that feeds into the MCL, with the upgrade believed to be able to relieve traffic congestion and reduce pollution as well as having the effect of improving traffic flows to the private road.

3.4.3 Financial risk

Financial risk refers to the variability in returns that an asset is expected to earn over time. It is typically affected by market confidence, public perceptions, consumer attributes, environmental threats and perceptions of misconduct (Asenova and Beck, 2003). The allure of PPPs has been captured by the discipline of project finance, in that PPPs force a project to service any financial debt from revenue streams derived from the project itself without recourse to public funding (cf., Debande, 2002; Li *et al.*, 2005b).

One apparent benefit of transferring financial risk to the private sector is that such risks are subject to the ruthless scrutiny of commercial practice and extensive due diligence related to the quantification and allocation of risks that private sector risk-takers carry out on projects (Corner, 2006). Having private finance at risk should, in theory, lead to a harnessing of the private sector's risk management skills. The decision rule to enter into a concession depends on whether the project yields a positive risk-adjusted NPV. This condition is contingent on the degree to which commercial risks can be mitigated contractually upfront. Because finance cost is the most expensive item, the private consortia should be motivated to find better ways to drive down costs. The private sector has access to a wider range of financial products in the international market. These resources have facilitated the formulation of the best financial packages, with the capital market having on offer various sophisticated financial instruments such as infrastructure bonds, stapled securities, fixed-rate loans, mezzanine loans, hedging, and insurance to cope with financial risk.

Many participants believed that the way the project finance is packaged is where the real competitive advantage should be.

> *What it costs to finance is when you win...And it's the innovations that they each bring to that that actually causes you to get the cost down whether it's a tax advantage; whether it's bringing money in from overseas; whatever. How that whole thing is packaged together is where the real competitive advantage should be. (Former CEO of a public road authority)*

> *On the financing side we've got access to a lot more products, just huge resources that make them come up with different financing ideas. (Consultant of an investment bank)*

As cited in Arndt (2000, p. 58), the manner and form of the risk allocation for a PPP project are the key drivers of the financial and contractual structure of the project. A rule of thumb is that private equity normally bears the risks that cannot be or are too costly to be mitigated, because equity has greater risk tolerance as it shares the project's upside gains – a benefit that is not open to debt financiers. The logic is that lenders are more conservative and thus require a much narrower band for risk errors, and this is particularly so for new roads. This requirement inevitably drives up the cost of finance, and hence equity is preferred. Asenova and Beck (2003) noted that finance companies preferred that risks that were difficult to mitigate, but remained with the consortia, be supported by equity rather than debt. The public sector also prefers a proponent with a strong balance sheet who is able to lower the cost of capital as well as sustain the investment in the long term. Nevertheless, the private sector is wary of government's approach to evaluating private proposals where focus is only placed on capital costs without giving adequate consideration to life cycle cost savings. Such an approach pressures the private sector to not price the risk premium into the project cost[29], and may threaten the project's long-term financial viability.

Despite the recent financial turmoil associated with the CCT and LCT, market participants remain sanguine about the future of PPP tollroads.

> *I think that public private sector partnerships are inevitable because the range of services that can be provided by the private sector are better than the public sector but in a way it's important to monitor the provision of those services so that the community has certain protections. So I think it is inevitable that they will continue. (Official of a public road authority)*

They are all cognisant of the fact that motorists value the comfort of driving in private cars, and hence the demand for tollroads is likely to remain strong.

> *Well I mean just on this sort of why the tollroads are attractive. Tollroads are attractive because people like being in their cars, you know? (CEO of an infrastructure group)*

Further, tollroad investment has strong appeal to superannuation fund managers because it offers investment opportunities that have a similar term to maturity (Malone, 2005). With the user-pays concept starting to gain greater acceptance, if risk allocation is managed equitably, there will be a growing market for PPP tollroads.

3.4.4 Risks associated with ownership

Underpinning the idea of private ownership is the concept that the greater the autonomy and flexibility in investment decisions, the higher the productivity efficiency that can be achieved.

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[29] One participant revealed to us that in a country which is by far the most active in PPPs, Treasury will impose a typical 40 per cent mark-up on whatever cost is budgeted by the public agency of roads. This add-on reserve imposes an extra cost on risk premium, the inclusion of which will no doubt make the project proposal appear "too expensive".

It is expected that in order to maximise commercial returns, ownership rights would motivate a private firm to employ cost-efficient means that are beyond what is possible under traditional procurement methods. This expectation corresponds to incomplete contracting, which suggests that the assignment of ownership rights of the relation-specific asset (an asset that has no cost effective alternative use except for those specified in the contract) would alleviate under-investment problems (Williamson, 1979; Hensher and Stanley, 2008). The main risks associated with ownership are D&C risks, and O&M risks.

3.4.4.1 Design and construction risks

These are the risks that design, construction or commissioning of the facility are carried out in a way that results in adverse on-costs and/or service delivery; examples are time and cost overruns. In particular, design risk represents the inability of either party to fully understand design concepts, specifications may be expensive to change after construction is complete, and the project is not delivered on time. Since most PPPs pass on these risks along with ownership to the private sector, such risks are mainly the responsibility of the private consortium.

Ball *et al*. (2003) established that decision makers' perceived risk transfer was dominated by the design quality and construction cost risks. Likewise, Shen *et al.* (2006) verified that compared with traditional procurement, PPPs have done better in mitigating D&C risks because they encourage a long-term view of the D&C, with the focus being on minimising life cycle cost. But transfer of D&C risks *per se* does not deliver VFM. First, the cost of assuming *optimism bias* is priced into the private firm's financial model and will be recouped from user tolls. Second, it does not need a PPP to transfer construction risk, as a fixed-price contract can yield the same benefit. The hard VFM is associated with efficiency gains from the private sector's expertise and associated learning efficiency from actively engaging in the construction of urban motorways. Such superior efficiency is manifested in a number of PPP roads (e.g., the M7 and MEL) that exhibit notably innovative D&C techniques.

Innovation in design has become a commercially as well as socially sustainable factor for the MCL. At the time the MCL concept was formulated, two short tunnels were proposed, but serious concerns soon arose for the government and the local community in relation to this approach (Lay and Daley, 2002). Transurban proposed a design concept that involved a longer tunnel in place of the short east-bound tunnel in order to minimise the impact on the local environment. Although the new concept created greater uncertainty in terms of traffic revenue, it indicated Transurban's awareness of the broader community, which has earned it significant community respect and support.

Transferring the D&C risks offers governments certainty in a project's timely commission. Commercially driven private firms have more flexibility in implementing the means to derive a desired outcome. A private sector participant informed us that his firm awarded the constructor a A$50 million bonus for finishing the project eight months ahead of schedule[30]. In contrast, governments do not have sufficient incentives to drive outcomes forward and are often mandated to follow rigid process-adherence procedures that may have created unnecessary delays[31].

3.4.4.2 Operation and maintenance risks

These are risks during the operational phase that may affect the profitability of the operator, such as changes in technologies, variations in input costs or components for maintaining and repairing the facility (Shen *et al.*, 2006). In tollroads, they further include the ability to penalise non-paying motorists, and risks associated with meeting safety and environmental standards (Arndt, 1998). Poor handling of the O&M risks by the private operator will also adversely impact on the residual value of the project – a risk to the government that will inherit these facilities at the concession's conclusion.

One of the notable benefits brought about by PPPs is tolling technology. The electronic free-flow tolling used in the MCL was the first in Australia. Since there was no real field experience at that time, reference to information on the impact on consumer take-up and use was not possible. This constituted a significant risk to the private proponent.

> *Putting a tollroad into Melbourne itself was high risk but doing a full electronic when that really hadn't been done virtually anywhere in the world certainly not on*

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[30] This is not to say that there exists any prohibition limiting governments from making such payments to encourage early completion. A participant informed us that, at the time when the Australian Government was the owner of Sydney Airport, the government paid a bonus of a similar nature for the early completion of the second runway.

[31] In cases where governments tried to constrain the design, a trivial variation from the specified blueprint would be considered as non-delivery. There were cases that ended up with hundreds of trivial complaints, which resulted in lengthy negotiation and delays in delivery notwithstanding these variations had no real effect on the ability of the facility to function. Even worse, some of the specified design was based on old technology. Going down that path will in fact mar the facility's performance efficiency.

this scale together with all the other risks was massive. (Legal councillor of a tollroad company)

But the MCL has proven that the market accepts cashless tollroads, and any increase in toll charges is outweighed by savings in travel time[32]. The revenue risk of a fully electronically tolled road will be amplified in the absence of a disciplined enforcement system, because it is difficult to stop a motorist who has not made prior payment arrangements with the operator from driving on an electronically tolled road. The enforcement system relies on government's policing and legislative powers to ensure that non-payment will be financially sanctioned.

But one of our particular issues is that when you have multi-laned, free flow toll-roads, you need support from the government in certain areas and one is enforcement. We have excellent compliance in Australia and in particularly here in Melbourne in terms of anyone can drive on our road here. There are no barriers. I always say to people, you can't turn off the electricity or the gas from non-payment. Therefore, most people do the right thing but those who don't, you have to have a system and we know have a world-class system and the Victorian government has always from way back to 1996 when we closed that first deal, has always worked with us to manage the risk of what we call enforcement. The issue there is does the legislation - is it robust to work? That varies from jurisdiction to jurisdiction. The management of it, the resourcing of it and that's an example where I believe the government has to take some responsibility and say, yes. This is a partnership. (Legal councillor of a tollroad company)

Ideally, the bundling concept will maximise efficiency in the O&M phase to give the best whole-of-life outcome. Combining the designer, the builder and the operator into one entity incentivises the designer to deliver a concept that is suitable to build, and the builder to

[32] Unpublished research by Hensher and Rose has shown that making tollroads cashless in situations where the tollroad previously had some cash payment booths, actually reduced revenue in the short run. This is due to the reluctance of specific segments such as the elderly and infrequent travellers, to obtain and use an electronic tag facility with direct debit or other credit card payment mechanisms. This constraint will disappear in the long run.

construct a facility that is suitable to operate and maintain in a manner that is cost-effective. All these ideas of bundling responsibilities and ownership seem to fit well in the theory of incomplete contracting (Hensher and Stanley, 2008). Empirically however, incomplete contracting theory fails the PPP roads for these two most noted reasons: (a) many private consortia do not intend to hold on to the asset for long; and (b) during the operational phase, the private operator will do the minimum to save operating costs. One example is the operation of ventilation stacks in tunnels as quoted earlier by a former CEO of a public road authority. They are being run only to a level that is barely sufficient to pass the key performance indicators linked to environmental standards.

3.4.5 Force majeure

F*orce majeure* recognises the need to provide contracting parties with protection for highly unanticipated events that will impair the project's functionality and profitability. It refers to the risk that events may occur that will have a catastrophic effect on either party's ability to perform its obligations under the contract. It includes natural disasters such as earthquakes and uninsurable events such as wars, which are beyond the control of either party (Arndt, 1998; Shen *et al.*, 2006). Of these uncontrollable events, insurable risks are generally borne by the private sector, whereas those that are uninsurable or too expensive to insure should be shared between the two parties.

Uninsurable *force majeure* events are covered under the MAE clause (Arndt, 2000). The MAE approach seeks to define certain risk events which will be borne by government, or shared, and defines a mechanism of redress for the aggrieved party if one of those events crystallises. Mechanisms may include reference to an agreed financial model in order to objectively determine any effects on the project. Alternatively, analysis may be limited to an independent, open-book audit of the project (Arndt, 2000, p. 280).

On occasions, private proponents have threatened to use MAE clauses to demand financial compensation when redevelopment of the transport network by government may lead to a negative impact on profitability of the private road (e.g., M2 and MCL). The private sector is also inclined to demand a tariff increase and an extension of the concession as redress (Arndt, 2000, p. 304). In our study, the private participants indicated that they regarded the category of *force majeure* as too restrictive. After extensive lobbying, the Victorian government has considered broadening the range of events to include utility services interruption during the operational phase, floods, ionising radiation, and contamination by radioactivity. The private sector also preferred a more transparent approach to any renegotiation with government if a MAE risk eventuates.

3.4.6 Sovereign risk

Sovereign risk relates to the uncertainty in legislation and government policy that may adversely affect the project's profitability, and the possibility of a new government abandoning or changing the PPP scheme. It is particularly relevant to PPPs because they are characterised by a long duration of contractual obligations.

Sovereign risk management is primarily the responsibility of government. It is important that government maintains a stable, coherent and transparent political structure to encourage private participation. In this regard, Norton de Matos (1996) in Arndt (2000, p. 30) notes:

> *Private development of infrastructure projects can only happen against a background of political stability, coherent and consistent industrial, investment and economic policies, clear and transparent legislation allowing for the involvement of the private sector in specific areas of the economy, and available of foreign exchange for the repayment of offshore debt, if applicable, and the repatriation of profits.*

In the Australian PPP market, the private sector has been supportive of research that would facilitate the development of a consistent and coherent policy framework to risk allocation (Arndt, 2000, p. 281), indicating the importance of a stable political structure to the market. Private proponents are frustrated with policy fragmentation among government agencies with respect to PPPs and toll pricing, which often results in lengthy and costly negotiation in order to close the deal. Typically, the average participation cost of these mega projects ranges from A$10 to A$20 million. For this reason, the private sector has a strong desire to have open dialogue with government and to push for a single, simplified procurement approach.

The UK is seen to have a more consistent PPP policy structure, as all PPPs are coordinated by a centralised unit, HM Treasury. This structure has enabled standardisation of documentation and a single framework for bidders to operate in, with obvious efficiencies in the tendering process – much shorter bidding periods and reduced tendering costs.

In the view of private participants in Australia, the local market comprises a variety of approaches to the procurement of infrastructure by different government entities, with no single model or policy framework in place. The situation is even more problematic in NSW where there are inconsistencies in PPP policy at different levels of government. In the early days of PPPs, Treasury's role was limited to offering advice to the government and taking part in the Budget Committee of Cabinet. Early deals were mostly closed by public agencies without any consultation with the Treasury.

> *We think there are risks. But Cabinet can overrule that [i.e., Treasury's recommendation]. I mean there have been situations where some of these have come forward at a very, very short notice. I think in the past some of the Ministers played games with Treasury. They didn't give Treasury long enough to review the proposals. Even the end principle proposals let alone final contracts and in some cases Treasury might've only had a few days or a week to look at substantial documentation and at times Treasury said, look we can see difficulties in this and the budget committee will still say, we think it's OK in principle. You offer us a level and go and sort it out but in principle we agree with it. I mean some past ministers used to try and keep Treasury in the dark. I don't know if that's the case in the last decade. (Former auditor-general of a state audit office)*

Project reviews by the government and the office of the respective state auditor-general are undertaken on an irregular basis. In addition, there remains an absence of guidelines and budget appropriations for *ex post* evaluation on PPPs to provide taxpayers and investors with information regarding the rises and falls of these projects. Victoria, however, has a better-defined regulatory framework called *Partnerships Victoria* to countenance PPPs, which provides international investors with a degree of confidence.

> *Are we seeing more PPPs in tollroads? Yes. It's a deliberate policy of the Victorian Government to countenance PPPs for major infrastructure. They have a thing called Partnerships Victoria which is a framework that's been sold all around the world*

and different governments have copied it including different jurisdictions in Australia. (Assistant auditor-general of a state audit office)

I think the government is just more experienced in Victoria. They've got an agency called...Partnerships Victoria... And all they look at is PPPs whereas in NSW its run by various departments. So I think it's hard to get that co-ordination between you know the RTA and the State Transit Authority and everyone else for these messages to come out. But that's just a framework we have to work in with the NSW versus VIC. (Consultant of an investment bank)

Statutory differences also frustrate governments. Most PPP projects have been entered into between the private sector and state governments, but the power to determine or influence certain key variables, such as the tax rate and the exchange rate, is outside the jurisdiction of state governments. As illustrated in Chapter 2, the uncertainty in regard to how the federal government would decide on the tax deductibility of the SHT delivered the NSW Government a $A24 million bill (NSWAGO, 2003, p. 209).

Nonetheless, international investors have confidence in the Australian market as Australia is a stable democratic country, and state governments are seen to be gradually evolving and improving in their dealings with the private sector to achieve better partnerships. There exists significant scope for a uniform, national approach to PPPs in Australia. The *Infrastructure Australia Act 2008* enacted by the Australian Government is a response to the recognition that a sustainable PPP environment needs the support of a coherent and consistent political structure. The Act signals a strong commitment by the federal government to greater and wider private provision of public infrastructure. It is hopeful that under the leadership of Infrastructure Australia there will be a more coordinated approach to PPPs across various levels of government.

3.4.7 Risk of unclear project objectives

It is easy to lose sight of the trade-offs between invited private innovative ideas and clearly defined project objectives. Some of the literature praises PPPs for the better-defined and controlled services through tight contracts (Hodge and Greve, 2007). On the other hand, unclear and poorly defined objectives will expose government to a series of new risks, including weakened bargaining power and adverse equity impact. The standard public procurement process requires the project objectives to be stated in an EIS, which must be publicly exhibited in order to obtain community approval. Accordingly, where the EIS sits in the process is important in relation to who assumes the related risks.

> *Well, you put out the EIS then on their [i.e., the preferred proponent] proposal and if the community doesn't like it, which is the case here [i.e., the ED] and you get into variations, you're then negotiating with one company on those variations and that's the hard bit then. So therefore it was decided that model doesn't work. So what the government then decided to do for all the new projects, you know, the M5 East, Western Sydney Orbital, Lane Cove Tunnel, Cross City, they actually went out and they put out an overview report and it was the beginning of this two stage process that you've now got in planning... Then we went out and we said, all right. We'll have a two stage process and we'll put out an overview report on what the project is going to look like, get community comments. We'll then modify it according to those community comments, put a new EIS out and then we'll take the approved project to the private sector. Right? So where does the EIS fit? Who takes that risk on all of that? (Former CEO of a public road authority)*

Offering an uncertain project to market tendering opens unlimited scope for negotiation. The ED in Sydney was initially put to the market with a set of vague objectives. The tender document only mentioned that the government wanted a road built, and invited the private sector to scope out the design, levels of toll charge, overall cost and financial arrangements. After selecting what it considered to be the best proposal, the government then undertook an environmental assessment for that project, but soon found itself confronted with the community's rejection. Since the government had chosen the preferred proponent in the absence of community consultation, this left the government in a very difficult position to renegotiate. Effectively, the government took the risk on the EIS not being acceptable to the community, and then had to negotiate with only one proponent on the changes requested by the community. The ED took many years of intense negotiation to reach the final close. During that long period of time, the project scope had changed considerably, and all the intellectual property belonged to the tenderer. The government's ability to reopen the tender to the market was hamstrung by this situation. In the end, an extra A$140 million of construction work was added to the original proposal and the private ownership term was extended from 38 to 48 years to cover the increased cost.

The CCT in inner Sydney is a classic example of a poorly defined project. It originally started as a road project but soon became an urban design solution to improve the surrounding neighbourhood. The initial idea was to remove traffic from the Sydney CBD. A short tunnel would have been sufficient to achieve this result and would have cost a lot less, but would not have provided the advantage of improving the design of the major surface streets involved. The then Lord Mayor of Sydney had a grand vision for the city precinct in which William Street, Oxford Street, Broadway and Taylor Square would become key boulevards after the major upgrade. When the RTA approved the EIS for the short tunnel design, the then Mayor, who had also become the NSW Planning Minister, lobbied to have it widened. The government subsequently accepted a non-compliant private proposal that would satisfy the broader, more ambitious vision of urban redevelopment. As a consequence, a modified EIS had to be prepared. The private proponent consortium foresaw that the new design would increase the project cost to government and at the same time expose the government to extra funding risks, unless the new proposal could demonstrate sufficient traffic volume to cover these new risks, it was unlikely that the government would accept its proposal. Subsequently, the consortium produced a highly unrealistic traffic forecast that enabled it to obtain approval (JSCCCT, 2006b).

As part of the new project, all pedestrian pavements were widened, road lanes were reduced and bus priority measures were put in place. This converted the initial tollroad project into an urban design solution, with motorists in effect subsidising the cost of the urban improvement. More than half the benefits from the tunnel were designated as accruing to non-motorists, resulting in serious inequity. Motorists were being charged a fee to cover the cost of the tunnel, but they were also providing a subsidy toward the cost of urban redevelopment. The CCT has generated significant debate about whether tollroads are equitable investments. Should such roads be paid for by taxpayers who may never need to use them, or financed from a user charge. If financed by the latter option, it is debatable whether motorists would be charged an equitable toll commensurate with the benefit they would derive from the facility. Although the CCT project was deemed successful in terms of transferring out financial risk and having a longer-term potential in improving urban amenity, it failed on the grounds that government was unable to deliver VFM in the public interest.[33]

Tollroads have discernable impacts on land use decisions. Over time, urban planning has broadened the scope of tollroads beyond a simple transport task. During this transformation, private provision is being captured by urban planners rather than traffic engineers, worsening the 'fuzziness' of project objectives.

> *I argue that Cross City is a good example of where a road solution i.e. a short cross city tunnel, became an urban design solution to improve William Street. What are your objectives? What are you really trying to do here?... So in actual fact it became an urban design solution rather than necessarily a road solution was the real dilemma and therefore the motorists were forced to pay for an urban design improvement and you could well argue that in that case, that in fact the government should've paid for the externality benefits of the motorway, the urban design benefits of the motorway, and the motorist should've paid for what was sort of the time savings or whatever. (Former CEO of a public road authority)*

[33] Two state government inquiry reports concluded that (JSCCT, 2006a; 2006b): 1) there was insufficient evaluation of the public interest before the decision was taken to open the project to the private sector and the public interest evaluation contained in the *Working With Government Guidelines* was not clear; 2) while the project may have resulted in no net cost to government, it has resulted in significant cost to the community, through higher than anticipated tolls and added inconvenience for the users of local roads in the area between the east and west tunnel portals, leading to considerable frustration and anger and potentially a political cost to government; 3) a separate, more detailed policy on privately financed projects should be developed solely for government agencies, and the policy should provide clear and unequivocal processes and procedures to be followed by agencies entering into privately financed projects, and provide avenues for escalation of issues where these may require variation from the standard processes and procedures; 4) there was concern that the secondary objective of 'minimisation of the financial cost to government', which the Committee inquiring into the project understood to effectively mean 'no cost to government', was the overriding concern at the time of the preparation and assessment of the supplementary EIS; 5) subsequent alterations to tolls, traffic levels and traffic management measures were made both during and following the supplementary environmental assessment process and these changes appear to have occurred without the depth of analysis or assessment that was undertaken for the initial EIS; 6) not enough attention was given to strategic planning at an early stage of the project, despite agencies that gave evidence to the inquiry indicating that they followed government policy in the consideration, planning and assessment of the CCT project; 7) a clear message from the CCT experience was that the community living in the areas affected by the surface road changes associated with the tunnel felt that they had been ignored, misinformed, and treated with indifference or even contempt; 8) the apparent degree of animosity between community groups with opposing views on the status of Bourke Street was regrettable, and may have severely impacted on the success of consultation; 9) notwithstanding the high toll levels and traffic congestion on surface streets, the CCT is an impressive feat of engineering excellence that will be considered an essential part of Sydney's road infrastructure for decades to come.

A dilemma for planners has been how to use private capital effectively to fulfil the objectives of an integrated transport network plan. Careful consideration needs to be given to a number of parameters: whether the tollroad is going to be part of urban planning or traffic demand management; and how to make risk sharing equitable to enable private capital to service the underlying objectives in the public interest. If the objective is urban planning to encourage usage, a toll should be set at a sufficiently low level to induce such usage. This may require subsidies from government to entice the participation of return-driven private investors. If the objective is to manage traffic demand, the contract should specify the outcome parameters and permit the proponent the freedom to set tolling at a level that satisfies these targets. Being in charge of daily operations, the operator would have superior knowledge in terms of varying the levels of toll to manage traffic flows. The High Occupancy Toll (HOT) lanes in Virginia, for example, give the private operator the flexibility to set the tolls based on the level of service it is required to maintain. Tolls rise in periods of high congestion to ensure that the HOT lanes continue to flow as required. The power to vary tolls has facilitated the delivery of required targets by the private operator.

> *The HOT lanes in Virginia are a different concept again. Totally variable. We set the tolls because it's based on whether we maintain a level of service. (Legal councillor of a tollroad company)*

There is a need for better communication with the private proponent as well as the community being affected in articulating project objectives, and how these objectives are tied to the broader transport vision and other economic and social benefits. Government, as well as the private sector, should employ the EIS mechanism to bridge communication with the public. Positive evidence shows that the fulfilment of promised objectives by government has created a welcome impact on public acceptance of government policy (Whitehead, 2002). We argue that this concept should also extend to public infrastructure projects.

3.4.8 Political and reputational risks

These are social-dimension risks. It has been widely recognised that PPPs are not just about infrastructure, they are essentially about long-term service provision (Forward, 2006). Political risk relates to questions about the continuing commitment of key political parties to a project, and is closely associated with reputational risk (Asenova and Beck, 2003). These risks are common to virtually all PPPs in every location.

Road infrastructure is distinctive in the sense that users are indeed paying the cost of finance. Metaphorically, PPP tollroads are described in Hodge and Greve (2007) as private credit cards through which government purchases the infrastructure with future road users' money rather than its own resources. Realistically, private provision does not reduce government's liability to provide road space. However, in this regard, there is an observably insufficient exercise of public accountability by government. The public sector is often seen as indifferent to the financial eventualities because inadequate care has been invested on the *ex ante* financial analysis, either by the Treasury or by the responsible public agencies, to understand the private bidders, the capability of the private proponent to undertake the project, and to test these implications.

> *It seemed to me that [the public road agency], for some strange reason, didn't pay much attention to the user. I think [the agency's] policy was that we introduce and widen the charges on motor vehicle users so that they would have sufficient funds to do what they wanted to do and so that they could engender later on perhaps a network wide charge as people became more used to charging the use of specific roads. But quite interestingly when we were doing the M1, there were two contending bids for it and broadly speaking, I have forgotten the figures, but broadly speaking one of them had a vehicle usage of 2X and a price of Y and the other one had 1X of vehicle volume at a price of 2Y and [the agency] seemed to be indifferent between the two and I thought that was quite odd because the user wouldn't be indifferent between the two. And in fact if you go back and have a look at, I think you can see some published work on this in the Audit Office's website. If you go back and have a look at the tender processes for M1, you will see that one decision was made by [the agency] under the head of MW and then RC came in and altered the decision and they chose the second proponent. So there must have been some inability of [the agency] to discern closely between these bids even though I would've thought on the basis of price you'd have a clear proponent. (Former auditor-general of a state audit office)*

In the road sector, economic instruments such as road pricing and government subsidies together with engineering instruments related to transport network integration are used to mitigate political risk, but they are usually attached to reputational risk. Road pricing has long been a politically sensitive subject (cf., Verhoef *et al.*, 1997; Viegas, 2001; Jou *et al.*, 2009). This is the main reason many governments are generally inflexible regarding limits imposed on the maximum toll a private operator is permitted to charge.

> *To me toll level is the most important political question and kind of whether you want to charge $2.50 as a starting toll for 35 years or $3 for 30 years or $2 for 40 years... One of these finer US tollroads, for example, a bunch of them went in and charged a toll and then they don't raise it for 20 years. Why? Well, because it just so happens that on the board there is a bunch of elected officials. So you can just imagine every year they sit around the table and say, should we raise the tolls? Well, there is an election next year, maybe we won't. (CEO of an infrastructure group)*

To make the tollroad economically sound with a minimum level of toll, private operators are compensated with degrees of freedom in negotiating the scope of the project, i.e., where the road starts and ends, toll escalation and the duration of the concession. Some jurisdictions, VIC for example, give the private sector the opportunity to bid for the risk allocation as well.

> *This is the expected risk allocation and in Victoria the private sector has been able to also bid their risk allocation. So the two the bidders on Eastlink put forward slightly different, not massively, but there was concession agreement with risk allocation, the state's preferred position, that both consortia looked at that and said, well look. We would want to modify that slightly here and there and they put in marked up versions effectively of the concession. So you're bidding both price and risk allocation. (Legal councillor of a tollroad company)*

Essentially these changes will create greater and longer-lasting impacts for a wider community, especially when the scope is extended. However, if not managed transparently, the reputation of government is at risk.

As noted earlier, tollroads are part of a transport network, and governments inevitably have to improve the roads flowing into and out of the tollroad by way of providing scope for alteration or additional lanes. Such decisions are often understood to generate windfall gains for the operator at public cost.

> *I mean one of the criticisms and my predecessor, TH as Auditor General, was always very critical of tollroads, private sector provision of tollroads because they're part of a network and governments invariably have to improve the roads flowing into and out of the tollroads and that results in a windfall gain to the operator because the tollroads become the main routes. Therefore you've got to provide extensions to them perhaps at public cost. You have to provide additional lanes quite often at public cost. (Former auditor-general of a state audit office)*

The initial design of the M5 motorway in the South West of Sydney scoped a number of ramps connecting the motorway with existing free roads. To prevent traffic by-passing the toll plaza, and to improve traffic flow to the privately tolled section, the RTA agreed to defer construction of these ramps until the tollroad was paid for (NSWAGO, 1994, p. 370). Soon after, when the M5 was struggling financially, the government accepted the private proponent's proposal to allow the current operator to construct and operate a toll-free extension that would have the effect of delivering increased traffic to its road (NSWAGO, 1994, p. 374). Subsequently, with little financial assistance from the private proponent,[34] the government extended both ends of the M5, eastward and westward respectively. The two free extensions funnel a considerable number of users onto the tollroad, producing a significant

[34] The total cost of stage 2 was A$65 million (1993 price) of which A$15 million was funded by Interlink (the private operator of the M5). In the opinion of the state audit office, through its A$50 million low-interest loan, the RTA funded the majority (77 per cent) of the construction cost and bore the credit risk of repayment (NSWAGO, 1994, p. 379).

windfall for the private proponent,[35] but disadvantageous costs to users and government, due to the location of the toll gate, users who have no need to travel to the private segment of the facility now have to pay a toll. The Labor Government later introduced a cashback scheme for privately registered vehicles to reimburse users travelling on the M4 and M5, spreading the financial burden among the state's taxpayers.

A similar case is the A$151 million upgrade of a public road in Melbourne, the Tullamarine-Calder intersection, which includes a new ramp that separates traffic travelling toward the city, and which has generated a minimum A$11 million profit windfall for the private operator. Although the Victorian government is entitled to an equal share of the windfall gain (which makes the total estimated minimum gain A$22M, see Transurban, 2005; VAGO, 2007, p. 46), this project demonstrates that government can exercise its power as the central planner to shift the revenue risk to motorists.

In addition to network alteration, government can decide where to situate the toll gates. For example, the M4 motorway in Sydney fills the gap between two existing freeways (NSWAGO, 1994, p. 353). During the negotiations, the private proponent persuaded the government to move the toll gate eastward in order to maximise the M4's financial viability (NSWAGO, 1994, p. 358). The situation of the toll plaza captures people travelling between Sydney and Parramatta such that at least 40 per cent of motorists who have no need to use the western section of the facility have to pay for the cost of servicing and repaying the capital of constructing the entire M4 (NSWAGO, 1994, pp. 358-359). The relocation of the toll plaza produced a substantial increase in the value of the private equity (NSWAGO, 1994, p. 363).

Reputational risk arises when adverse public perception is formed. The worst scenario is when governments are seen to be offloading public accountability.

> *However the risk of course of that, the risk of transferring reputation is a different issue and reputation can't be transferred in that way and as a result you know the [the road agency] did suffer a decrease in reputation as a result of that project. This is where the contracts between the public and private become tricky for me in*

[35] It is estimated that the stage 2 work of replacing the missing link between Moorebank and Prestons would generate an additional 3,000 vehicles per day at a day toll of A$2.00 indexed for 10 years (NSWAGO, 1994, p. 406).

working in communications because you can't transfer the risk to reputation from one group to another. (Official of a public road authority)

With private ownership, governments brush off the need to make the business economically sustainable, because financial risk has been transferred to the private operator. Surrendering 'control'[36] of toll adjustments to private ownership allows government to distance itself from congestion problems (Hensher and Chung, 2011). Participants who act in the role of public sector performance evaluators are wary of government's narrow view about PPPs. Government often does not know how to measure these risks, and does not realise that optimal risk sharing requires that these risks be retained in hand and internalised within the public sector. Public procurers only see the economic and engineering aspects of these projects, while neglecting the social dimension embedded in the essential public services these projects are meant to provide. Government's ignorance of public values has significantly undermined its reputation within the community.

Some of these major projects are seen by people as a relatively narrow engineering sort of project. Like you hire the dredge, you dig it out, you know, etc you do your procurement. But most of these projects have a community dimension to them as well, an environmental dimension, a social dimension, a public debate dimension even an ethics dimension. So one of the things that's happened in Victoria, we franchised out the tram and train system. We've also given private inspectors quasi police powers to enforce tickets and things like that. That raises all sorts of ethical issues around powers of government which are not the sort of issues and not the sort of risks that people who procure PPPs are necessarily equipped to manage. So we always mention to government to think widely about these sorts of projects. Don't just think about it as an engineering project. You think about it as a stakeholder project. You think about all the complexities and I've been talking about that. So absolutely community interest in these is very strong. (Assistant auditor-general of a state audit office)

[36] Single quotation marks are used to hint that private operators do not have full control over the toll escalation. Toll adjustments for all Australian PPP tollroads are subject to the respective state government's consent.

3.4.9 Media risk

PPPs create contractual liabilities and obligations among the contracting parties to deliver public services in order to meet the expectations of multiple stakeholders, including the public (Demirag and Khadaroo, 2008). Public perception is a malleable object, and the media, which is regarded as the representative of many key stakeholders in a democracy, serves as an effective channel through which public perception is shaped. The impact of media coverage can be instant and can extend beyond immediate users. Second to the state parliament, the media is also a highly influential vehicle through which criticism raised in the auditor-general's report is heard and attended to by politicians and bureaucrats. Especially in the PPP domain, the media's interest in the findings of performance audit reports exerts significant pressure on the bureaucracy.

> *The media is quite important. It's the only weapon the Auditor General has really, it is for the media to report something so that the government…The government is not going to respond to the Auditor General but the government will respond to responses to the Auditor General and the media is the important vehicle for that. I mean the Auditor General's only weapon is the report. I mean they're not part of the executive. They can't determine where resources are allocated. They're not part of the judiciary. They can't impose fines and penalties and the like. The only thing they can do is report and to have an impact you have to report in a way that allows the media some role. (Former auditor-general of a state audit office)*

A well-maintained relationship with the media is equally important to the private and public sectors, as it serves as a medium of community expectations and public perception management. The experience of the CCT illustrates that media risk is a sensitive and difficult issue to manage. One participant highlighted that the NSW government's poor management of the media directly contributed to the CCT issue.

> *[The CCT issue] went from post opening wrinkles to a migraine to a catastrophe in the space of a short period of time. (Former state minister for roads)*

PPP parties are now devoting more efforts to managing the powerful media, albeit slowly. A proactive approach of keeping the media informed fast-tracked the completion of the LCT. A dedicated media relations unit inside the public agency helped to maintain an open dialogue with the public about the progress of the Brisbane North-South Bypass Tunnel. Transurban devotes substantial human resources to communicating project benefits to the media, which in turn, conveys information about these benefits to the public. All participants expressed a wish that such efforts would gain media support and hence translate into positive public perceptions of the PPP scheme.

3.4.10 Risk of public misperception

Public perception can be conducive or detrimental to a proposed PPP road. Unfortunately, this generally escapes the forecasters' attention. The CCT lesson, for example, showed for the first time that traffic modellers need to take into account perceived community resentment about a facility. It is important to realise that how a project is managed in the public realm is an important driver of resentment or support.

> *For the first time traffic modellers I suspect have to take into account community resentment about a facility or perceived resentment over whatever issues and I think that's where things are changing and it'd be interesting to see how people approach the next one. Hopefully people will learn from it. Hopefully the private sector will realise how a project is managed in the public realm is really important in terms of driver resentment. (Official of a public road authority)*

Adverse public perception is manifested in the lack of public support, resulting in delays in project approval and consequent contract variations. The most debatable issue in this regard is who should be responsible for the risk of adverse public perception (cf., Li *et al.*, 2005a).

To investigate this risk, the differences in public perception toward road pricing versus toward private ownership of tollroads need to be carefully distinguished. Studies investigating users' attitudes toward road pricing (Odeck and Bråthen, 2002; Whitehead, 2002) report that pricing can be made more publicly acceptable if users are confident that revenues so generated are hypothecated to public road and transport investments. This sort of confidence may not eventuate with PPP tollroads, since toll revenues are the source of return on private capital, and it is rare that these revenues are available for government apportionment[37].

We are unaware of any study on the public's attitude toward private ownership of tollroads. Anecdotally, labouring under the perception that they own roads through their tax contributions, the public has been finding it difficult to accept the concept of private ownership and private operation of roads. Many early PPP roads encountered this problem, experiencing the public's consequent refusal to use these facilities.

Governments have a vested interest in reducing public aversion and are active in this respect. Currently, public perception is managed by Australian governments in two tangible ways: the *Value for Money Statement* (VFMS) and the *EIS* (EEA VIC, 1978; EP&A NSW, 1979; EP&A Regulation NSW, 2000). The VFMS is a government-endorsed public document through which the project procurer communicates to the community about how the procurement can result in VFM. The idea underlying the VFMS is to pressure governments to structure the deal so that the community can have confidence and assurance that the tendering competition, the way the tolling model is structured, and the method by which the procurement is offered to the market, are designed to extract value for the community. Many respondents were convinced that community perception should be managed early in the process, back at the EIS stage. If the authority takes on board the community's views at that early stage, public resistance can be minimised.

> *But I think it's just sort of that perception that you know people don't realise that tollroads actually can potentially reduce the cost of a trip using less petrol, less stop-start time and all that sort of stuff and I think people sort of slowly starting to become aware of that as well. It's all just sort of managing the community properly. It will help to reduce this aversion to them... I think it's something that's got to be started very early in the process right back at the environmental impact*

[37] As detailed in Chapter 2, recent Australian PPP tollroad concessions have provisions for governments to share upside gains. The private proponent is contracted to pay an incentive rent to government only when the actual revenue receipts are greater than the predetermined threshold. To date, no evidence suggests that any incentive rent has been received by any Australian governments.

stage... Taking on board the community's views about you know where the ventilation stacks are and where entry points are. If you have decent ramps into the project and that sort of stuff. I think on Lane Cove Tunnel there are issues about the entry ramps with Epping Road. But if they can take on the community's views and those sorts of things certainly assists acceptance of them. (Consultant of an investment bank)

One example is the $A60 million shared lane for bikes that was scoped into the design of Sydney's M7 by the RTA and subsequently financed and built by Macquarie Infrastructure Group (MIG) together with other members of the consortium.

Most public misconceptions about tollroads come from a lack of understanding of the benefits they generate. Tollroads can produce significant positive externalities such as savings in travel time and fuel efficiency from reduced congestion (Verhoef *et al*., 1997), increased property values in the neighbourhood from higher accessibility, and greater business productivity and economic vitality from increased mobility (Munroe *et al.*, 2006). The private sector is partly responsible for inadequately conveying information on these benefits to the public. In the past, private operators allocated few resources to promoting the benefits of tollroads due to the myopic focus on cost minimisation. This has proven to be one of the impediments to patronage of the CCT.

An often-neglected issue is market segments. An urban environment is not a homogenous market with all risk perceptions and travelling and living habits exhibiting strong localised patterns. Most tollroad companies have the philosophy that if they build a tollroad, people will use it, without actually understanding the market they are selling to. However, the private sector is gradually realising that the best mitigator of public disapproval is to make the project part of the community. Transurban positions itself at the forefront of this initiative, followed by the MIG. They adopt a good corporate citizenship model, actively engaging with community groups along the whole of the corridor, regardless of whether they are potential users or not. Both companies take part in many community activities even if they are not customer-related. Examples are tree planting initiatives and temporarily shutting roads so they can be used for events such as 'Run for the Kids' to raise money for charity. They have also donated money collected from tolls for a given period from investments in a number of

Sydney motorways to the 'Drive for Charity' day. Communities do value these corporate inputs and public perception is slowly becoming supportive.

> *Engagement with the community includes both the community in the corridor whether they're users or not. We have a responsibility you know the classic words "good corporate citizen". You know it's important that we are part of that in that corridor. So we have all sorts of community engagement be it customer related or otherwise. It might be tree planting. It might be a whole range of issues that relate to our effect on the community and our interaction with the community. So we do a lot of work in relation to having events you know, 'Run for the Kids' in Melbourne, for example, is done to raise money for charity. We shut down the road and to use it for that purpose as an example. So we always had a philosophy wherever we go in Australia or in the US, for example, that there's got to be engagement with community groups and the whole of the corridor. But also this customer service side, that's just good business. (Legal councillor of a tollroad company)*

> *But the interesting thing to me is doing stuff to try to some extent be part of the community. We have this drive for charity day which you know where all the toll money got donated from the M4 and M5 and ED to charity and I do think you're trying to buy yourself in. It is a hard sell at the end of the day. Tollroads aren't glamorous and you get the bang when they open but other than that. It's interesting though, you know, Blacktown City Council when the M7 was announced put up signs that said, 'No tolls, no tolls' and through our management of it, and part of our management part of this event was desperately needed. Ultimately we had a letter that they wrote to us about a month before we opened, saying this was the greatest thing since sliced bread. Part of them had given up on the problem on trying to argue against tolls because they have been told enough times it was just happening. But part of them was kind of they had gone on board with the fact that the economic development that was going to come from it was actually for their constituents more importantly than for the toll. (CEO of an infrastructure group)*

The overall impression is that public misperceptions about PPP tollroads can be corrected by involving the public early in the EIS process. The EIS should promote the pros and convey the cons that the project may generate, as well as demonstrate how public values will be considered and improved. Given the difficulty to hypothecate toll revenues to public reinvestment, there is significant scope for private initiatives to enhance public confidence with respect to the derived benefits of tollroads.

3.5 Summary of Findings

This chapter has investigated key stakeholders' risk perceptions of PPP tollroads in the following dimensions: (a) the dominating risks concerning the public sector, and the risks concerning the private sector; (b) the public/private sector's capacity to manage risks; (c) considerations that drive each party entering into a PPP tollroad contract, and the extent to which these considerations influence their approach to negotiating risk allocation; and (d) the process by which levels of tolls are determined.

All participants felt strongly that significant VFM generated by partnership schemes has been translated into commercial and social benefits. Experience accumulated over time and across projects has contributed to the betterment of risk-sharing optimisation among PPP parties. Yet many PPP tollroad projects have experienced teething problems between the contracting parties as the result of misconceptions, and hence, misallocation of risks. Noticeable disparities over which party should bear certain risks reveal the chronic tensions between the public and private sectors in a number of areas. A matter of concern is the perception that certain risks should be left to the party that is understood to be best able to manage those risks. Our investigations suggest that most risks should be shared by both sectors even though some risks may be perceived to be in the domain of the respective sector's field of expertise.

All participants confirmed that perceptions about which party is best able to manage certain risks have a powerful influence on final risk allocation. Both sectors perceive that the private sector has developed sophisticated approaches to managing commercial risks, due partly to accumulated experience and partly to increasing market competition. The most prominent commercial risks in tollroad projects are identified as traffic risk, financial risk and risks associated with ownership. The private sector's capacity to cope with these risks is guided by the perception that this sector (a) is better equipped with traffic modelling expertise; (b) has wider access to financial instruments to package the best deal to handle financial distress; and (c) has greater incentive and operational flexibility to drive outcomes forward and achieve cost efficiency over the asset's whole-of-life cycle. These perceptions, however, often contrast with the reality as the poor traffic forecasts in cases studies reviewed in Chapter 2 and the GFC experience entail.

The private sector's main concerns are network risk, sovereign risk, *force majeure*, media risk, and risk of public misperception. The view is that these risks are beyond the expertise of the private sector, and that the public sector should handle these risks in a manner that assures the profitability of private investment in roads. Armed with these perceptions, the private sector seeks to negotiate with government on preventive measures to minimise risk occurrences. One such measure is that constraints be imposed on transport network development or the private sector will demand financial compensation from government under the MAE approach.

The public sector is perceived to be best able to manage risks that are in the domain of public governance, including network risk, sovereign risk and risk of unclear project objectives, because network planning matters, assurance of certainty and consistency in legislation, and the setting of project objectives and their enforcement through public policy all require government's judiciary power. Governments are most concerned with issues of transport network fragmentation; projects being unwanted by the community, with the possibility of political and reputational repercussions; unpopular media coverage; and public misperception. The task of balancing these conflicting objectives between the two sectors is not without difficulties. This mission is in part executed with careful trade-offs between politically sensitive components – toll pricing, and other economic (e.g., subsidy) and engineering (e.g., project scope) means.

This phenomenon is not unique to Australia, but has more general applicability (Estache *et al.*, 2000; de Palma *et al.*, 2007b; Acerete et al., 2009). We have seen that restraint on the levels of tolling that a private operator is permitted to charge is a common approach to minimising political risk. But engineering and other economic means implemented at public cost to compensate private capital for the reduced unit price often place government's reputation at risk. This knowledge of the process in which the levels of tolls are determined has raised a fundamental question about the true value of toll pricing. Such political interference has serious implications in that current practice may have undermined the power of the pricing mechanism in allocating scarce road space.

Both sectors have reservations regarding the willingness of the other party to invest in understanding the respective risks they are managing. The private sector's capacity is handicapped by its myopic focus on cost minimisation and self-profitability, notwithstanding that the financial success of any tollroad is crucial to an integrated transport network. The problem is compounded by the different views regarding the bandwidth of risk tolerance held by various parties within the SPV, which may create distortions in traffic estimates.

The subject of the public sector's capability to manage risks that are in the public governance sphere is more complex. Many participants argued that the apparent lack of exercise of public accountability by government authorities indicates that governments do not know how to measure these risks; and public authorities' indifference to the financial eventualities of these tollroad projects has led to the underestimation of reputational risk. Further, roads are vital components of the transport network and urban development. Many portfolio ministers, such as ministers for planning, transport, and roads, and even local councils, have vested interests in roads. The intricacy of reconciling conflicting interests among public sector agencies obscures the clarity of project objectives.

The most vexed issue centres on risks that have been transferred to the extent that they have imposed a threat to public value. Gradually, market competition has transformed PPPs from an approach of risk guarantee by government to a paradigm of risk dumping by government. On occasion, competition has driven private bidders to compete on levels of risk that they were reluctantly prepared to accept. It seems that the danger warned of by Arndt (2000) that government would use competitive pressure to over-transfer risks has materialised. A true partnership needs a continual multi-faceted dialogue between all levels of government and the private sector to facilitate mutual learning of each sector's perceived ability to manage risk.

Some of the findings in the current chapter concur with those identified in Arndt (2000), suggesting that different parties' conflicting aims have a prolonged effect on risk allocation, and the misuse of market competitive forces may distort the ethos of optimal risk-sharing. Nevertheless, new risks gradually emerge as the PPP market evolves. The most prominent issues are associated with social dimensional risks and public misperceptions about what a PPP project is setting out to achieve. The media is a powerful channel through which the PPP scheme is embraced or rejected by malleable public perception. At present, it seems that transparency and coordination between the public and private sectors may have resulted in the PPP scheme generally being considered positively, yet it remains far from clear which party is best positioned to take responsibility for newly emerging risks. The new challenges faced by governments and private proponents warrant further research aimed at simplifying the complex risk allocation process in order to adapt to the continuously evolving nature of PPPs.

3.6 Chapter Conclusion

In summary, this chapter has sought to answer Research Question One – *To what extent is the outcome of risk allocation between the public and private sectors influenced by risk perceptions of different stakeholder groups* – through in-depth interviews with stakeholders who have been actively engaging in or evaluating PPP tollroad concessions. Our findings have confirmed that perceptions of risk have a decisive impact on the outcome of risk allocation. The cases we have discussed in the chapter show that misallocation of risk was often caused by misperception not only of risk but also of contracting parties' ability to manage risks.

In the course of our investigation, we have identified the key risk dimensions and the likely levels associated with each risk attribute that a range of stakeholders have suggested are the main drivers of the PPP risk allocation process. These important findings are summarised in Appendix D. Although the interviews were conducted in Australia, given that this country has been a pioneer in tollroad projects under PPPs, and that many Australian construction companies and banks are now active in this field on the international stage, the evidence herein is of global interest.

The risk attributes are the key variables for our research task number three. They also form the basis of our hypotheses formulation in the following chapter. With this critical knowledge, we are ready to proceed to the next step. The findings above, which confirm that perceptions of risk will have an impact on individuals' risk-taking behaviour, steer us to call on the literature examining risk-sharing behaviour among economic actors who are heterogeneous in interests, objectives and risk preferences. In Chapter 4, we will establish the theoretical elements required to specify a framework that can accommodate our analytical needs. The skeleton of the framework is constructed on antecedents in theories of contracting, which will enable us to develop a series of hypotheses for empirical testing within the setting of decision making in risk allocation.

CHAPTER 4: RISK ASSESSMENT IN PPP CONCESSIONS – INTUITIVE HUNCH OVER RATIONALITY?

4.1 Introduction

Theories of contract are often invoked to both explain and justify exchange arrangements, their resonance with PPPs being principally derived from agency theory (AT) (Laffont and Tirole, 1991; Dewatripont and Legros, 2005); theory of incomplete contract (ICT) (Schmidt, 1996; Hart, 2003; Bennett and Iossa, 2005) and transaction cost economics (TCE) (Parker and Hartley, 2003; Välilä, 2005; Jin and Doloi, 2008; Ricketts, 2009; Soliño and Gago de Santos, 2010).

In this chapter, we explore from the contracting perspective how the PPP method might incentivise risk-sharing, i.e., Research Question Two. The aim is to seek a greater understanding of the interactions between public sector authorities and private sector agents during contract negotiations with respect to risk-sharing outcomes. This leads, in the next section, to discussion of the economic and behavioural perspectives of deploying private provision in public infrastructure delivery. Section three outlines theories of contract. Section four takes a closer look at PPPs through the lens of contract and develops a set of hypotheses inspired by the contracting literature to test the rationale of PPPs. The final section summaries the chapter findings.

4.2 PPPs – Contractual Partnerships

It has been argued in the literature that the PPP procurement method that formalises the rationale of allocating risk to the party that is the least risk-averse in long-term contracts between government authorities and private proponents has opened up a "new paradigm for government contracting" (Evans and Bowman, 2005, p. 66).

A contract is a set of mutually agreed promises under which parties make *ex ante* reciprocal commitments in terms of their *ex post* behaviour to coordinate (Brousseau and Glachant, 2002, p. 3; Brousseau, 2008, p. 37). This interpretation is premised on two dimensions of contract: the multilateral agreements coordinated via a governance structure to reduce *ex ante* decision costs; and *ex post* behaviour conditioned on decision-making structures.

Within PPP governance are the partnering relationships between the public procuring authority and multiple private proponents who are organised together under a single entity called the SPV; the relationships being bounded by long-term contractual commitments to deliver infrastructure-based services (cf. English and Skellern, 2005; Zarco-Jasso, 2005). These multilateral commitments are not short of complexity, and include imperfect information, knowledge asymmetries and uncertainty about future events. When confronted with such complex conditions, decision making is predominantly dictated by human cognition. The cognition costs that arise from human responses to uncertainty and imperfect information have significant implications for the institutional framework (Joskow, 2008), be it in law and order enforcement, organisational form, or multilateral contracting; and such institutional framework in turn frames the contractual behavioural of the agent (Brousseau, 2008).

Notwithstanding the extensive discussion on risk allocation in the PPP literature, such as Acerete *et al*. (2009), Akintoye *et al*. (2003), Broadbent and Laughlin (2008), Becker and Patterson (2005), Bennett and Iossa (2006), Bloomfield (2006), Corner (2006), Duffield (2001), Edwards and Bowen (2003), Edwards and Shaoul (2003), English and Walker (2004), Froud (2003), Grimsey and Lewis (2002), Shaoul *et al*. (2007) to name just a few, and the extensive literature on decision making under uncertainty, synthesised in Gilovich *et al*. (2002), behavioural theories have gained little momentum in PPP research, with only two sighted studies (Arndt, 2000; de Palma *et al.*, 2012) linking a decision-maker's perceptions of risk to prospect theory. Both studies concurred that asymmetries in the risk perceptions of decision makers will prejudice the design of an optimal contract.

Before we examine PPPs at the contract level, we shall begin the investigation from a broader perspective. The debate on the matter of ownership to infrastructure delivery is the most contentious issue that any PPP research should be mindful of.

4.2.1 Contracting the State: PPPs – The Broader Perspective

Dissatisfaction with the performance of state enterprises grew in the latter part of the twentieth century, with a wave of reforms involving a reduction in direct state provision of goods and services across the world (Parker and Saal, 2003). It was argued by protagonists like Shlefier (1998) and Schmidt (1996), that market contracts are preferred to state ownership for the production of public goods. Ever since, various forms of partnerships with the private sector have flourished.

Arguments in favour of the pricing mechanism presume that the market would have achieved higher productive efficiency relative to the state (Meunier and Quinet, 2010). The perplexity that the apparent failure of the pricing mechanism coexisted with the growth in government regulation is, in Coase's words, a phenomenon of the enforceability of property rights: "when [enforcement of property rights] is done...chaos disappears; and so does the government" (1959, p. 14), except that the necessary legal system to define property rights and to arbitrate disputes is not costless (Coase, 1960; Williamson, 1991). In the pursuit of minimising *ex post* transaction costs, the step of formalising rules of the game to define property rights and to enforce contracts must be followed by a governance structure to institutionalise 'the play of the game' (Williamson, 2000). PPPs have become a predominant institutional structure to govern the play of the game between government authorities and private sector actors (Hodge and Greve, 2009).

4.2.2 Are PPPs Contractually Efficient?

Although the focus here is not to join the chorus of debate over public versus private ownership, it is worth noting that discourses of agency cost that believe that lower-powered incentives of public bureaus are the primary source of inefficiency (Brealey *et al.*, 1997) completely miss the points argued in ICT and TCE.

We have explained at length in Chapter 1 that PPP concessions are contractual agreements with respect to long-term service provision derived from a specific asset. These long-term investments are divided into two phases that are very different in character, as well as in service and skill requirements: the construction phase, which relies on a substantial amount of capital investment and project management skills to bring alive a complicated project in time and within budget; and the O&M phase, which requires sustainable market demand to recoup the capital investment, and specialised skills to manage economic and political turbulence over the concession term.

The inevitably high uncertainty brought about by the longevity of these contracts would require an elaborate governance apparatus for these specific investments (Williamson, 1979, p. 254). The idea that empowering concessionaires with the ownership right attenuates *ex post* opportunistic hazard has been attested elsewhere (see Rindfleisch and Heide, 1997, for a comprehensive review of empirical studies of TCE). PPPs deploy similar mechanisms for the purpose of facilitating risk-sharing across contracting parties by packaging the operation of the asset with the finance of the asset. The empirical findings in Chapter 3 have asserted that this package fosters efficiency by enabling the private owner greater flexibility to manage market and project risks, allowing the public sector procurer to concentrate on other dimensions of risk that are best not left to the market.

Nevertheless, some researchers are of the view that the PPP concession approach to infrastructure delivery is at odds with transactional efficiency. Parker and Hart (2003) concluded that under the contracting environment featured in information asymmetry, asset specificity and the likelihood of *ex post* opportunism, PPPs in the UK defence sector did not economise transaction costs, nor did they improve economic efficiency. Evidently, the problem was more apparent in public transport. The British experience illustrated that bringing private provision into passenger rail has created contracts that would not exist if left to the pure market pricing mechanism. The outcome was witnessed as a flawed "contractual and market structure imposed by administrative fiat" (Tyrrall, 2004, p. 37), the contracting process being politicised in order to provide the promised service, which would otherwise be impossible for the distant future, and to keep the public sector debt off the balance sheet (Ricketts, 2009, p. 9).

4.2.3 Human Actors and Decision Making in PPPs

Despite critics having differing views in regard to the PPP structure incentivising greater efficiency, they share some common ground – the outcomes of contract negotiation are steered by human actors. Many will concur with Simon (1997a) that human processes of reasoning are the building block of economic theory. Attributes of human behaviour, such as self-interestedness, opportunism and bounded rationality (BR), paired with contractual incompleteness, will manifest themselves as adverse selection, moral hazard, and other forms of strategic behaviour. On the other hand, the capacity of conscious foresight will guide contracting parties to look ahead, recognise potential hazards, resolve contractual ramifications, fold these into *ex ante* contractual negotiations, and enjoy the *ex post* advantage of reduced transaction costs (Williamson, 2000).

Edwards and Bowen's (2003) attention to the social perspective of risk pinpointed that risks in PPP projects were those of the project stakeholders participating in them. It follows that any risk must be perceived by human beings. These perceptions were diverse because they were influenced by value systems, and hence by attitudes, judgements, emotions and beliefs. Such diversity manifested itself in the meaning of risk – different risks would mean different things to different people, and some risks would even mean different things to the same people at different times in their lives or under different circumstances (Edwards and Bowen, 2003, p. 85). This illustrates that the magnitude of the environment within which the human mind operates can form and shape perceptions, as documented in the psychology and economics literature (cf., Hertwig and Ortmann, 2005).

These normative viewpoints mirror the basic psychology principles of perception and judgment, in which an agent's conception of the acts, outcomes and contingencies associated with a particular choice (or decision frame) is prescribed to be partly controlled by the norms, habits, and personal characteristics of the decision maker (Tversky and Kahneman, 1981). The likelihood that perceptions of risk will vary among different stakeholders warrants the investigation of each agent's decision frame as the vital role in risk management. As such, Edwards and Bowen (2003) paved the way for an important prospect in the research field of PPPs that encompasses cognitive science in the search for risk-sharing optimality.

Two studies pursued this path. Arndt's (2000) empirical study employed semi-structured interviews followed by a qualitative survey to elicit the impact of human behaviour on final risk allocation in PPPs. The result showed a significant proportion of respondents (32 per cent) believed that a financier's requirements may be irrational and therefore hinder market development. The overwhelming correlation between the role of stakeholders and their perceptions regarding the importance of various factors in influencing the final risk allocation for a project concurs with the general finding in the field of behavioural research, which asserts that dimensionalities of risk are perceived quite differently by different individuals. An interesting finding of Arndt's study showed that the ability of a party to take on risk bears no significant influence on risk negotiation (p. 325). This result may potentially refute the fundamental risk-sharing rationale of PPPs, because understanding a party's ability to manage risk adds little value to the risk-allocation process. Although his empirical results offered little support for the economic rationale of PPPs, there was strong evidence endorsing the vital role of human cognition in achieving optimal risk allocation with reduced transaction costs. Prospect theory seems to bear a remarkable congruence with these findings: upside gains were not valued as highly as downside risks by stakeholders, with the potential distortion of overpricing risks (p. 326); and certainty was highly valued as a crucial factor in minimising transaction costs (p. 323), highlighting the importance of a consistent approach to risk allocation in the presence of uncertainty.

de Palma *et al*. (2012) is the most recent study that examines the risk-sharing rationale of PPPs from the behavioural perspective. They proposed a typology emphasising that contracting parties' perception bias would complicate the rational evaluation of risks. In line with prospect theory, the study suggested that due to differences in decision-makers' subjective probabilities and aggregation bias, which would result in overestimation of low probabilities but underestimation of high probabilities, it would be very unlikely that costs of uncertain events would be borne by contracting parties, leading to substantial costs for taxpayers. These biases may explain why PPP projects often meet opposition from the public.

Another dimension of de Palma *et al*. (2012)'s typology lends itself to AT, with the public sector acting as the principal and the private sector as the agent, to examine the impacts of asymmetry of roles and of information between contracting parties. Their proposed model introduces partnership risks that are distinctively different from those intrinsic to the project, and expands the key assumption underlying AT, i.e., the agent has more information about its own actions and the state of nature. The model allows for two-way information asymmetry, and states that it is possible that the principal holds more information than the agent, so both parties equally face risks of the partnership. The paper further delves into another key assumption of AT, namely, conflicts of interests between two parties, and predicts that the consequential incentives used to distort the facts will further exacerbate perception bias. Following ICT's assertion that decision makers may intentionally withhold full disclosure of their true preferences toward risk in order to gain greater residual rights over the *ex post* distribution of surplus (Grossman and Hart, 1986), the proposed model foresees that information incompleteness would affect the design of the optimal contract.

Although remaining empirically untested, de Palma *et al*. (2012) have shed important light on a new dimension of PPPs: triangulation of perception bias. AT and ICT represent a significant breakthrough in PPP research suggesting that a paradigm that integrates theories of contracting and behavioural choice may offer greater insight into the optimisation of risk-sharing. The following section will survey contracting theories, with attention drawn to the embedded behavioural assumptions. This will be followed by analysis of PPPs through the lens of contract.

4.3 Theories of Contract

In the contracting literature, three approaches have come to dominate the analysis of contracts: AT, ICT and TCE. They are distinguished by differences in their underlying assumptions, in their emphasis on different motives to contract, and different functions of contract.

Structuring contracts to share risk in light of incentive problems is the central premise of AT and ICT. AT focuses on remuneration schemes; contracts are drawn up to facilitate risk transfer and foster incentive alignment (Masten and Saussier, 2002). ICT has its roots in the effects of property-rights allocation on distribution of the residual surplus between contracting parties, and on parties' incentives to invest (Brousseau and Glachant, 2002, p. 10). Both AT and ICT focus on the *ex ante* aspects of contract, interpreted as efforts to overcome the incentive deficiencies of contracting traditions and property rights (Williamson, 1985, p. 26). TCE considers contracts as devices structured *ex ante* to foster *ex post* efficiency, hence placing greater emphasis on *ex post* support institutions of contract (Williamson, 1985, p. 29). TCE argues that the study of economic organisation has to go beyond incentives and ownership to include an examination of governance (Williamson, 1985, p. 393), and economic activities should be organised in transaction cost-economising terms (Williamson, 2000).

While AT and ICT have achieved greater success in developing formal models of contracting behaviour, they fare poorly in empirical validation (Brousseau and Glachant, 2002; Masten and Saussier, 2002), and they are also unable to explain the existence of various forms of governance structure (Brickley, 1999; Williamson, 2000). On the other hand, TCE is an empirical success story covering different classes of solutions to coordination of problems, ranging from markets, through hybrid forms, to hierarchies (Shelanski and Klein, 1995; Rindfleisch and Heide, 1997). The remainder of this section will discuss each of the three approaches in detail.

4.3.1 Agency Theory

AT focuses on the design of incentives and revelation mechanisms aimed at channelling *ex ante* the *ex post* behaviours of agents within a firm (Brousseau, 2008). It is concerned with the search for an optimal contract of risk-sharing between the principal and the agent (Ross, 1973; Holmström, 1979; Mirrlees, 1999). The agency relationship is described using the metaphor of a contract: it views the role of contracts as a vehicle of voluntary exchange (Alchian and Demsetz, 1972), and seeks to explain various organisations of the firm as the locus of contractual relations within which the conflicting objectives of individuals are brought into equilibrium (Jensen and Meckling, 1976; Fama, 1980; Fama and Jensen, 1983a; Fama and Jensen, 1983b; Jensen, 1983; Jensen, 1986).

The elementary unit of analysis is the individual actor. The behavioural assumptions are that economic actors are rationally bounded, have different preferences toward risk (Arrow, 1971), and display a propensity for shirking opportunism (Alchian and Demsetz, 1972). BR justifies conflicts of interests between individuals (Charreaux, 2002, p. 261), and is responsible for risks being the consequence of outcome uncertainty (Eisenhardt, 1989). This is because economic actors elicit 'complete' information by envisioning the future on the basis of a subjectively held probability distribution, which unfortunately is prone to error due to BR (MacLeod, 2002, p. 219). As the analysis unfolds, we will see that many of these behavioural assumptions are shared by ICT and TCE. Furthermore, factors of analysis in the other approach, i.e., institutional factors described in TCE, will in turn have an influence on AT's outcome uncertainty (Eisenhardt, 1988).

These behavioural attributes translate into agency problems of inefficiencies and transaction costs. Information asymmetry between the principal and the agent gives rise to *ex ante* inefficiencies, known as adverse selection, and *ex post* inefficiencies of moral hazard (cf., Holmström, 1979; Mirrlees, 1999). The resultant transaction costs include (a) costs of information searches in order to reduce inefficiency of adverse selection and (b) costs of monitoring and enforcement to ensure the agent fulfils the terms of the contract so as to minimise losses from moral hazard. Cooperative behaviour among self-interested individuals who have different risk preferences gives rise to transaction costs in other forms, such as negotiation costs, bonding costs and residual loss (Jensen, 1983). Positive transaction costs together with outcome uncertainty that ramifies the trade-off between risk and reward have a decisive effect on the choice of contracts (Eisenhardt, 1989).

Solutions to these problems are formulated in contracts by the principal as an *ex ante* incentive alignment to (a) induce self-revelation by the agent of their private information, and (b) induce the agent to adopt behaviour compatible with the interests of the principal. In this light, the firm can be regarded as a nexus of these contracts (Alchian and Demsetz, 1972) within which "the conflicting objectives of individuals ... are brought into equilibrium within a framework of contractual relations" (Jensen and Meckling, 1976, p. 311) with the aim of minimising agency costs (Jensen, 1983, p. 331).

AT's propositions have found an empirical foothold in the literature on managerial labour markets and the financial sector (see Windram, 2005 for a review), and on the incentives of co-alignment of managerial behaviours with owner preferences and the choice of contracts (see Eisenhardt, 1989 for a review). More recent empirical investigations of AT are found in the literature on franchising and supply chain management (Brickley *et al.*, 1991; Brickley, 1999; Rossetti and Choi, 2008) and procurement of transport contracts (Merkert and Hensher, *in press*).

4.3.2 Incomplete Contract Theory

AT provides an explanation for the firm's inner organisation rather than a rationale for the firm's existence; the ability to explain the existence of firms is covered by ICT. ICT focuses on the elicitation of *ex ante* investments, and is chiefly concerned with the low describability of transactions *ex ante* and uncertainty due to the absence of complete information on future states. In anticipation of large transaction costs involved in writing a comprehensive contract and the rigidity of court enforcement of written contract terms, parties to a relationship will prefer to settle with a contract that is incomplete (Klein, 1996). Distribution of rights to capture *ex post* surplus is managed through renegotiation frameworks (Brousseau, 2008). Property rights are at the centre of ICT's analysis – in Hart's word: "[it is] incompleteness [that] opens the door to a theory of ownership" (1993, p. 141). Property rights empower the owner with a bundle of *ex post* decision rights: (a) ability to act on uncontracted-for provisions and therefore have greater incentive to invest *ex ante* (Grossman and Hart, 1986); (b) protection against *ex post* expropriation on investments (Laffont and Tirole, 1991); and (c) residual rights to insider information (Schmidt, 1996).[38]

The foundation of this theoretical framework had its origins with Grossman and Hart (1986), Hart and Holmström (1987), and Hart and Moore (1990; 1999). Its behavioural assumptions regard contracting parties as rational without constraint, whereas the rationality of an outside arbiter (the judge) is irremediably bounded – a premise that necessitates the relevance of *ex ante* asset ownership (Hart, 1990). Credible commitments, reputation and trustworthiness of contracting parties play little role in ICT because of the judicial imperfection that believes that contract variables are observable but not verifiable (Hart, 2002).

[38] Laffont and Tirole (1991) magnify the trade-off between efficiency and asset expropriation when the regulated firm has an information advantage. Its extended model (Schmidt, 1996) considers regulation with asymmetric information. Both models are integral to the theory of property rights and incomplete contracts. The analysis on PPPs however, is most extensively based on Laffont and Tirole's proposition, which features symmetric information with contract incompleteness and uncertainty.

Since contracting parties have access to symmetric information, costless *ex post* renegotiation guarantees *ex post* efficiency. The only issue that matters is the governance structure, especially the assignment of residual rights, because it affects the incentives of the contracting parties (Hart and Moore, 1990) and determines the distribution of *ex post* surplus (Grossman and Hart, 1986, p. 696). However, distortions to *ex post* distribution are expected when contracting parties are risk-averse, because reservation of residual rights is most likely (Grossman and Hart, 1986, p. 717).

4.3.3 Transaction Cost Economics

ICT's assumptions of symmetrical information and costless *ex post* renegotiation, albeit convenient, are commonly contradicted by the reality that consists of alternative governance structures. The allowance for costly transactions and alternative economic organisations in TCE signals a significant departure from ICT and other economic orthodoxy. Moreover, ICT considers that in the state of certainty where a complete contract is feasible, the advantages derived from governance structures vaporise, whereas TCE seeks to craft *ex post* governance structures to align with the differential attributes of transactions (Williamson, 1979). In Williamson's approach, transaction costs are the comparative costs of planning, adapting and monitoring task completion under alternative governance structures. TCE explains not only why various forms of governance structure exist, but also why exchange partners value reputational effects, multilateral dependence, mutual credible commitments and self-enforcing agreements.

Acknowledging that complex contracts are invariably incomplete (Williamson, 1975, p. 20-36; p. 91-94) by reason of the BR of not only the outside arbiter but also the contracting parties, TCE attaches special significance to the microanalytics of *ex post* contract execution consequences, with emphasis on private ordering (compared with court ordering), and regards the contract as the basis for ultimate appeal (Williamson, 1985, p. 163-205). His approach postulates that embedded in a cost-effective governance solution is the conscious looking ahead and uncovering contractual hazards of *ex post* implementation arising during contract execution intervals (Williamson, 2000).

4.3.3.1 Key attributes

The significance of Williamson's TCE framework is twofold. First, the identification of human factors (BR and opportunism) as a set of key attributes in studies of economic organisation. Second, the analysis of contractual hazards through the joining of human factors with dimensions of transactions (uncertainty and asset specificity).

4.3.3.1.1 Human factors: Bounded rationality and opportunism

> *Bounded rationality, a rationality that is consistent with our knowledge of actual human choice behaviour, assumes that the decision maker must search for alternatives, has egregiously incomplete and inaccurate knowledge about the consequences of actions, and chooses actions that are expected to be satisfactory (attain targets while satisfying constraints)...Of course, unpredictability, whether due to lack of reliable data, inadequacy of theories, or limitations on computational capabilities is at the very heart of bounded rationality (Simon, 1997a, p. 17; p. 66).*

BR of economic actors as well as the enforcer highlights the importance of the institutional embeddedness of contract. Within Williamson's framework, BR regulates all forms of comprehensive contracting (Williamson, 1993), because it is "the cognitive assumption on which transaction cost economics relies" (Williamson, 1985, p. 45). The resultant predictions are that economic actors are assumed to be "intendedly rational, but only limited so" (Simon, 1997b, p. 24). The intended rationality elicits a utility-maximising orientation (Williamson, 1985, p. 45), consistent with what Simon (1997a, p. 18) termed "substantive rationality", which is concerned with analysing the situation but not the decision maker. Limited cognitive competence[39] lends itself to the study of decision making, and coincides with Simon's (1997a, p.18) "procedural rationality" that is concerned with how the decision maker generates alternatives for proposed actions and compares them. The rational person of the latter kind goes about making decisions in a way that is procedurally reasonable in light of the available knowledge and means of computation. Accordingly, it necessarily rests with a theory of human cognition to study the decision-making process itself (Simon, 1986).

`Economising BR takes several forms. The first entails decision processes that involve heuristic problem-solving; examples include individuals adopting decision-making strategies to simplify the process when tasks become more complex (Payne, 1976; Russo and Dosher, 1983). The second form concerns the governance structure that occupies the heart of TCE.

[39] Limited cognitive competence is explained thus: "… the capacity of the human mind for formulating and solving complex problems is very small compared with the size of the problems whose solution is required for objectively rational behaviour in the real world – or even for a reasonable approximation to such objective rationality" (Simon, 1957, p. 198).

The physical limits of BR "take the form of rate and storage on the powers of individuals to receive, store, retrieve and process information without error" (Williamson, 1975, p. 21). These conditions pose limitations on the contracting parties' ability to conceive all the possible contingencies *ex ante*, or to contemplate all the aspects of complex investment decisions. As such, governance models that place large demands on cognitive competence are relatively disfavoured and long-term contracts are unavoidably incomplete (Williamson, 1985, p. 46). The third form involves interactions between economic actors where greater understanding of the behaviour of other transacting parties, either through information exchange, receptivity to influence by others or trust, has the benefit of economising BR (Chiles and McMackin, 1996).

The interplay of BR and uncertainty, which impairs the ability of humans to write comprehensive contracts *ex ante,* ramifies contractual hazards in the form of opportunism. Williamson augmented Coase's initial position of pairing uncertainty with BR – a term he defined as opportunism – to describe economic actors as "self-interest seeking with guile" (Williamson, 1975, p. 26). Opportunism resembles AT's "moral hazard" and "adverse selection" (Williamson, 1988, p. 570) with added contractual hazards being the consequence. Its strongest form, however, goes much further into "incomplete or distorted disclosure of information, especially to calculated efforts to mislead, distort, disguise, obfuscate, or otherwise confuse ... it is responsible for real or contrived conditions of information asymmetry" (Williamson, 1985, p. 47-48).

Hazards of opportunism in long-term contracting were first recognised in Coase (1937), who subsequently realised that these problems can be mitigated by suitable contract provisions and the incentives to continue a mutually advantageous relationship. Coase further noted that long-term contracts were commonly accompanied by informal arrangements not governed by contract. He explained these observations in transaction cost terms: "… the longer the period covered by the contract, the more costly it would become to specify in the contract all the contingencies that might arise and what the supplier of the services would be expected to do in these various circumstances" (Coase, 1993, p. 67). These realisations lend support to (a) creditable commitments, in that "promises to behave responsibly that are unsupported by creditable commitments will expose the parties to hazard" (Williamson, 1993, p. 93), and (b) the reputational effect that "propensity for opportunistic behaviour is usually effectively checked by the need to take account of the effect of the firm's actions on future business" (Coase, 1993, p. 71).

In a nutshell, TCE emphasises transactional difficulties, i.e., long-term contracts ramified in the presence of BR have limited adaptive capacity to uncertain events. When these difficulties are joined by opportunism, incomplete long-term contracts predictably pose interest conflicts between the parties (Williamson, 1975, p. 17). The twin assumptions of BR and opportunism are the cornerstone of Williamson's thesis on economic organisation (1993, p. 93), under which alternative modes of governance should be structured to economise BR while simultaneously safeguarding the transactions in question against the hazards of opportunism.

<u>4.3.3.1.2</u> *Dimensions of transactions: Uncertainty and asset specificity*

In Williamson's framework, the core problem of economic organisation is dealing with two kinds of uncertainty: primary (or parametric) uncertainty is of a state-contingent kind, while secondary uncertainty is of a strategic kind. Primary uncertainty may arise from 'state of nature' or changes in the external environment. Williamson maintains that long-term contracts under conditions of primary uncertainty are prohibitively costly for several reasons:

> *First, not all future contingencies for which adaptations are required can be anticipated at the outset. Second, the appropriate adaptations will not be evident for many contingencies until the circumstances materialise. Third, except as changes in states of the world are unambiguous, hard contracting between autonomous parties may well give rise to veridical disputes when state-contingent claims are made. (1985, p. 70)*

The intrusion of strategic uncertainty compounds transactional difficulties, under which problems of *ex ante* uncertainty and *ex post* surprises emerge. This strategic kind of uncertainty is attributable to opportunism, with its behavioural origin arising from "strategic non-disclosure, disguise, or distortion of information" (Williamson, 1985, p. 57).

Both kinds of uncertainty have little influence on transactions that are non-specific[40]. However, an increase in uncertainty about transactions that are specific to a non-trivial degree – a condition termed asset specificity in TCE, defined as "the degree to which an asset can be redeployed to alternative uses and by alternative users without sacrifice of productive value" (Williamson, 1991, p. 281) – enlarges contractual gaps, and hence, poses an adaptive, sequential decision problem. Such transactions will require more negotiations and shorter

[40] Merkert *et al*. 2010 show that uncertainty has an influence on non-specific transactions, e.g., timetabling.

contract renewal intervals (Williamson, 1985, p. 243); and since they require greater control more integration is better.

Evidence strongly supports the proposition that the greater the asset specificity, the longer the duration of contracts (Joskow, 1987; Masten and Saussier, 2002). Other empirical investigations affirm the importance of asset specificity in explaining variations in vertical relationships (Joskow, 1993; Shelanski and Klein, 1995; Rindfleisch and Heide, 1997) and invited competition as a safeguard for a purchaser's specific investments (Dutta and John, 1995).

Among the few experimental studies that test the effect of interactions between asset specificity and competition on levels of transaction cost, Polling *et al*. (1994) did not find these interactions had any significant impact on transaction costs, but that the two dimensions acting alone had positive effects on decision-makers' perceptions of transaction costs. Dutta and John (1995) undertook two complementary studies, combining their investigation results from a laboratory experiment to assess the degree to which invited competition in licensing attenuates opportunistic price hikes on lock-in buyers. Their results concur with Merkert *et al*. 2012 and Merkert 2012 that competition safeguards a purchaser's specific investments. However, a large number of competitors at the outset does not necessarily imply that a large numbers of bids will ultimately be obtained (Williamson, 1993, p. 99). This is because incomplete contracts that feature in asset specificity involve a high cost of switching contracting partner, and they are therefore susceptible to opportunism – a proposition that makes a strong case for bilateral dependency between contracting parties (Williamson, 1993, p. 94). Bilateral dependency encourages coordination between parties, but at the same time, it (a) attenuates incentive intensity, with added bureaucratic costs for purposes such as information disclosure and dispute-settlement apparatus (Williamson, 1991, p. 279-280), and (b) creates an unintended contractual hazard – a strong incentive for bidders to low-ball the initial contract. An alternative form of governance structure, namely vertical integration, may minimise such exchange hazards. It is to different forms of governance structure that our discussion now turns.

4.3.3.2 Governance structure

TCE maintains that court ordering is a very crude instrument, since continuity is rarely intended after a dispute has reached litigation; private ordering (governance) is thus the principal arena for dispute avoidance (Williamson, 1985, p. 29-30). The search for the machinery for processing disputes is the distinctive focus of TCE. Williamson (cf., 1975; 1985; 1993) advocated strongly that the asset attributes of investment projects and incentive intensity need to be matched with governance modes in a transaction cost-economising way.

Three governance structures exist within the TCE regime: the two polar opposites – markets and hierarchies (firms), and an intermediate hybrid mode (contracts). Each is described in terms of different levels of governance attributes, i.e., incentive intensity, administrative control and contract law regime (Williamson, 2006, Table 1). Vertical integration (hierarchy) is comparatively adaptive, while the market enjoys comparative bureaucratic costs. The hybrid mode, which includes various forms of long-term contracting of high levels of asset specificity (Williamson, 1985; 1991), fosters autonomous and cooperative adaptations; risk-sharing is a central motivation to organise transactions under this form (Ménard, 2004).

The effectiveness of governance mechanisms largely relies on the institutional environment within which transactions are organised. Williamson proposed the shift parameter framework, where the institutional environment is treated as a set of parameters, “changes in which elicit shifts in the comparative cost of governance” (1991, p. 287), which may change the optimal governance form for a given set of transactions.

4.3.3.3 Risk preferences of transactors

Although an individual’s risk preferences play a large part in other disciplines of contract theory, their effects are absent in TCE. This is because TCE maintains the behavioural assumption of risk neutrality. This much less frequently referenced factor is maintained plainly, to place emphasis on governance structures, which may go unnoticed when the risk preferences of transactors are made the focus of attention (Williamson, 1985, p. 388-390).

This assumption has, as critiqued by Chiles and McMackin (1996), become the major roadblock to TCE’s predictive validity. The authors argued that risk preferences would vary with the levels of asset specificity of the transaction, and therefore, the choice of governance structure would vary with the risk preferences in respect of the transaction. In an empirical study testing the risk allocation practice in PPP projects from the TCE perspective (Jin and Doloi, 2008), risk preferences were confirmed to have an impact on the transaction system. Chiles and McMackin’s (1996) model widens the application of TCE to incorporate variable risk preferences in studying the science of governance choice; it bridges an important gap in understanding transactors’ risk behaviour under the TCE framework.

4.3.4 Summary

The foregoing discussion on the contracting literature has shown that each of the three strands offers a unique insight into contracting problems while sharing complementary perspectives. Beyond the common ground on behavioural attributes of economic actors, each strand formulates its theoretical constructs based on its respective unit of analysis. AT investigates how human traits affect the choice of contracts; its unit of analysis is individual actors. Further propositions are developed in ICT to account for attributes related to contract; its unit of analysis is contract. TCE introduces asset specificity and extends the factors of investigation to institutional variables; its unit of analysis is transaction. The three strands are interconnected by the added attributes. On the one hand, contract incompleteness and low verifiability in ICT increases the risk of opportunism in AT (recall that moral hazard and adverse selection are equivalent to opportunism). On the other hand, asset specificity in TCE magnifies the costs associated with contract incompleteness, low verifiability and uncertainty in ICT, and at the same time increases the risk of opportunism in AT. TCE's analysis of the impact of institutional factors on uncertainty emphasised in ICT explains the choice of contracts from a wider perspective. These interplays are depicted in Figure 4-1.

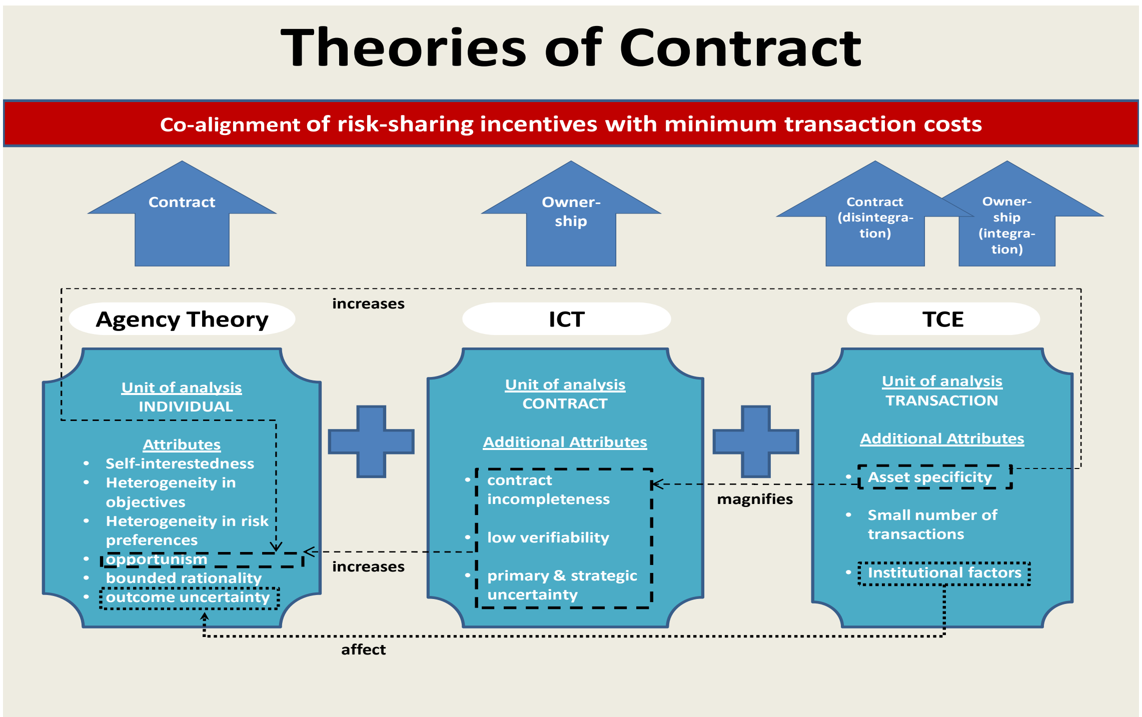


Figure 4-1: Theories of Contract

In deriving the common objective – co-alignment of risk-sharing incentives with minimum transaction costs – AT considers ways the contract can encourage co-alignment of incentives; ICT explores the likelihood of risk-sharing outcome through the assignment of residual rights; and TCE searches for the optimal governance structure suitable for the dimensions of the underlying transaction.

Risk-sharing is the key ingredient of VFM of PPPs. The rationale that risk should be allocated to the party that is the least averse to that risk, through the packaging of incentives, echoes the theoretical constructs of contract theory. As acknowledged in de Palma *et al*. (2007a, p. 9) the challenge of managing transport services operated by a concessionaire is the degree to which the convergence of the private objectives of the concessionaire toward the public objectives of the regulator can be achieved. In this regard, the economics of incentives – described as "the design of rules and institutions for inducing economic agents to exert high level of effort (in broad sense), and to reveal truthfully all socially relevant information they might have" (Laffont, 1996, p. 49) – must be carefully managed.

In the following section, we examine PPPs through the lens of long-term contract, during which a number of testable propositions are developed. They progressively lay the groundwork for the solution to Research Question Three, i.e., how to realise risk-sharing optimisation.

4.4 PPPs in the Lens of Contract

4.4.1 Agency Theory and PPPs

The effort in reaching incentive agreements among parties, who are motivated by different interests and are in possession of different levels of informational structure, has been a privileged field of investigation of PPPs in AT (Brousseau, 2008; Macário, 2010).

Among the main concerns of procurement contracts is the *ex post* inefficiency of moral hazard. Solutions to the problem, as suggested by AT, include contracts that encourage adequate incentives through the provision of equitable risk-sharing allocation to motivate the agent to adopt behaviour compatible with the interests of the principal (McAfee and McMillan, 1986). One of the well-applied incentives in PPPs is risk transfer (Evenhuis and Vickerman, 2010). Transferring risk to the private proponent (the agent) incentivises the agent to act in the interest of the government (the principal). However, the principle of risk-sharing is not about transferring all risks, but rather, allocating each risk to the party that is least risk-averse to that particular risk. Because contracting parties have different preferences toward different risks, transferring all risks out without considering the other party's risk preferences would cost government a sizeable risk premium that would outweigh the benefits of the partnership. Accordingly, allocation of risk needs to consider the degree of risk aversion of the contracting parties. Arndt's (2000) empirical findings that the risk allocation approach was dominated by parties' loss aversion (see Section 3.3) suggest that, for example, a party that is willing to bear traffic risk supposedly has lower risk-aversion to that risk than the other party.

Hypothesis 1: *Contracting parties of a PPP tollroad have different risk preferences toward different risks.*

AT specifically cautions the trade-off between risk-sharing and incentive provision because the agent is more risk-averse than the principal, one reason being that the agent is unable to diversify their employment whereas the risk-neutral principal is capable of diversifying their investments (Jensen and Meckling, 1976, p. 349). This conjecture is even more likely to hold true in a relationship involving government, because government has in its possession powerful means (e.g., the taxing power) of resource re-allocation. If the rationale of PPPs were in line with AT, it would expect that:

Hypothesis 2a (i): *At the aggregate level, the public sector authorities and the private sector agents have different tastes in risk.*

Hypothesis 2a (ii): *Private sector agents are more risk-averse than public sector authorities.*

A risk-averse agent will prefer to contract with a government that is considered to have a low risk of default:

Hypothesis 2a (iii): *Private sector agents who are risk-averse would prefer PPPs to other procurement methods.*

When applying AT in the procurement contracting literature, where the agent is more risk-averse than the principal, an incentive contract that emphasises risk-sharing offers an optimal solution for government (McAfee and McMillan, 1986). If Hypothesis 2a(ii) is not rejected, it is expected, therefore, that public sector authorities who are less risk-averse than private sector agents would prefer the PPP model to other methods of procurement

> *Hypothesis 2b:* *Public sector authorities who are less risk-averse would prefer PPPs to other procurement methods.*

The idea of PPPs is to pass risk on to agents using an outcome-based contract. Performance outcomes vary across different models. In models that transfer out traffic and financial risks, the outcomes are primarily linked to the number of road users, whereas under the availability model, as described in Section 2.3.1.3, the private concessionaire does not partake in toll revenue-sharing with government, and outcomes are primarily based on service outputs meeting prescribed outcomes, i.e., making the facility available for public use. AT's focus on remuneration schemes postulates that the more risk-averse the agent is, the less attractive are outcome-based contracts to them (Eisenhardt, 1989, p. 62). The trade-off between risk preferences and the compensation scheme found empirical backing in Gaynor and Gertler (1995) in relation to partnerships in the medical profession. The authors concluded that the more risk-averse were the physicians, the more likely it was that the partnership would use revenue-sharing as the group's compensation structure in order to spread risk. However, the effect of reduced physician effort was dramatic. Their conclusion implied that a compensation scheme that was not linked to individuals' performance outcomes could induce shirking, and therefore be ineffective.

If Hypothesis 2a (ii) is not rejected and AT is correct, then it is reasonable to expect that the more risk-averse are the private sector agents, the less effective is the availability model to induce their effort, because the lack of provision for revenue-sharing in the model does not compensate performance effort with commensurate reward.

> *Hypothesis 2c:* *The more risk-averse the private sector agents, the less effective is the availability model to incentivise efficient performance during the operational phase.*

As outlined in Dewatripont and Legros (2005), the financing structure of PPPs introduces a second level of agency problem between the consortium and outside investors. Typically, a consortium relies on a sizeable share of external equity and debt to finance the infrastructure. This raises the incentive issues that have been the subject of the theory of corporate ownership structure (Jensen and Meckling, 1976). Having outsiders share the risks induces a lower risk-averse preference of the contractor who leads the consortium.

> *Hypothesis 3:* *The leader of the bidding consortium is less risk-averse compared with the other members of the consortium bid team.*

4.4.2 ICT and PPPs

The impossibility of contracting *ex post* decisions has orientated ICT's emphasis to the relative cost of contracting (Hart, 2003), and the consequences of transferring rights to capture residual surplus (Brousseau, 2008). The divisions of *ex post* surplus are very sensitive to the characteristics of the communication mechanism – in particular, whether the parties' messages are verifiable or not. Further, even if messages are verifiable, parties to relation-specific investments will not generally be able to sustain efficient investment levels (Hart and Moore, 1988). Ownership, hence the entitlement of residual rights, induces appropriate levels of productive investment, particularly so in areas like roads where the service provision can be well specified (Hart, 2003).

The enhanced incentive that comes with the ownership right to improve productive efficiency has become the principle argument for PPPs being superior to traditional public procurement methods (Dewatripont and Legros, 2005; Välilä, 2005). Ownership becomes paramount in incomplete contracts because *ex post* decision rights give rise to greater efforts *ex ante* and bargaining power in non-contractible situations (Grossman and Hart, 1986). This entitles the proprietor to make autonomous decisions to invest without the need for contract renegotiation, thus savings on transaction costs.

PPP bundles asset construction and service provision under one ownership. In areas like roads where the quality of service can be sufficiently specified and verified, bundling helps to save transaction costs related to contract specification as well as future maintenance costs. It relaxes the requirement to specify outputs that meet the ever-changing service quality in great detail, and combines incentives to carry out careful planning over the long haul and to invest efficiently at the outset to reduce maintenance cost over the asset's life cycle.

The bundling structure also helps strengthen incentives for risk taking. For example, as argued in Dewatripont and Legros (2005), transferring ownership to the contractor could provide protection against the risk of unclear project objectives by the government authority. This has been identified in Chapter 2 and Chapter 3 as a significant risk attribute in PPPs. Their argument sheds light on the private sector agents' risk aversion to unclear project objectives (Hypothesis 4a). A further implication is that PPPs would shield the contractor from the risk of unclear project objectives by the government authority because ownership entitles the contractor to the freedom of adopting measures to manage uncontracted-for events. If the private sector dislikes the risk of unclear project objectives, their agents would perhaps prefer the PPP procurement model, which is as prone to this risk as it has been in the past, captured by different portfolio ministers for their own gain (see Section 3.4.7) (Hypothesis 4b). The enhanced value of clearly defined project objectives, as highlighted in Bajari and Tadelis (2001), reinforces the benefit of cost savings to the public sector procurer carried through from the *ex ante* competitive tendering. Following this line of reasoning leads us to predict that the public sector authorities would prefer clearer project objectives, and that they are risk-averse with respect to unclear project objectives (Hypothesis 4c).

Hypothesis 4a *Unclear project objectives will increase private sector agents' risk aversion.*

Hypothesis 4b *The higher the risk of unclear project objectives, the more preferred is the PPP method by private sector agents.*

Hypothesis 4c *Unclear project objectives will increase public sector authorities' risk aversion.*

Property rights are meant to entitle the proprietor to the freedom of making decisions on how much they charge users for using their asset. PPP contracts, however, often preclude this privilege (see Appendix B for some Australian examples). From the perspective of ICT, both the agent and the principal should be in favour of the relaxation of this condition, because such freedom would incentivise the agent to exert more performance effort from which the principal would equally benefit.

Hypothesis 5a: *Private sector agents are in favour of the option of having the freedom to set toll pricing, i.e., the freedom will reduce* *private sector agents' risk aversion.*

Hypothesis 5b: *Public sector authorities are in favour of the option of granting the private sector agents the freedom to set toll pricing, i.e., the granting of the right will reduce public sector authorities' risk aversion.*

We have argued in Chung *et al.* (2010) that governments were often seen to use private ownership to shield themselves from risks related to politically sensitive matters, such as direct exposure to conflicts arising from the workforce. From the ICT perspective, such perception would be in the agent's favour because the concession owner would be able to exercise full flexibility, as if they were the owner, to deal with labour productivity issues with the benefit of *ex post* efficiency enhancement. The perception however, would have the opposite effect on the public sector procurer, as it would mar not only public acceptance of the PPP policy, but also the public image of government.

Hypothesis 6a: *The public perception that ownership transfer is seen to transfer ownership-related risk arising from workforce dispute will reduce the risk aversion of private sector agents.*

Hypothesis 6b: *The public perception that ownership transfer is seen to transfer ownership-related risk arising from workforce dispute will increase the risk aversion of public sector authorities.*

4.4.3 TCE and PPPs

It is arguable whether the long-term benefits of PPPs will outweigh the transaction costs of establishing and maintaining the partnership, and minimising contractual incompleteness. Empirical studies on transaction costs of PPPs mainly rely on sources from contract tendering and bidding costs, negotiation costs, advisory costs, administrative costs, monitoring costs and enforcement costs.

Data in Europe confirm that transaction costs related to the procurement phase to establish the partnership were significant. On average, they amounted to well over 10 per cent of the project's capital value (Dudkin and Välilä, 2005). Advisory costs of PFI hospitals in the UK varied between 1 and 8 per cent of the project's capital value, with an average of 3.7 per cent (Välilä, 2005). Contract monitoring costs in the United States were found to be between 3 and 25 per cent of the contract value (Torres and Pina, 2001). Bidding and negotiation costs for private sector bidders were the highest in the road sector, compared with hospitals and schools. Transaction costs during the procurement phase can add up to 11 per cent of the project's capital value: 3 per cent was shared by the public authority, another 3 per cent by the winning private sector bidder, and a further 5 per cent by the losing bidders (Dudkin and Välilä, 2005). Further studies reported that transaction costs for the public sector alone varied considerably among projects, with a minimum of 1.4 per cent of capital value and a maximum of 6.9 per cent of capital value (NAO, 1997; 1998; 1999).

4.4.3.1 Shift parameter framework

Different procurement methods within the PPP framework were found to have a significant impact on the level of transaction costs during the tendering process (Soliño and Gago de Santos, 2010). For road projects, theses levels varied between 2.86 per cent and 10.01 per cent of the project's capital value for the public sector, for the winning bidder and failed bidders combined. These findings place PPPs under the microscope of TCE. In many cases, procurement methods are characterised by the surrounding institutional environment, and hence they vary from one jurisdiction to another (English, 2008). This phenomenon suggests that institutional factors can influence the choice of procurement methods. This proposition was first established in Williamson's shift parameter framework (Williamson, 1991) and was later empirically confirmed in Oxley (1999), but its validity is yet to be tested in the PPP domain.

Hypothesis 7: Institutional factors will significantly influence the choice of procurement methods by all parties, i.e., PPPs versus other methods.

4.4.3.2 *Uncertainty effect*

We have noted above the analysis of transaction costs in PPPs from the empirical perspective. Theoretical analysis of PPPs under TCE is dependent on hybrid governance that establishes the implemented regime of risk-sharing (Brousseau, 2008, p. 47). Lying between two polar forms of market and hierarchy, hybrids retain some of the incentive characteristics of markets while allowing enhanced monitoring and multilateral adaption, and avoid some of the bureaucratic and shirking costs associated with hierarchy (Williamson, 1991). Like other hybrid arrangements (cf., Ménard, 2004), pooling resources to deal with significant uncertainties and to share risks, together with the capability of reconciling legal autonomy and interdependency of investments among a large number of partners are the driving forces for PPP transactions.

The long duration of PPP contract terms is inevitably confronted by parametric uncertainty. For example: demand uncertainty, such as the use of the facility by private vehicles, generates financial concern for the private operator; technology uncertainty, which includes tolling technology, generates operational difficulty for the operator and creates network integration problems for the road authority[41]; and uncertainty of the institutional environment will have a fundamental influence on the choice of method of organising transactions for all parties involved (cf., Oxley, 1999). Further, these transactional variables may give rise to strategic uncertainty, which is highly prone to opportunism. Not only is the private proponent susceptible to opportunistic behaviour, but as a major purchaser of the contracted service, the government may also behave opportunistically through hold-ups (Parker and Hartley, 2003; Wickelgren, 2007) or asset expropriation (Brealey *et al*., 1997). If we make allowance for variable risk preferences existing in the TCE framework as proposed by Chiles and McMackin (1996), we argue that the greater the uncertainty an economic actor confronts, the more risk-averse they become. To a large extent, however, uncertainty can be minimised, and risk aversion can be reduced by transacting in a stable institutional environment and by clearly articulating contractual conditions.

> *Hypothesis 8a: Contractual conditions and institutional variables will significantly affect the risk preferences of contracting parties.*

[41] The integrated electronic tolling for MCL encountered serious technical problems that caused a lengthy delay in its opening.

In light of Dequech’s argument (2000; 2004) that institutions contributed to reducing uncertainty, it is expected that private sector agents’ risk aversion is positively associated with sovereign risk:

> *Hypothesis 8b:* *Sovereign risk will significantly increase the risk aversion of private sector agents.*

4.4.3.3 Reputational effect

The extreme degree of asset specificity associated with PPP transactions, i.e., there is a near-nil possibility of relocating a transport infrastructure other than designated in the contract, exposes governments to lock-in and hold-up situations. Lock-ins occur where the obligation of being responsible for significant financial compensation to the capital provider once the asset financed by the concessionaire is built may deter the public sector procurer from seeking service supply elsewhere (Williamson, 1979, p. 251). Problems of lock-in are very likely in contracts where revenue to the private operator has been guaranteed. Hold-ups occur when unanticipated events place the contractual relationship outside the self-enforcing range (Klein, 1996). Lock-ins and hold-ups deepen in the presence of asset specificity (Hart, 1990) because of the asset’s limited alternative purpose. The asset owner is exposed to deceptive acts by other parties, who may withhold crucial inputs or pose threats to terminate the contract in order to obtain benefits that the owner hoped to derive from the investment. These two kinds *ex post* inefficiencies in PPP road infrastructure have the manifestation of welfare distortion to end users, to whom the public procurer is ultimately accountable.

Mitigations to problems of this kind include self-enforcing safeguards, such as credible commitment, reputation and trust. Over an indefinite time horizon these traits have yielded lower transaction costs compared with repeated short-term legal contracts (Dyer, 1997). Transactions are more likely to be secured based on reputation, and by way of trust in situations where writing a complete long-term contract over a specific asset or service is near impossible (Parker and Hartley, 2003; Ménard, 2004). These findings reinforced our proposition in Section 3.4 that a successful partnership cannot be sustained without commitments from all contracting parties. The findings in Chapter 3 have asserted that the private sector is wary of its reputation in the eyes of the public, and indicated that building a trusting relationship with the public community would have a deterministic impact on the welcomeness of the PPP scheme in the long-term. This would, in turn, affect the transaction costs of entering into future PPP contracts with the public sector.

Hypothesis 9: Private sector agents who are actively engaging in PPP contracts value their reputation effect.

4.4.3.4 Risk preferences versus contract structure

Decision maker's risk preference can be classified as risk averse, risk neutral or risk seeking. Risk-averse individuals do not like risk and they prefer a sure thing to a choice that occurs only with some probability; risk-seeking individuals prefer the risky choice to a sure thing whereas risk-neutral people are indifferent between the two choices (Bonner, 2008, p.98).

The Chiles and McMackin (1996) model predicts that interdependence exists between the choice of governance structure and risk preferences of transactors with respect to the underlying transaction. Their prediction implies that risk preferences can be shaped by the structure of contract. In a risk-sharing partnership, the contract structure specifies how risks are shared.

We argue that:

Hypothesis 10: Risk preferences are significantly affected by how risks are shared.

4.4.4 Summary

In summary, the underlying attributes of PPPs – heterogeneity in risk preferences among transactors, contracts are incomplete, and the trait of asset specificity – share a great deal of similarity with the characteristics of analysis underlined by the theories of contract. The incentive structure of PPPs mimics the incentive alignment mechanisms proposed by the contracting paradigm. Figure 4-2 illustrates this view of PPPs through the lens of contract.

4.5 Summary of Chapter

This chapter has analysed PPPs through the lens of contract in order to investigate Research Question Two, i.e., from the theoretical perspective of contract, to what extent does the PPP procurement method help incentivise risk-sharing. We have concluded that contract theory provides useful insights into making sense of the risk-sharing rationale in PPPs. Grounded in the propositions established in the contracting paradigm, we have formulated a number of hypotheses with the view of seeking an answer to Research Question Three. We will reflect on the extent to which the contracting paradigm is adequate in understanding risk-sharing in PPPs after testing the hypotheses in Chapter 8.

With the support of contract theory and the risk attributes identified through the in-depth interviews, we can now proceed to collect data for hypothesis testing. But before we move forward in the empirical analysis, we need an analytical framework to consolidate all the pieces of the puzzle we have identified so far, and to guide our next step in research design for data collection. This is what we set out to achieve in the next chapter.

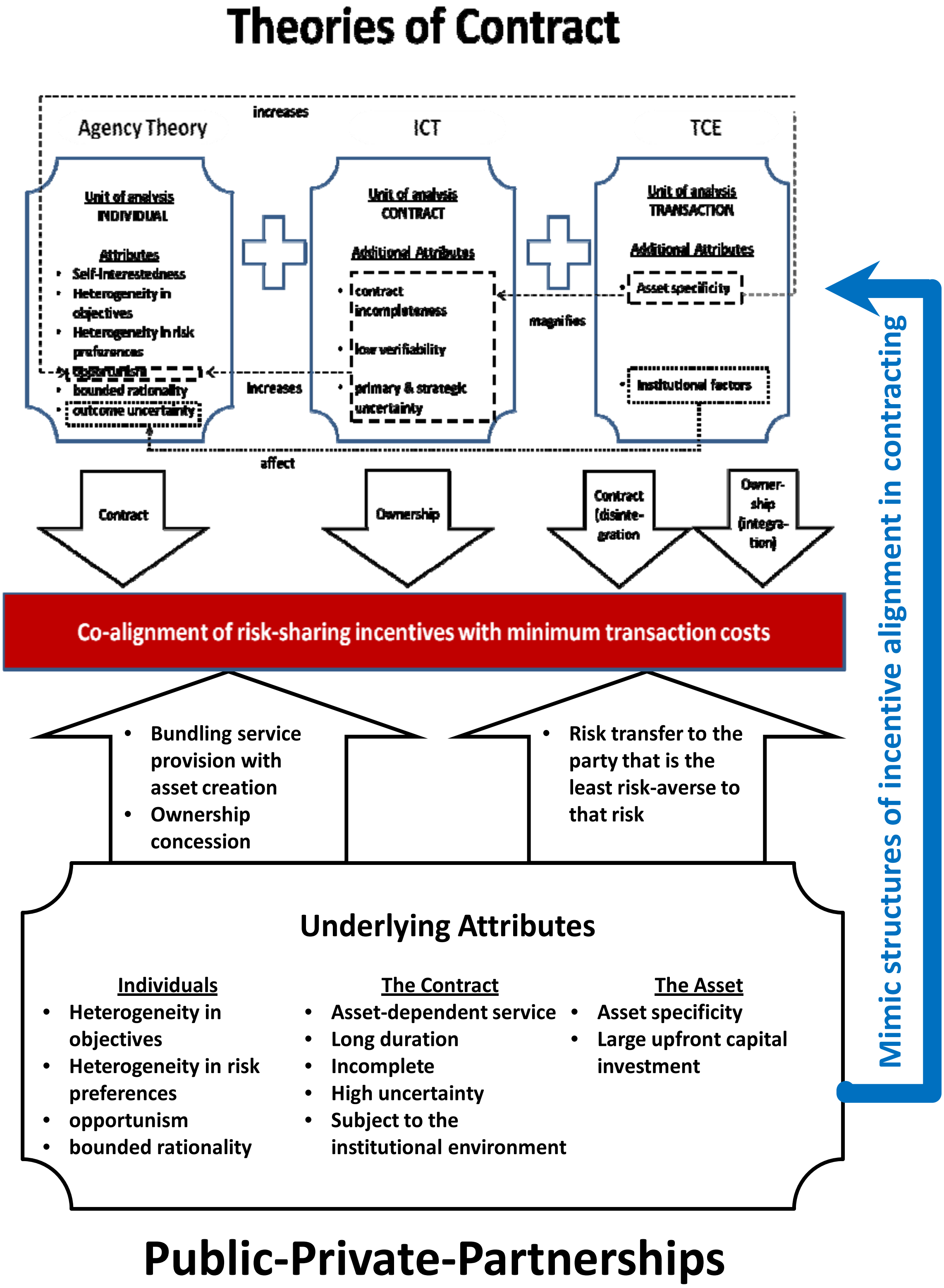


Figure 4-2: PPPs through the Lens of the Contracting Paradigm

CHAPTER 5: RESEARCH METHODOLOGY AND FRAMEWORK OF ANALYSIS

5.1 Introduction

The findings of the in-depth interview study in Chapter 3 and the examination of incentive structures embedded in PPPs through the lens of contract in the preceding chapter have opened up the avenue to investigate risk-allocation optimisation between parties whose interests, objectives and perceptions of risk are profoundly different. The behavioural perspective of relevance in contracting between the parties is driven by questions of a discrete choice nature (Williamson, 1991; Sykuta, 2008). Therefore, methods of collecting discrete choice data and, in particular, logit models used for analysing discrete choice data (cf., Hensher *et al.*, 2005a) will be considered as the primary form of research methodology in this thesis.

This chapter begins with an analytical framework that is set up to guide the steps of data collection and hypothesis testing to answer Research Question Three, i.e., how to realise risk-sharing optimisation. Section 5.3 introduces paradigms of choice data, followed by Section 5.4 covering choice models whose properties suit analysis of discrete choice data. As the framework unfolds, it becomes intuitive to construct an instrument for contract evaluation and to measure risk perception. The development of such an evaluation tool, named the PPP Risk Index (PPPRI), will be discussed in Section 5.5 in which the Service Quality Index developed by Hensher (Hensher and Prioni, 2002; Hensher *et al.*, 2003) is used as the basis of the risk index idea. Section 5.6 summaries the chapter.

5.2 Conceptual Framework of Risk-Sharing Optimisation

The preceding chapters have laid the foundation for establishing a conceptual framework that searches for avenues of risk-sharing optimisation. Chapter 2 has identified the need for this research, which investigates ways to optimise risk-sharing in the policy framework that seeks private capital to deliver much-needed public infrastructure. The information gathered from stakeholders by way of in-depth interviews in Chapter 3 asserts the proposition that decision-makers' perceptions have a fundamental impact on the outcome of risk-allocation. It alerts us to what has been critically missing in studies of risks – a rigorous understanding of the behaviour of decision makers, which explains why, after decades of experience, risk-sharing outcome in PPP tollroads remains sub-optimal. The contracting antecedents in Chapter 4 offer useful directions on possible ways to correct some of the mistakes that have occurred in terms of misallocation of risks. Optimisation can be realised through a greater understanding of the risk preferences of the parties involved, combined with appropriate structures of contractual conditions that accommodate diversity in incentives and encourage goal alignment. They also orientate our attention to consider methods of analysing discrete data.

The schema in Figure 5-1 illustrates the interdependence between elements identified in preceding chapters and the direction to undertake empirical investigations to test our hypotheses. With the aid of this conceptual framework, we are now able to identify methodologies and develop the instruments required to carry out the remaining research task.

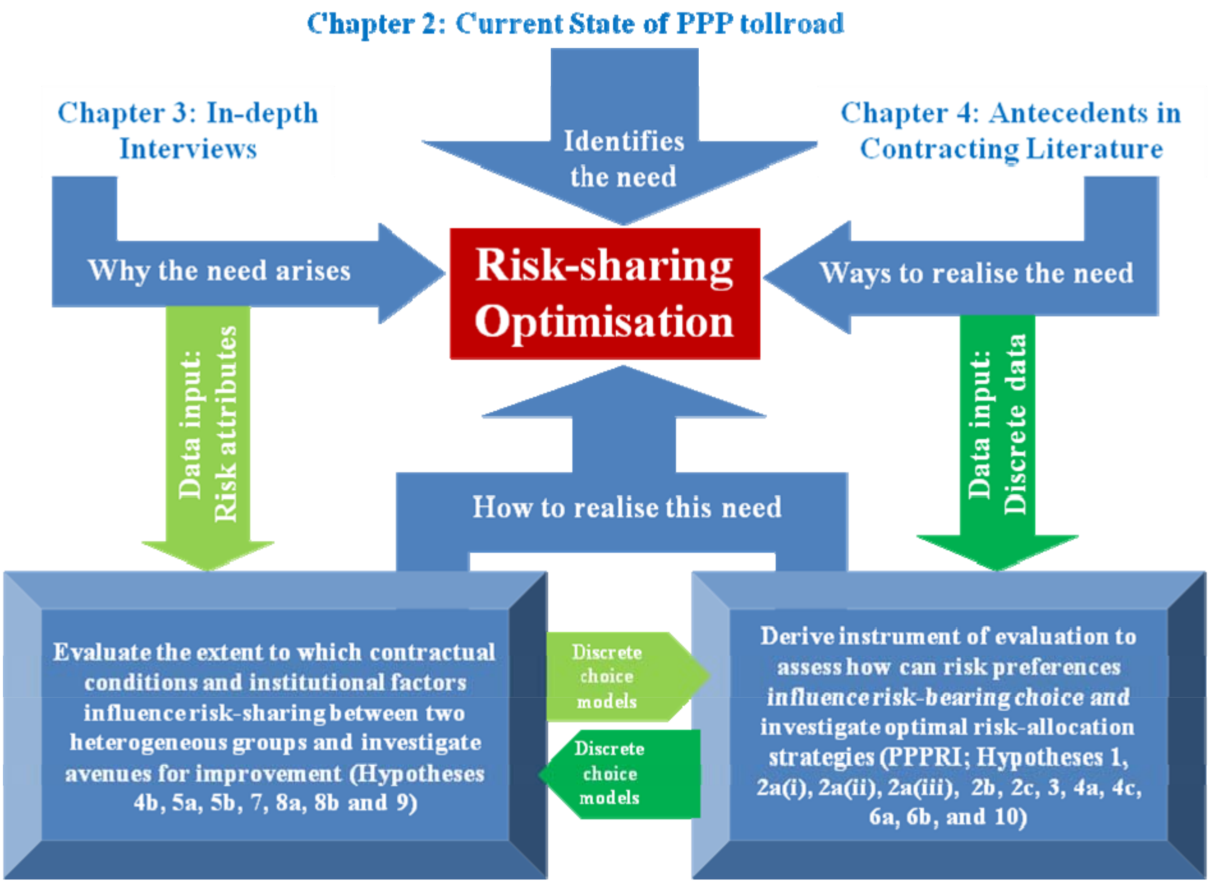


Figure 5-1: Conceptual Framework of Risk-sharing Optimisation

As illustrated in Figure 5-1, the first task involves confirmation that the two groups, i.e., the public sector authorities and the private sector agents, are indeed heterogeneous in terms of their risk preferences. We have established this to some degree in Chapter 3 through the qualitative method of in-depth interviews, and have identified theoretical support in contract theory, presented in Chapter 4. It is imperative to confirm our proposition by way of quantitative testing. The choice paradigm approach to collecting behavioural data that is well accepted in studies of behavioural perceptions can be very useful in this respect. We will explore the relevance of this approach in the next two sections. These are followed by the description of the second task identified in the framework, i.e., to design an evaluation instrument that can be applied to assess how behavioural perceptions can influence risk-bearing choices.

5.3 Paradigms of Choice Data

Within the choice literature, two paradigms of data collection have emerged as the primary approaches to obtaining choice response associated with the attributes of the alternatives. These are known as revealed preference (RP) data and stated choice (SC) data (the latter is also known as stated preference data) (Hensher *et al.*, 2005a, p. 5). They have complementary strengths and weaknesses that potentially can be exploited to enhance understanding of preference processes.

RP data refer to situations where the choice is actually made in real market situations. In cases where the available alternatives can be identified, RP data allow the analyst to examine the factors influencing real-market choices. The advantage of RP data is that they are based on actual decisions; thus, there is no need to assume that decision makers will respond to simulated choice situations in the same way as they would to actual market situations. This characteristic gives RP data high face validity, i.e., the observed choice was the one actually chosen. However, RP is not a viable option in cases involving alternatives that do not presently exist (i.e., the choice whether to travel on a new tolled facility), or where attributes or attribute levels to be evaluated are outside the domain of market experience. Further shortcomings include a lack of variation in observed attribute levels and a common inability to identify the range of alternatives from which the decision maker had to choose when making a given observed choice. That is, although the final choice may be observed, the analyst does not observe the set of alternatives considered by the decision maker. Without such knowledge, it is difficult to accurately parameterise the exogenous influences on the choices made, and hence to estimate behavioural outputs of policy interest.

In contrast, SC data refer to situations where a choice is made by considering hypothetical situations (these are typically the same alternatives as in the RP data set, but are described by different levels of the same attributes to those observed in actual markets, as well as additional attributes not in the data collected from actual markets). SC data are especially useful when considering the choice among existing and new alternatives since the latter are not observed in RP data (Hensher, 1994). Another advantage of the SC approach lies in the number of observations an analyst can obtain. With SC data, respondents are usually shown multiple choice situations, each of which has different attribute levels and possibly even different alternatives. Thus, for each respondent, we gain multiple observations that amount to the number of choice situations completed. RP data, however, usually provide the analyst with information about a single choice that was made, unless panel data are collected – at considerable cost. The major weakness of the SC data is their hypothetical nature. Respondents are sometimes placed in unfamiliar situations in which complete information is not available, or in situations where personal constraints (i.e., income) are not considered as constraints at the time of choice. At best, respondents give truthful answers that are limited by their unfamiliarity; at worst, they give trivial answers due to the hypothetical nature of the scenario. It is important therefore to make hypothetical scenarios as realistic as possible. The complementary strength and weakness of RP and SC data have engendered a data-enrichment paradigm that has seen studies (cf., Hensher *et al.*, 1998; Mark and Swait, 2004; Whitehead *et al.*, 2008) seek to exploit the contrasting strengths of the various approaches, while minimising their weakness through the combination and joint estimation of the two paradigms of preference data.

The limitations of the RP approach, namely its attribute-level invariance and single captured observation, have constrained its suitability as the data collection method in the current research application. As such, a stated choice experiment (SCE) was adopted as the primary data collection method for this thesis. We will explain our survey design using the SC approach in Chapter 6.

After deciding on the type of data required, our next task is to identify the models of analysis. The following section begins with a short presentation of the choice analysis paradigm, followed by a discussion of a basic choice model as well as an advanced choice model whose properties can specifically account for heterogeneity in decision-maker segments.

5.4 Discrete Choice Models

Choice analysis is about explaining variability in behavioural choice response among a set of considered or offered alternatives in a sampled population of individuals or other units of choice-making, such as firms, community groups, etc. The main task for the analyst is to capture the sources of behavioural variability at the individual decision-making level, which are initially unobserved by the analyst but assumed to be known with certainty by the decision maker. The challenge to the analyst is to capture as much as possible of the variability through a set of observed influences, while finding ways of accommodating the remaining unobserved influences. How to account for the latter and minimise the amount of unobserved heterogeneity is at the centre of choice analysis (Hensher *et al.*, 2005a).

To overcome these challenges first requires extensive inquiry to identify and compile sources of influence, i.e., attributes that matter to the decision maker. The literature review in Chapter 2 and in-depth interviews in Chapter 3 have fulfilled this requirement. The next step is to collect data on the identified attributes, which will be introduced into a functional form in order to establish their role in identifying the level of utility contributed by that attribute to the overall level of utility associated with each alternative in a choice situation. That is, a given alternative j faced by decision maker n can be expressed as a vector of attributes k as $\boldsymbol{x_{njk}}$ – each component of which has a number of levels specified by the analyst either in absolute or relative (i.e., percentage deviation from a respondent-specified RP level) terms.

The behavioural process assumes that each decision maker n acts as if he or she is a utility maximiser when choosing the most preferred alternative j in a choice situation. Denoting the utility decision maker n derives from an alternative j as U_{nj}. The utility maximisation exercise of the decision maker n can be expressed in its most basic form as:

$$max_j \; U_{nj} = \beta_{njk} \times x_{njk} \qquad \textbf{(5.1)}$$

s.t. $U_{nj} > U_{ni}$ for all $j \neq i$

where $\boldsymbol{\beta}_{njk}$ represents the vector of marginal utilities respondent n receives for each attribute $\boldsymbol{x}$ associated with the jth alternative. That is, the task of the respondent is to choose one and only one alternative j; the alternative chosen is that which maximises his or her utility U_{nj} that can be derived from a choice among the alternatives on offer.

It is generally assumed that the analyst is only capable of observing a subset of the influences on the propensity of respondents to prefer a given alternative, and hence the resulting econometric model must specify U_{nj} as a function of observed effects V_{nj} and unobserved effects ε_{nj} (cf., McFadden, 1974):

$$U_{nj} = V_{nj} + \varepsilon_{nj} \qquad \textbf{(5.2)}$$

where

$$V_{nj} = \hat{\beta}_{njk} \times x_{njk} \qquad \textbf{(5.3)}$$

and $\hat{\beta}_{njk}$ represents the vector of estimated marginal utilities respondent n receives for each attribute x and alternative j. Any deviations of $\hat{\beta}_{njk}$ from the true values $\boldsymbol{\beta}_{njk}$ are biased parameter estimates. The application of appropriate econometric models within a discrete choice framework will minimise the information loss in the unobserved effects, allowing one to more closely approximate U_{nj} with V_{nj}.

Since we know nothing about the unobserved component ε_{nj}, it is necessary to make some assumptions about its distribution over the population. The simplest starting point is that the set of unobserved components across different alternatives are independent (i.e., with no cross-correlated terms so all covariances are equal to zero), with the exact same extreme type 1 (EV1) distribution[42] such that the variances of different ε_{nj} are identical for each alternative

[42] The phrase "extreme value" arises relative to the normal distribution. The essential difference between the extreme type 1 and normal distributions is in the tails of the distribution where the extreme values reside (Hensher *et al*., 2005a, p. 84).

(i.e., identically distributed). This set of assumptions is referred to as the IID condition – independently and identically distributed. Imposing such strong assumptions is a necessary but not sufficient condition to derive the functional form for the utility expression of a multinominal logit model. Where there is a concern about possible violation of the IID property, choice models that allow for less restrictive assumptions should be considered.

In the following sections we will compare two choice models: the multinominal logit model (MNL) and the latent class model (LCM), each of which has different behavioural implications. The comparison centres on how these models can identify the critical risk dimensions influencing the preferences of each stakeholder. Given the objective that the application of choice methods is to test whether the public sector authorities and the private sector agents are heterogeneous in terms of their risk preferences, and to derive the PPPRI, the following sections summarise the essential elements of the choice modelling methods.

5.4.1 Multinominal Logit Model

The MNL model is the most basic form of choice model; it has for many years provided the fundamental platform for the analysis of discrete choice. It is highly advisable that any choice analysis should start with the MNL model as it is the simplest and best way of getting to know your data (Hensher *et al.*, 2005).

The derivation of this basic choice model can be found in Hensher *et al.* (2005a, Chapter 3). Generally, the imposed IID property makes it possible to gather unobserved influences associated with each alternative into a single unknown distribution, so the utility an individual receives from choosing alternative j can be collapsed into:

$$U_{nj} = \sum_{k=1}^{K_j} \beta_{jk} \cdot x_{njk} + \varepsilon_{nj} \qquad \textbf{(5.4)}$$

The subscript n attached to $\boldsymbol{\beta}$ is removed because the model assumes that the taste weights are the same across all individuals and across all choice situations in the MNL model.

In choosing among alternatives, the decision maker compares the utility levels that they derive from each alternative within the choice situation on offer. As the analyst does not have all the information that the decision maker has, they can use only the sub-set of information they have managed to compile. This is equivalent to saying that the analyst can explain an individual's choice only up to a probability of an alternative being chosen. The probability arises because the ε_{nj} are a random distribution over the population. The individual's behavioural choice rule available to the analyst is as follows. The probability of an individual choosing alternative j is equal to the probability that the utility of alternative j is greater than (or equal to) the utility associated with alternative i, i.e., $V_{nj} + \varepsilon_{nj} \geq V_{ni} + \varepsilon_{ni}$, which becomes $V_{nj} \geq V_{ni} + \varepsilon_{ni} - \varepsilon_{nj}$; after evaluating each and every alternative in the choice situation of $i = 1,...j,...I$ alternatives. The analyst does not know what a specific person's 'location' is on the error distribution scale; hence there is a probability distribution of this occurring given that ε_{nj} and ε_{ni} are random variables.

Before we introduce the logit probability formula of the MNL model, we need to bring in certain assumptions about the distribution of the random component ε in Equation (5.4). A popular distribution that has plausible behavioural properties and will lead to parsimonious forms of a practical choice model is the EV1 distribution, which takes the following form:

$$Prob(\varepsilon_j \leq \varepsilon_i) = exp(-exp - \varepsilon) \qquad \textbf{(5.5)}$$

The focus of Equation (5.5) is on the unobserved component of a utility expression for a specific alternative j; ε represents draws from a random uniform. Equipped with all this information, we can now present the choice probabilities associated with each alternative; this results in the logit probability formula of the MNL (Hensher *et al.*, 2005a):

$$Prob_{nj} = \frac{\exp V_{nj}}{\sum_{i=1}^{I} \exp V_{ni}}; \ i = 1, ... j, ... I \qquad \textbf{(5.6)}$$

Equation (5.6) states that the probability of an individual choosing alternative j out of the set of I alternatives is equal to the ratio of the (exponential of the) observed utility index for alternative j to the sum of the exponentials of the observed utility indices for all I alternatives, including the jth alternative. V_{nj} is equivalent to V_{nj} defined in Equation (5.3).

Although the MNL model represents the most widely used choice model to date, its maintained assumptions, e.g., IID and homogeneity of preferences, are potentially limiting. Recall that the empirical findings from Chapter 3 recognise that PPPs involve stakeholders who are heterogeneous in terms of their objectives, interests and perceptions of risk. The MNL model assumes that taste weights associated with each attribute are fixed across individuals. This assumption limits the model's ability to handle preference heterogeneity, hence it is of little relevance to the research application in this thesis. The restrictive assumptions of the MNL model have motivated researchers to develop a variety of alternative formulations. Here, we will consider an advanced model, namely the LCM.

5.4.2 Latent Class Model

The LCM is one of a number of choice model forms that have evolved in the literature to handle heterogeneity in preferences. Its underlying theory posits that individual behaviour depends on observable attributes and on latent heterogeneity that varies with factors that are unobserved by the analyst (Greene and Hensher, 2003). That is, it relaxes the preference homogeneity restriction imposed in the MNL model by facilitating membership of latent classes up to a probability. In this way, it engenders heterogeneity between classes. An added advantage is its ability to identify the heterogeneity in discrete clusters across the sampled individuals, without the extra burden on the analyst to make specific assumptions about the distributions of parameters across individuals.

Preference heterogeneity is handled via discrete distributions in parameters. These discrete distributions are referred to as classes. According to the model, each individual resides up to a probability in a latent class, Q. In estimating the model, there exist a fixed number of classes, Q, where the number of classes is defined a priori by the analyst. Estimates consist of the class-specific parameters and for each respondent, a set of probabilities defined over the classes. Within each class, the parameters and choice probabilities are assumed to be generated by MNL models.

The utility functions of the LCM differ to the MNL model in that there now exist several utility functions that require estimation. First, the class-specific utility functions, which are represented as:

$$U_{nj|q} = V_{nj|q} + \varepsilon_{nj|q} \quad \textbf{(5.7)}$$

where n = individual, j = alternative, q = class and $\varepsilon_{nj|q} \sim$ IID EV1.

Individuals are implicitly placed into a set of Q classes up to a probability. However, which class contains any particular individual, whether known or not to that individual, is unknown to the analyst. Typically, the class-assignment model is specified as an MNL model, which requires that an additional utility specification be defined. These additional sets of utility functions are used to help distinguish individuals in terms of class membership. We represent the class assignment model utility function as:

$$U_{nq} = \delta_q h_n + \varepsilon_{nq} \quad \textbf{(5.8)}$$

where h_n represents a set of observable characteristics used to separate sampled individuals into different latent classes and δ_q associated parameters.

For purposes of model identification, at least one class-assignment (typically the last) utility function is normalised to zero. If no utility function is directly specified by the analyst, then only class-specific constants are used in the model to allocate individuals, up to a probability, into the different latent classes. The characteristics contained in the h_n vector must remain constant within each choice situation, and hence the class-assignment model, in effect, assigns individuals and not choice situations to the different classes.

The central behavioural model is defined as follows:

$$Prob\ (nj|q) = \frac{\exp\ V_{(nj|q)}}{\sum_{i=1}^{I} \exp\ V_{(ni|q)}} = F(n, j|q) \quad \textbf{(5.9)}$$

The above equation assumes heterogeneity and discrete distributions rather than continuous distributions in the parameters to be estimated.

5.5 Quantitative Instrument to Measure Risk Perceptions

The objective of the PPPRI is to obtain a single measure that quantifies stakeholder risk preferences over a wide range of issues. It can be implemented at project level to establish a project-specific risk index, or at policy level to assess whether variations in policy variables (e.g., subsidies, performance indicators, relaxation of pricing regulation etc.) will change private investors' risk-taking behaviour. It can also be applied to different institutional environments to evaluate how institutional norms and public opinion affect the risk preferences of private investors and the preference for the PPP method by public sector authorities. We draw on the Hensher Service Quality Index (HSQI) (Hensher and Prioni, 2002; Hensher *et al.*, 2003) as a way to establish such a set of risk indices pertinent to PPP tollroads.

5.5.1 Hensher Service Quality Index

The HSQI represents a set of quantitative performance indicators used to measure bus service delivery quality and effectiveness. Under this framework, the overall level of passenger satisfaction is measured by how an individual evaluates the total package of services offered. The evaluation process involves the search for appropriate weights attached to each service dimension in order to identify the strength of positive and negative sources of overall satisfaction. To fulfil this objective, SC methods were used in the original study (Hensher and Prioni, 2002), whereby a sample of passengers were asked to choose their most preferred package from a number of alternative packages of service levels based on their attributes. A number of logit models were estimated to establish the relative weights attached to the statistically significant attributes, representing the contribution of each service attribute to the calculation of an overall service quality index.

In addition, as reference levels must be identified in order to apply the weights, RP data of the perceptions of passengers relative to the levels of each attribute as experienced in a current trip were obtained and then multiplied by the relevant weight. Summing these calculations across all attributes produced the service quality index for each sampled passenger.

The HSQI offers the economic regulator and bus operators a benchmark to evaluate service effectiveness. It can be incorporated into a cost-per-kilometre model to explain variations in unit costs associated with the passenger service quality index and other influences on costs (Hensher, 2011), and provides a global measure for cost efficiency and cost effectiveness (Prioni and Hensher, 2000).

5.5.2 PPP Risk Index

Although the HSQI was specifically designed for a different area of research to that under discussion in this thesis, it opens up an insightful avenue for the formulation of a risk index in the domain of PPPs. To construct a risk index as an output of the estimation of the choice model using data from an SCE, we first need to identify the weights attached to each risk attribute, with the most likely source coming from SC data to parameterise the source of risks. SC data are chosen over RP data because, as discussed above, SC data provide greater flexibility to vary the levels of risk attributes so as to create a large number of scenarios within a systematic package of risk attributes in order to identify potential trade-offs (Hensher, 1994; Hensher *et al.*, 1998).

Nevertheless, RP data are an important input to determine the reference level. The preferred approach is to apply parameter estimates derived from data gathered by way of a SCE to the current RP level that each participant in the sample currently experiences. Once the data are collected, choice models are estimated to establish the relative weights attached to the risk attributes. The resulting utility indicators emanating from the estimation of models based on the SCE, measure the expected utility that a stakeholder obtains from the average level of risk allocation in recent contracts and how this might change under alternative risk-sharing regimes.

The PPPRI has great potential. It captures stakeholder perceptions of risk toward any specific project. The effect of various attribute combinations in a risk-allocation package is achieved by varying the levels around the respondent-specific RP inputs; the resulting utility indicators will convey the effect in the form of various risk perceptions toward the project. Contracting parties then can weigh the trade-offs between different risk combinations and decide what risks they wish to take on and those they can transfer, taking into account the risk premium they would require. The PPPRI can therefore be incorporated into a contract assessment regime that provides a meaningful measure of how risk perceptions can be balanced. Hence, risk preferences can be managed by modifying the level of contractual conditions as well as policy and institutional variables.

5.6 Summary of Chapter

This chapter has set out the key elements of the behavioural choice framework that translates the theoretical and conceptual contributions into an empirical setting capable of obtaining estimates of the role of identified risk dimensions for stakeholders in the public and private sectors. A critical element of the behavioural choice framework is the development of an aggregate risk perception index linked to risk preferences that can assist in guiding *ex ante* contract design and its *ex post* evaluation, which we named the PPPRI. Quantifying PPPRI requires identification of weights to attach to the underlying dimensions of risk associated with public-and private-sector stakeholders. SC methods have been selected as the basis of designed choice experiments that can deliver the data required to study stakeholder choices among alternative packages of attributes that represent the dimensions of project risk. A couple of discrete choice models were reviewed to understand their merits in identifying the critical risk dimensions influencing the preferences of each stakeholder.

In the following chapter, we will describe in detail the data collection approach. During the design process, careful consideration will be given to the issues identified in this chapter to ensure that our data instrument will deliver the evidence required to develop the PPPRI, and to test the suite of hypotheses centred on the role of specific risk dimensions.

CHAPTER 6: SURVEY DESIGN AND DATA COLLECTION

6.1 Introduction

The conceptual framework developed in the preceding chapter provides a structure within which to place the empirical data collection process. In this chapter, we focus on the design of the data collection instrument, a computer-assisted personal survey instrument (CAPI). The CAPI includes a SCE and a number of additional screens that seek information on the respondent's experience with PPPs as well as their subjective views on the key drivers of risk. Given the growing recognition in the literature on decision making (cf., Cyert *et al.*, 1956; Tversky and Kahneman, 1974) that individuals adopt a number of strategies (or rules) when processing the attributes offered in SCEs (and also in real market settings), we include a series of questions related to attribute processing strategies (APSs) designed to elicit whether particular attributes representing dimensions of risk are processed in a fully compensatory manner (i.e., they are deemed relevant), or whether specific attributes are not attended to. The data collection process is also discussed in the chapter.

6.2 The Instrument of Empirical Evidence Collection

An internet-based survey is the most economical way to survey stakeholders internationally. The purpose of the survey is to collect empirical evidence to test the hypotheses developed in Chapter 4. Following the theme conceptualised in Chapter 5, the survey contains an SCE and a series of non-stated-choice questions.

There are several distinct parts to the survey: (1) general questions capturing the socio-demographic covariates of respondents and other contextual effects; (2) choice menus corresponding to a PPP tollroad concession setting; (3) questions related to the APSs enacted by respondents within each choice situation; (4) RP questions surveying respondents' prior experience to determine the reference level for the derivation of the risk index; (5) attitudinal questions intended to obtain respondents' opinions of the adequacy of risk allocation in PPP tollroad projects and their preference for the PPP procurement method; and (6) questions intended to evaluate the extent to which other institutional and contractual conditions impact on respondents' decisions to enter into a PPP contract. Screens shots of the survey are provided in Appendix E.

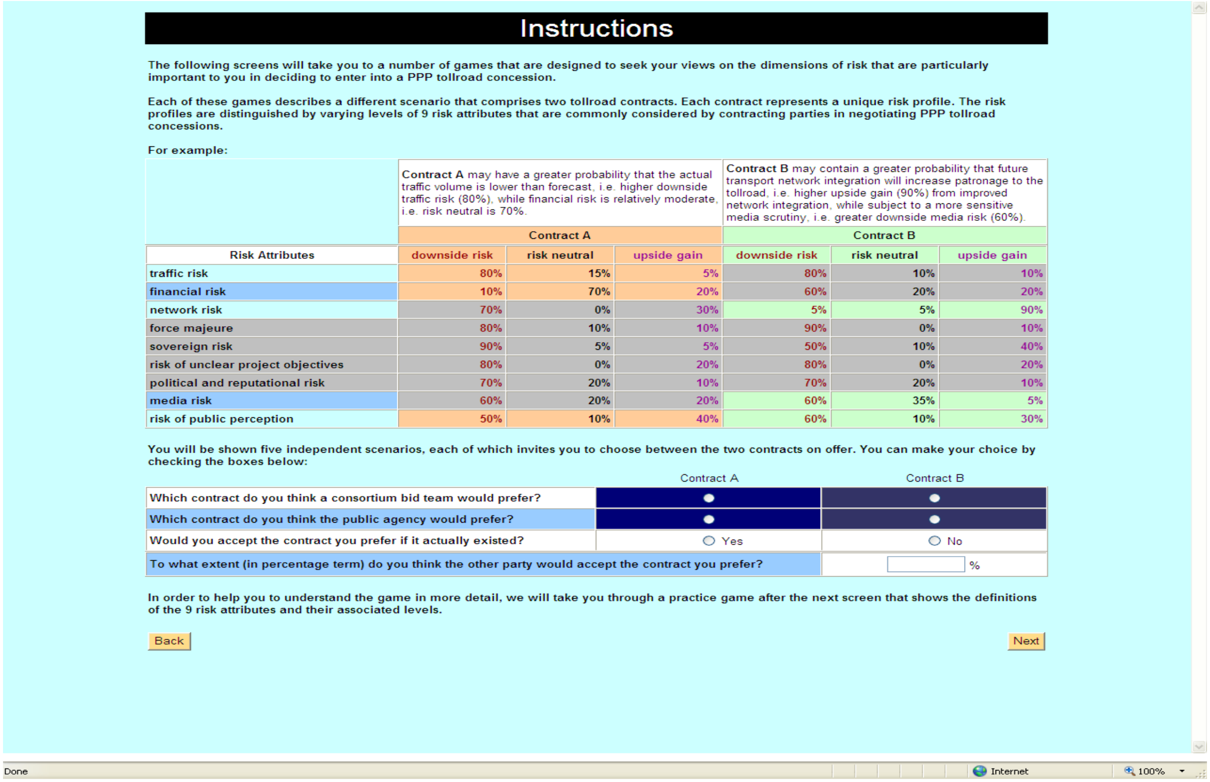
In the following sections, we will describe in detail the design as well as the theories underlying the design of parts (2), (3), (4) and (5), and will return to the evidence collected through parts (1) and (6) in Chapter 7.

6.2.1 Part 2: Stated Choice Experiment

The SCE contains a number of decision choices based on hypothetical scenarios, in which a sample of individuals evaluates two unlabelled alternative contracts. An unlabelled contract is one described by a bundle of attributes with no label or brand name to characterise what the alternative might be. In contrast, a labelled experiment has a specific name attached to each of the alternatives. For example, in the Instructions screen in Figure 6-1, a labelled experiment will have SHT instead of Contract A, and MCL instead of Contract B.

The decision to use an unlabelled experiment rather than a labelled one has multiple advantages. First, since this is an international study, an unlabelled experiment does not require the identification and use of all PPP tollroads in the world, representing significant savings in data collection cost and time. Second and more importantly, because a project's name acts somewhat like an alternative in a labelled experiment, this may invite unintended perceptions that respondents might hold with regard to that alternative to enter into their decision process, as well as induce the possibility that they will make inferences about attributes that are outside the focus of the study (i.e., that are not shown in the experiment). This may include assumptions based either on direct experience or second-hand information as proxies for these additional attributes (Hensher *et al.*, 2005a, pp. 112-114).

Each contract (A or B) represents packages of attributes that are defined by levels of risk, and respondents are asked to indicate which package they believe would be preferred by the public sector and the private consortia. The risk attributes are anchored to current experience described in Chapter 3, so that respondents can understand and relate to the attributes in a realistic way. It is then important to create the other possible levels as reasonable variations on either side of current experience (Stopher, 1998). Failure to do this may result in respondents providing poor quality and inappropriate responses, as they try to relate to attribute levels that are totally outside their experience and sometimes difficult to imagine.



Instructions

The following screens will take you to a number of games that are designed to seek your views on the dimensions of risk that are particularly important to you in deciding to enter into a PPP tollroad concession.

Each of these games describes a different scenario that comprises two tollroad contracts. Each contract represents a unique risk profile. The risk profiles are distinguished by varying levels of 9 risk attributes that are commonly considered by contracting parties in negotiating PPP tollroad concessions.

For example:

	Contract A may have a greater probability that the actual traffic volume is lower than forecast, i.e. higher downside traffic risk (80%), while financial risk is relatively moderate, i.e. risk neutral is 70%.			**Contract B** may contain a greater probability that future transport network integration will increase patronage to the tollroad, i.e. higher upside gain (90%) from improved network integration, while subject to a more sensitive media scrutiny, i.e. greater downside media risk (60%).		
	Contract A			Contract B		
Risk Attributes	downside risk	risk neutral	upside gain	downside risk	risk neutral	upside gain
traffic risk	80%	15%	5%	80%	10%	10%
financial risk	10%	70%	20%	60%	20%	20%
network risk	70%	0%	30%	5%	5%	90%
force majeure	80%	10%	10%	90%	0%	10%
sovereign risk	90%	5%	5%	50%	10%	40%
risk of unclear project objectives	80%	0%	20%	80%	0%	20%
political and reputational risk	70%	20%	10%	70%	20%	10%
media risk	60%	20%	20%	60%	35%	5%
risk of public perception	50%	10%	40%	60%	10%	30%

You will be shown five independent scenarios, each of which invites you to choose between the two contracts on offer. You can make your choice by checking the boxes below:

	Contract A	Contract B
Which contract do you think a consortium bid team would prefer?		
Which contract do you think the public agency would prefer?		
Would you accept the contract you prefer if it actually existed?	Yes	No
To what extent (in percentage term) do you think the other party would accept the contract you prefer?		%

In order to help you to understand the game in more detail, we will take you through a practice game after the next screen that shows the definitions of the 9 risk attributes and their associated levels.

Back Next

Done Internet 100%

Figure 6-1: Stated Choice Experiment – Instructions Screen

In our design, three attributes were selected for each risk; downside risk (where the actual outcome of the risk is inferior to expectations at the contract's financial close), risk neutrality (where the actual outcome of the risk more or less meets expectations at the contract's financial close), and upside gain (where the actual outcome of the risk is superior to expectations at the contract's financial close). Attribute levels were presented in percentage terms to represent the degree of (un)certainty of a future eventuality (the three percentages sum to one for each risk). Choice situations were assigned by a block column so that no contract would be presented more than once to the same respondent. The attributes of risk (i.e., downside, neutral, upside) that are presented in columns are randomly rotated in order to minimise left-hand-side bias.

In designing the attribute combinations in the SCE, a Bayesian D-optimal design with 500 Halton draws was chosen to reduce the 5^7 full factorial design to a smaller D-efficient design (Rose and Bliemer, 2008).[43] The design that yielded the best Bayesian D-error was selected

[43] A full factorial design is a design where all possible combinations of attribute levels are generated (78125 for a 5^7 design). However, it is necessary to generate only a subset of these, as giving respondent 78125 choice situations is probably posing too much of a cognitive burden on their part. Hence, we used a fractional factorial design. One way to do this is to generate efficient designs that attempt to select the best choice situations that

for coding into the internet interface. Since this is the first SCE study in PPPs, there were no prior parameter estimates that we could rely on to attach to the percentage points. We could therefore only assume their direction. For this reason, we used Bayesian uniform priors between zero and minus one for the downside parameters, and zero and one for the upside, and left the neutral level out of the utility function when calculating the asymptotic variance-covariance matrix (so the design would not confound). We specified the range of attribute levels between zero per cent and 95 per cent, with an increment level of five per cent. To cover all combinations, i.e., nine risks with three attributes each (upside, neutral and downside) and by two alternatives (contract A and contract B) plus one additional degree of freedom, the design would require 55 choice situations. We increased the choice situations by a multiple of 55, in this case to 165, in order to maintain an equal spread for high and low percentage levels for upside and downside attributes so as to minimise bias toward high (low) percentage levels at the individual respondent level. The blocking column was also used to reduce the choice situations to five for each participant.

6.2.2 Part 3: Attribute Processing Strategies of Respondents

Bounded rationality emphasised in TCE (refer to Section 4.3.3.1) suggests that decision-making processes are sensitive to the complexity of the decision-making context (Simon, 1986). When confronted with complexity, individuals will adopt decision-making strategies to simplify the process, including focusing on a limited number of attributes that are of paramount importance to them. This information-processing strategy will ultimately guide the decision maker to the preferred option from the available alternatives. In a path-breaking article that constituted a first crucial step in analysing rationality in decision making, Cyert *et al.* (1956) concluded that changes in processes of information-gathering and in processes of search for alternative courses of action, actually had major effects on the final decision.

In the context of a choice experiment, the information structure of an SCE is often used as an indicator of its complexity. That is, more information (in terms of attributes, levels and alternatives) means greater complexity, and hence greater difficulty in making a choice. With 54 cells in a single-choice situation (two contracts by nine risks by three attributes), we

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will maximise the information necessary to estimate discrete choice models. This was done by calculating the asymptotic variance-covariance matrix for the design and choosing the design with the smallest values in this matrix. One type of efficient design is a Bayesian D-efficient design, which requires analysts to assume parameter priors but does so by assuming a distribution of possible values, rather than exact parameter priors.

suspected that participants would not consider all risk attribute levels when choosing the preferred contract.

In a similar vein, recent developments in behavioural and cognitive psychology have raised fundamental questions about the underlying behavioural processes that individuals bring to bear on the information they are confronted with in making choices. Some researchers suggest that in order to process the context and arrive at a choice outcome, individuals enact various coping strategies derived from heuristics to comprehend the way that information embedded within attributes that define alternatives is represented (cf., Tversky and Kahneman, 1974; Kahneman and Tversky, 1979; Gilovich *et al.*, 2002). The accumulated empirical evidence in choice analysis lends support to the proposition that some individuals do not adopt a strictly weighted additive alternative-based processing rule in making a choice (Hensher and Greene, 2010)[44]. In some cases, individuals were found to ignore specific attributes as a coping strategy to process information in order to deal with the perceived complexity of a SCE (Hensher *et al.*, 2005b); in other scenarios, individuals were observed to ignore unimportant attributes as part of an appraisal of the relevance of the information available (Hensher, 2004; Hensher, 2006).

One strong theme emerging from these studies signals that accounting for information relevance and cognitive burden due to BR is essential if we are to accommodate individual heterogeneity in the processing of choice experiments. The important message here is that APSs should be built into the estimation of choice data from SC studies, and that failure to account for APS heterogeneity may yield behavioural outputs that are biased. Serious ramifications of this omission include an increase in the variance of the unobserved effects (Puckett and Hensher, 2008) and under(over)-valued parameter estimates (Hensher *et al.*, 2005b; Scarpa et al., 2009).

Two methods are emerging to investigate the role of process heuristics – one involving supplementary questions on how attributes are processed, such as whether specific attributes are ignored (Hensher *et al.*, 2007; Puckett and Hensher, 2008), and another involving the inclusion of an opt-out or null alternative (Rose and Hess, 2009; Hensher, 2010).

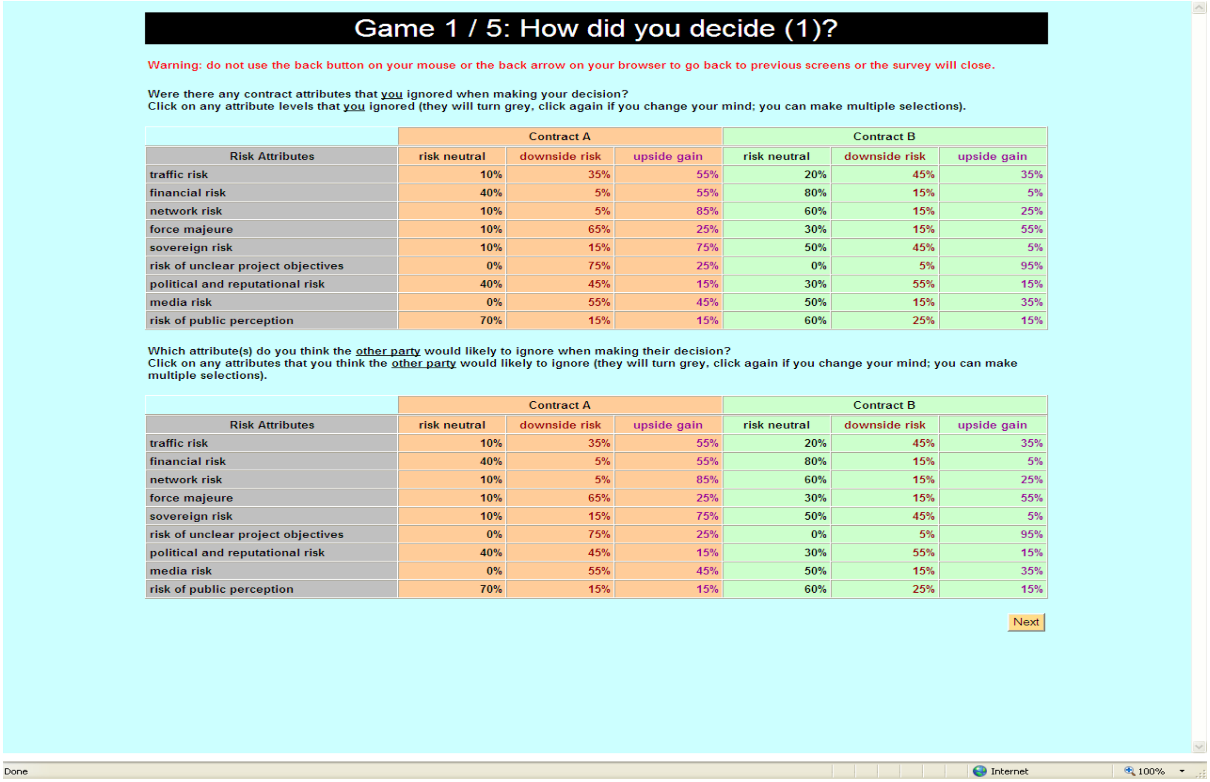
[44] However, there exists evidence to suggest otherwise. Hess *et al*. (2010) found that there were subsets of respondents who did use a strictly weighted additive alternative-based processing rule in making a choice.

The first method implements accounting for APS heterogeneity at the attribute level within all alternatives in a choice experiment. In the SCE survey we included supplementary self-stated response questions on whether particular attributes were ignored. The advantage of incorporating supplementary questions is twofold. First, it minimises the risk of over-simplifying the SC design because some respondents may require all the information to make meaningful choices and some may require information that may be irrelevant to others – this is highly possible because this study is about understanding the choice of decision makers from two very different backgrounds. Second, it acknowledges that varying APSs may be enacted not only across decision makers, but also across choice situations faced by a given decision maker.

A further issue to consider was the location of these self-stated questions. Two options were available: (1) present these questions after each choice situation had been completed (cf., Hensher *et al.*, 2005b; Rose *et al.*, 2005); and (2) present these questions only after all choice situations had been completed. Our decision to follow the first option was based on the empirical results in Puckett and Hensher (2009), which confirmed that a choice-set-specific specification of APS prompts was an improvement over one that prompts respondents only upon completing all choice situations, since it could recognise the levels of attributes in each choice situation.

Figure 6-2 shows an example of the supplementary APS screens. In such screens, which were shown immediately after each choice situation, respondents were asked to click on the attributes that they ignored during the experiment (the upper panel in Figure 6-2). An attribute could be ignored within some alternatives but not within others, hence the APS task involved respondents indicating which attributes were ignored for each alternative (it could be a particular level of an attribute they were ignoring). Another issue to take into account, given that the interest in the risk perceptions of two vastly different cohorts, involved asking each respondent to click on the attributes that they thought the other party would ignore when making their decision (see the lower panel of Figure 6-2). We will return to this aspect when reporting the results in Section 7.3.2.

To implement the second method, an additional response question was added to each of the choice scenario screens: "*Would you accept the contract you prefer if it actually existed?*" (see Figure 6-1). This gave respondents a choice to not choose any of the contracts on offer.



Game 1 / 5: How did you decide (1)?

Warning: do not use the back button on your mouse or the back arrow on your browser to go back to previous screens or the survey will close.

Were there any contract attributes that you ignored when making your decision?
Click on any attribute levels that you ignored (they will turn grey, click again if you change your mind; you can make multiple selections).

	Contract A			Contract B		
Risk Attributes	risk neutral	downside risk	upside gain	risk neutral	downside risk	upside gain
traffic risk	10%	35%	55%	20%	45%	35%
financial risk	40%	5%	55%	80%	15%	5%
network risk	10%	5%	85%	60%	15%	25%
force majeure	10%	65%	25%	30%	15%	55%
sovereign risk	10%	15%	75%	50%	45%	5%
risk of unclear project objectives	0%	75%	25%	0%	5%	95%
political and reputational risk	40%	45%	15%	30%	55%	15%
media risk	0%	55%	45%	50%	15%	35%
risk of public perception	70%	15%	15%	60%	25%	15%

Which attribute(s) do you think the other party would likely to ignore when making their decision?
Click on any attributes that you think the other party would likely to ignore (they will turn grey, click again if you change your mind; you can make multiple selections).

	Contract A			Contract B		
Risk Attributes	risk neutral	downside risk	upside gain	risk neutral	downside risk	upside gain
traffic risk	10%	35%	55%	20%	45%	35%
financial risk	40%	5%	55%	80%	15%	5%
network risk	10%	5%	85%	60%	15%	25%
force majeure	10%	65%	25%	30%	15%	55%
sovereign risk	10%	15%	75%	50%	45%	5%
risk of unclear project objectives	0%	75%	25%	0%	5%	95%
political and reputational risk	40%	45%	15%	30%	55%	15%
media risk	0%	55%	45%	50%	15%	35%
risk of public perception	70%	15%	15%	60%	25%	15%

Next

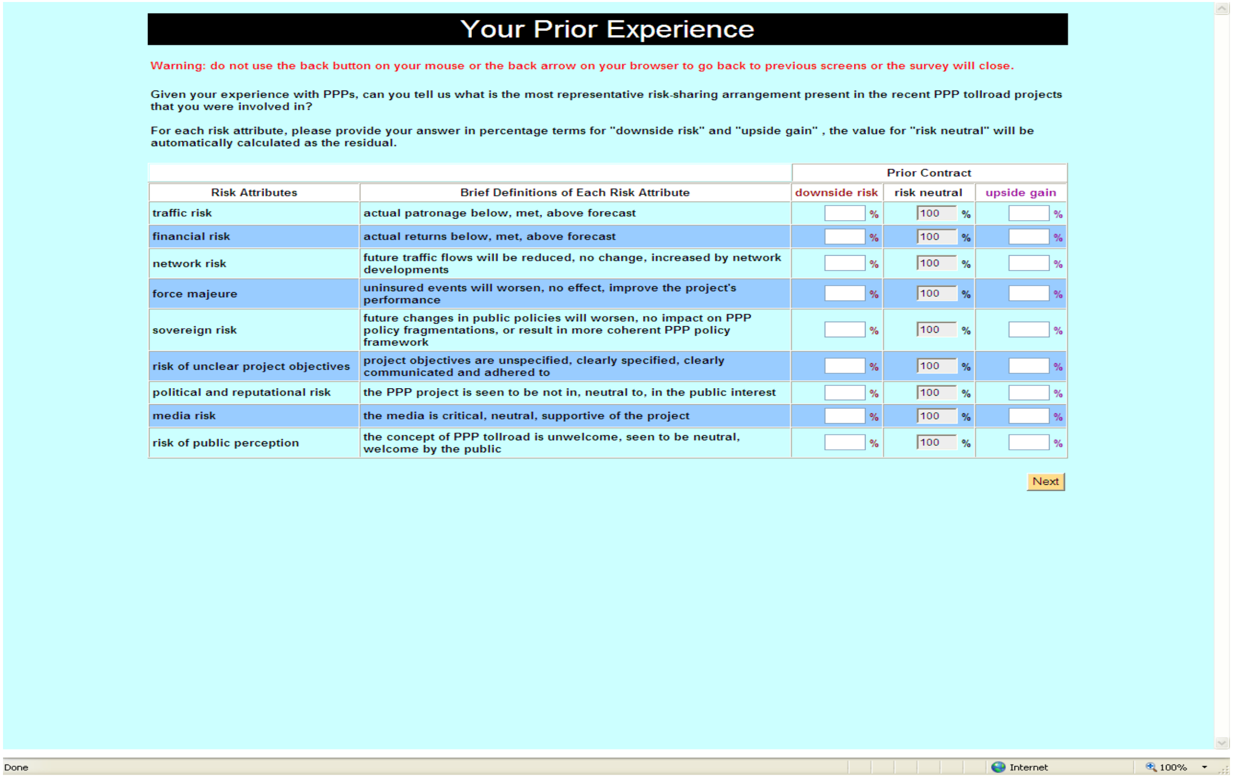
Done Internet 100%

Figure 6-2: Stated Choice Experiment - Attribute Processing Screen

6.2.3 Part 4: Reference Level Based on Prior Experience

The choice experiment provides the variability needed to parameterise the source of risks. However, as remarked in Section 5.5, the reference point is needed to apply the model within the framework of PPPRI using the sentiment of HSQI.

In the screen shown in Figure 6-3, the respondents were asked to complete the boxes for downside risk and upside gain for each risk, based on their prior experience in relation to risks. The percentage of the risk neutral attribute was automatically calculated after the data were entered into the other two boxes, and the percentages across the three boxes sum to 100. These RP data define the reference level for calculating PPPRI.



Your Prior Experience

Warning: do not use the back button on your mouse or the back arrow on your browser to go back to previous screens or the survey will close.

Given your experience with PPPs, can you tell us what is the most representative risk-sharing arrangement present in the recent PPP tollroad projects that you were involved in?

For each risk attribute, please provide your answer in percentage terms for "downside risk" and "upside gain" , the value for "risk neutral" will be automatically calculated as the residual.

		Prior Contract		
Risk Attributes	Brief Definitions of Each Risk Attribute	downside risk	risk neutral	upside gain
traffic risk	actual patronage below, met, above forecast	%	100 %	%
financial risk	actual returns below, met, above forecast	%	100 %	%
network risk	future traffic flows will be reduced, no change, increased by network developments	%	100 %	%
force majeure	uninsured events will worsen, no effect, improve the project's performance	%	100 %	%
sovereign risk	future changes in public policies will worsen, no impact on PPP policy fragmentations, or result in more coherent PPP policy framework	%	100 %	%
risk of unclear project objectives	project objectives are unspecified, clearly specified, clearly communicated and adhered to	%	100 %	%
political and reputational risk	the PPP project is seen to be not in, neutral to, in the public interest	%	100 %	%
media risk	the media is critical, neutral, supportive of the project	%	100 %	%
risk of public perception	the concept of PPP tollroad is unwelcome, seen to be neutral, welcome by the public	%	100 %	%

Next

Done Internet 100%

Figure 6-3: Revealed Preference Data – Prior Experience

6.2.4 Part 5: Attitudinal Questions

To further understand stakeholders' personal views on optimal risk-sharing arrangments, we included attitudinal questions seeking respondets' views on risk-sharing in PPP tollroads. In the screen presented in Figure 6-4, each respondent was asked to indicate the extent to which each of the nine risks had been adequately dealt with in the PPP tollroad contracts that they have been involved in, by rating on a one-to-seven likert scale (1=not very well; 7=very well).

The extensive literature on the choice of procurement between PPPs and other methods (see Section 4.2.1) highlights an interest in attitudinal views of stakeholders. We designed a second set of attitudinal questions to obtain a feeling about respondents' preference for the PPP procurement method. In Figure 6-5, respondents were asked to rate on a one-to-seven likert scale whether they preferred PPPs over other methods (1=PPPs are the most preferred method; 7=other methods are the most preferred or PPPs are the least preferred). We will discuss the responses to these questions in the next chapter.

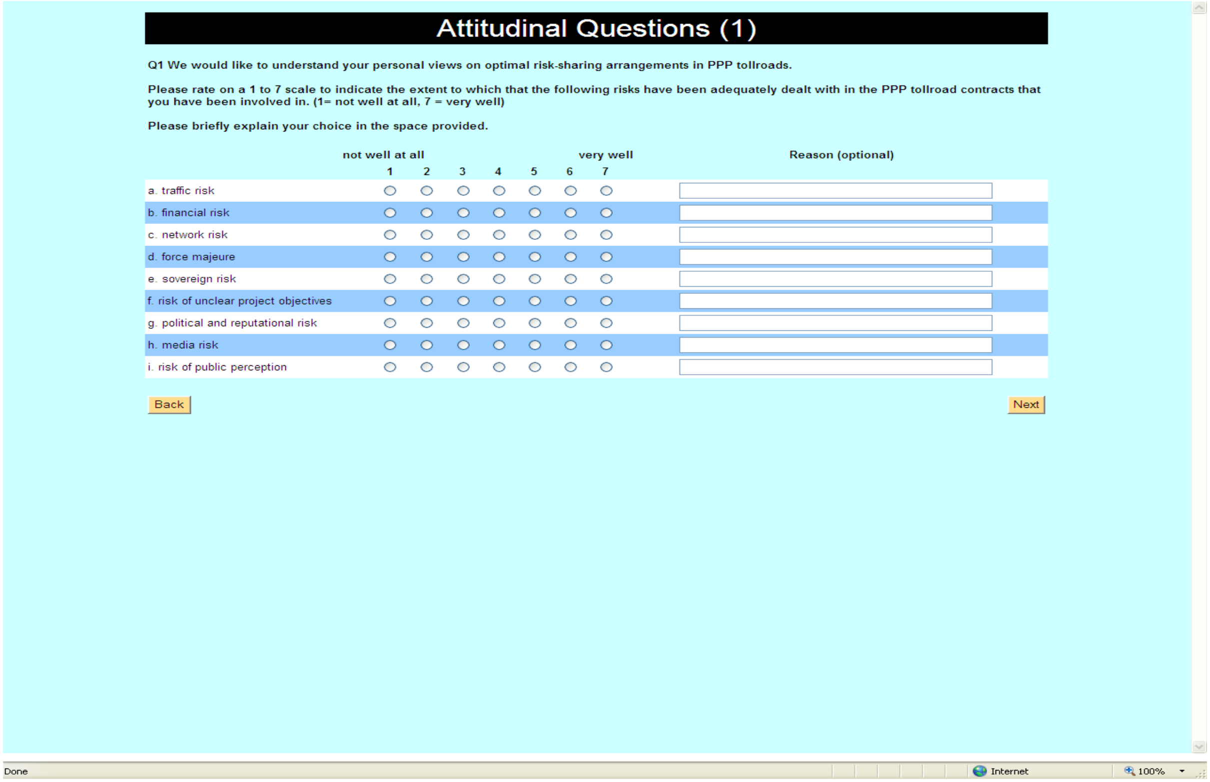


Figure 6-4: Online Survey – Attitudinal Questions (1) Screen

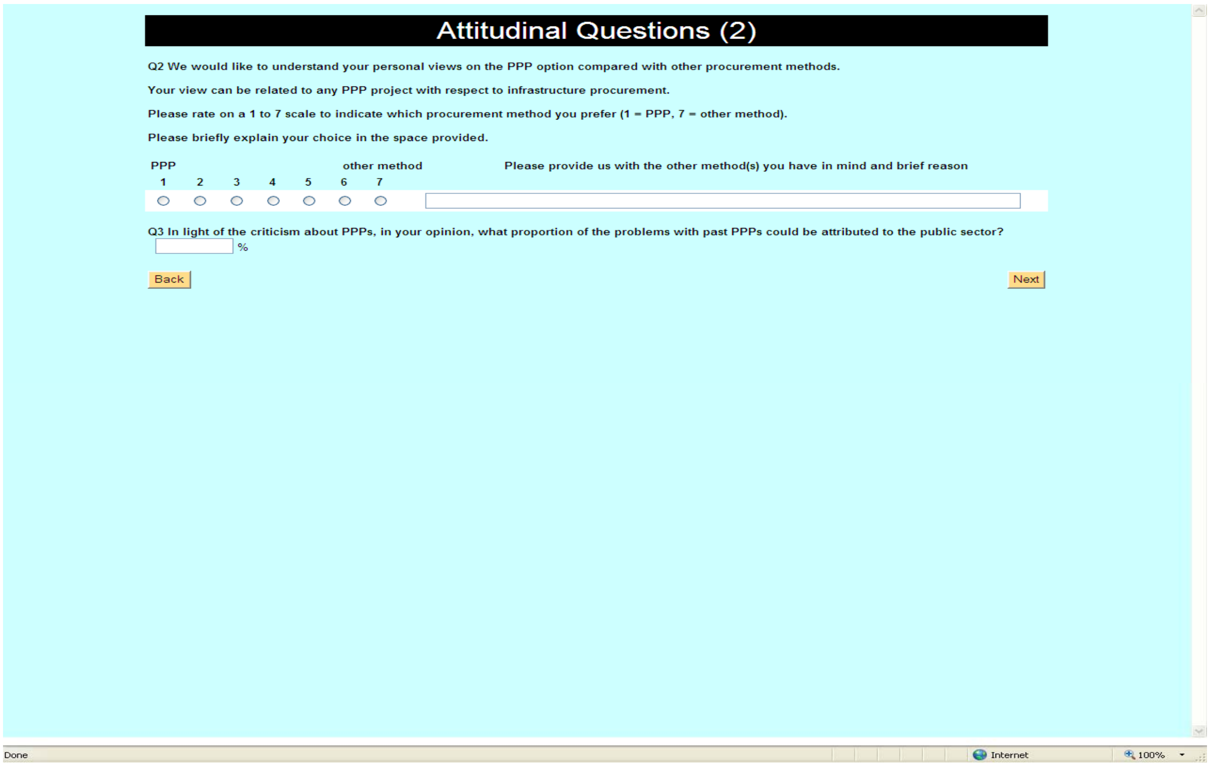


Figure 6-5: Online Survey – Attitudinal Questions (2) Screen

6.3 Data Collection

Standardisation in PPP contracts acts in our favour in data collection. The idea that uniformity economises transaction costs (Ménard, 2004) and consolidates learning effects to lower contracting costs (Välilä, 2005) also features in PPPs, and becomes an advantage to support this global study. We found in the pilot survey that participants from various institutions and from different language backgrounds were able to relate readily to our experiment, hence the lower transaction costs in data collection. Interestingly though, contrasting results have emerged in the UK, where contract standardisation in PPPs did not reduce transaction costs (Dudkin and Välilä, 2005).

Individuals who have had direct experience in making decisions regarding PPP tollroad concessions were invited to take part in the experiment. In order to mitigate the inhibiting effects of loss-aversion bias – i.e., if decision makers expect that evaluation of the outcomes of their performance will take place after each choice situation, they become extremely loss-averse in terms of risk-taking (Kahneman and Lovallo, 1993) – all participants were informed at the commencement of the experiment that they would be invited to assess five choice situations based only on hypothetical scenarios that had been designed to mimic the risk profile of PPP tollroad contracts.

After the pilot study with eight participants, it was clear that the conciseness of the experiment required a detailed explanation to ensure a consistent understanding of the experiment across all participants. Therefore, a decision was made to adopt the CAPI approach to complete the collection process.

Semi-structured interviews were set up for the subsequent 93 participants. Interviews lasted on average 100 minutes. Most meetings were face-to-face, some were through Skype, and two were by telephone; all were undertaken by the author. Since the choice situations were assigned by the blocking column and the order of attributes was randomly rotated, the author would have no knowledge of what choice situations would arise unless the participant signed into the survey with their identification number. Face-to-face and Skype interviews had an advantage over telephone interviews because the former methods enabled the author and the participant to share the exact information on the computer screen. In telephone interviews, the participant had to explain to the author what they were seeing on their computer screens. Although time consuming, working through the survey with each participant had considerable empirical advantage as it enabled the author to guide the participant throughout the whole experiment process and provide instant clarification when needed.

At the beginning of the survey, participants were invited to give an account of their background and experience in the field. These accounts were recorded on tape (with permission) to provide a means of assurance to cross-reference the information provided in the survey. These 10-15 minute initial conversations benefit the research in a number of ways: (a) they help make sense of the perspectives of the participant (the information is then reflected in the first part of the experiment – About You and the Projects You Have Been Involved In); (b) the information unveiled in the conversation determined the role the participant would play in the experiments; and (c) they provided points for cross-referencing with survey data when information was missing or unclear.

With this background, we were able to understand each participant's most recent experience or the area that they were most experienced in. Given the number of years of experience in the field, many participants had held multiple roles and had worked for different organisations across the public and private sectors. In order to obtain high-quality data and minimise cross-over in their roles of play in the experiments, each participant was reminded during the survey to consistently play the role associated with their most recent experience, or their most experienced role.

After finishing the first choice situation, the author asked the participant the reason for their decision, these questions being framed in accordance with the information the participant provided during the initial conversation. As a way of illustration, the author asked a participant why they would choose contract A given their background as the regulator. The participant would then finish the remaining choice situations with the author sitting on the side observing their choices. When the participant chose a contract that was inconsistent with their previous choices and accounts, the author would clarify the reason for the inconsistency without influencing/changing their choice.

6.4 Summary of Chapter

This chapter has provided a detailed account of the design of the data collection instrument and the data collection process. The survey design and the CAPI technique have assured the quality of the collected data. After six months of data collection and 101 interviews (eight pilots plus 93 post-pilot) with people who have had direct experience in dealing with PPP toll road concessions, we have data capable of testing the suite of hypotheses of interest. The next chapter will report the descriptive statistics of these data and discuss the information obtained from the interviews. Results of hypothesis testing will be reported in Chapter 8.

CHAPTER 7: DESCRIPTIVE OVERVIEW OF EMPIRICAL DATA

7.1 Introduction

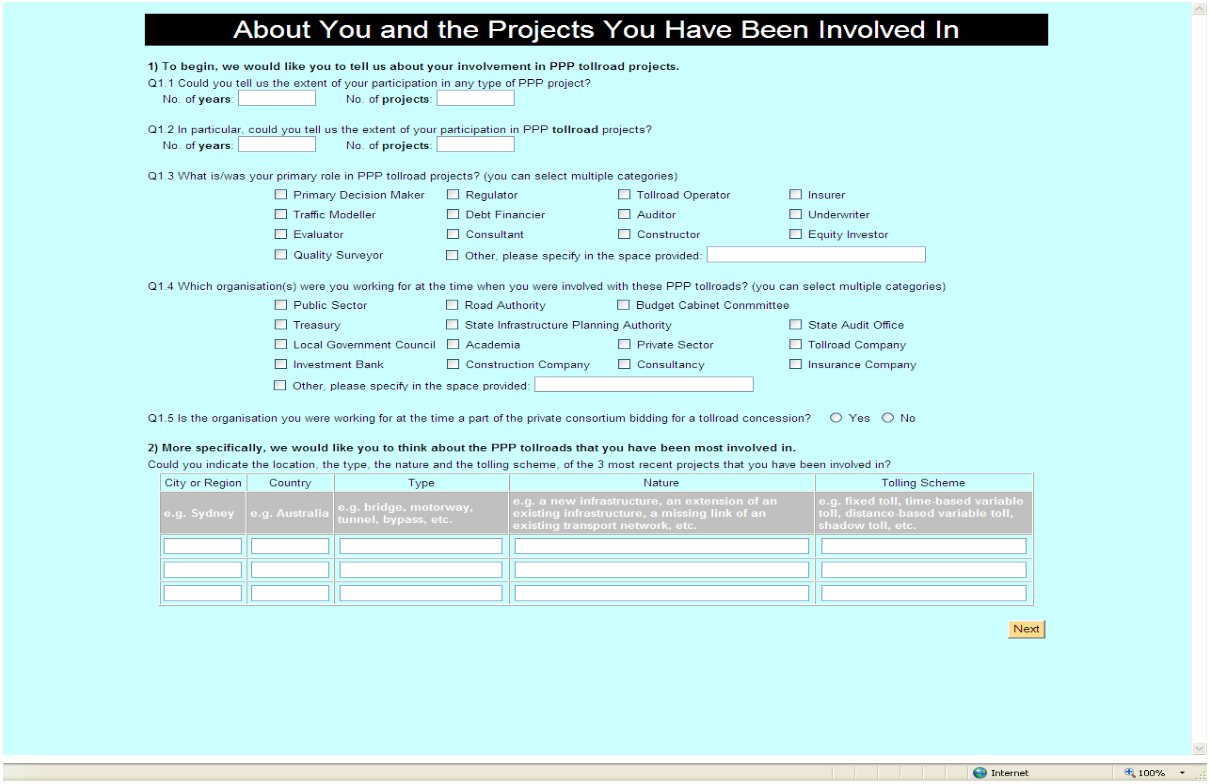
The previous chapter introduced the data collection instrument, with a focus on the key components of the CAPI survey that were designed to provide all the data required for formal statistical analysis, including hypothesis testing. In this chapter, we present descriptive statistics of the data collected and discuss the preliminary implications of the findings revealed in the descriptive assessment.

Overall, the international significance of this study is enhanced by the coverage and diversity of the experience and knowledge of participants who took part in the survey. The participants' experience in PPP years (projects) ranged from 1 to 46 years (1 to 120 projects), and brought to this study their project experience in 6 geographic regions covering 32 countries. The diversity of their backgrounds has strengthened the study's global significance: there are 24 different roles represented, from primary decision maker to consultant, from 14 different organisations, including steering committees and commercial banks.

We discuss the data in greater detail in the next section, with an emphasis on the comparison of socio-demographic attributes between public and private sector participants. Section Three examines the type of contract selected by the two groups of participants, including the APSs they adopted by eliciting their attribute non-attendance (ANA) through self-reported supplementary questions. Section Four provides the summary of statistics on participants' prior experience. Section Five reports participants' views on optimal risk-sharing in PPPs and their preferred method of procurement. The last section summarises the chapter findings.

7.2 Socio-Demographic Attributes of Respondents

This is the first of the six sections of the online survey; the screen that captured the data input is presented in Figure 7-1. One hundred and one people participated in the survey, of whom 41 represent the public sector and 60 the private sector. A list of participants is included in Appendix F. The distributions in Figure 7-2 and Figure 7-3 show that the participating cohort represents a good spread across roles and organisations.



About You and the Projects You Have Been Involved In

1) To begin, we would like you to tell us about your involvement in PPP tollroad projects.

Q1.1 Could you tell us the extent of your participation in any type of PPP project?

No. of **years**: No. of **projects**:

Q1.2 In particular, could you tell us the extent of your participation in PPP **tollroad** projects?

No. of **years**: No. of **projects**:

Q1.3 What is/was your primary role in PPP tollroad projects? (you can select multiple categories)

☐ Primary Decision Maker ☐ Regulator ☐ Tollroad Operator ☐ Insurer
☐ Traffic Modeller ☐ Debt Financier ☐ Auditor ☐ Underwriter
☐ Evaluator ☐ Consultant ☐ Constructor ☐ Equity Investor
☐ Quality Surveyor ☐ Other, please specify in the space provided:

Q1.4 Which organisation(s) were you working for at the time when you were involved with these PPP tollroads? (you can select multiple categories)

☐ Public Sector ☐ Road Authority ☐ Budget Cabinet Conmmittee
☐ Treasury ☐ State Infrastructure Planning Authority ☐ State Audit Office
☐ Local Government Council ☐ Academia ☐ Private Sector ☐ Tollroad Company
☐ Investment Bank ☐ Construction Company ☐ Consultancy ☐ Insurance Company
☐ Other, please specify in the space provided:

Q1.5 Is the organisation you were working for at the time a part of the private consortium bidding for a tollroad concession? ○ Yes ○ No

2) More specifically, we would like you to think about the PPP tollroads that you have been most involved in.

Could you indicate the location, the type, the nature and the tolling scheme, of the 3 most recent projects that you have been involved in?

City or Region	Country	Type	Nature	Tolling Scheme
e.g. Sydney	e.g. Australia	e.g. bridge, motorway, tunnel, bypass, etc.	e.g. a new infrastructure, an extension of an existing infrastructure, a missing link of an existing transport network, etc.	e.g. fixed toll, time-based variable toll, distance-based variable toll, shadow toll, etc.

Next

Internet 100%

Figure 7-1: Details of Participants and Projects of Involvement

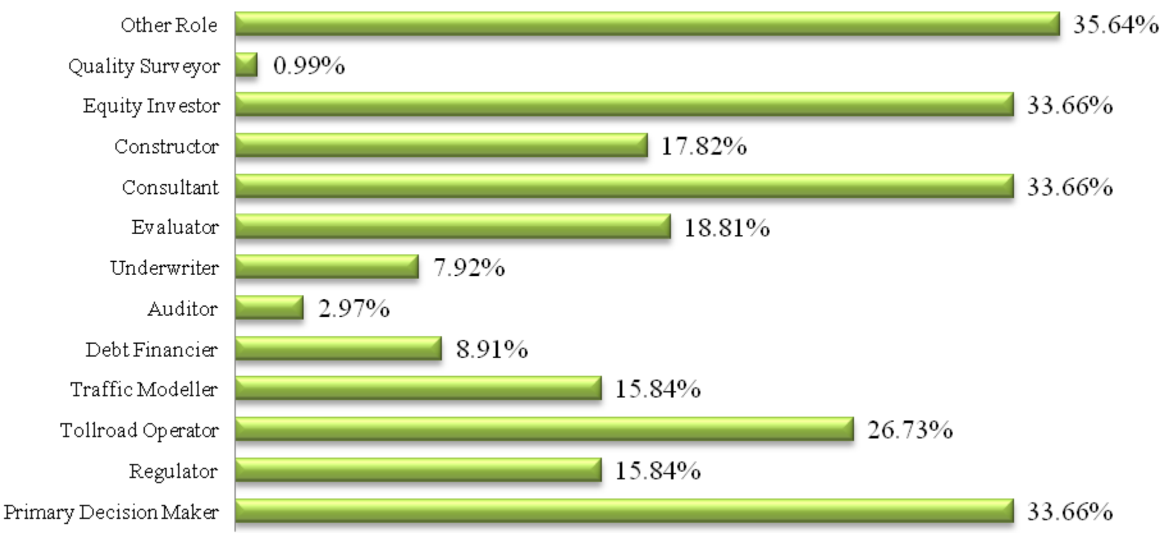


Figure 7-2: Distribution of Roles - All 101 Participants

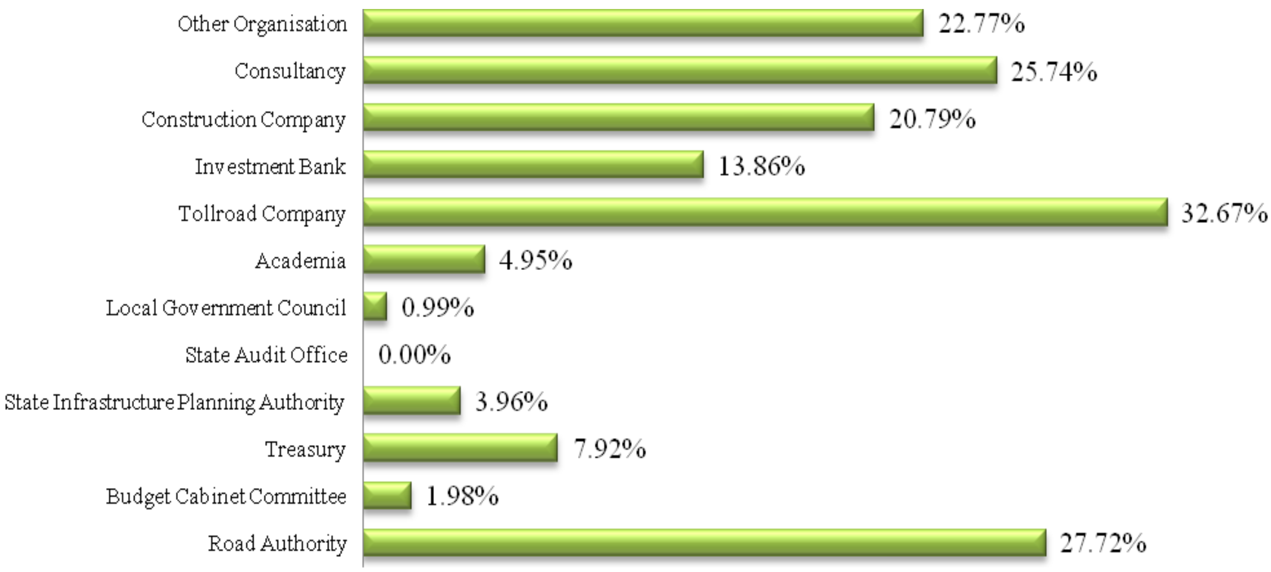


Figure 7-3: Distribution of Organisations - All 101 Participants

7.2.1 Public Sector Participants

Among the 41 public sector participants (PUSPs), there is a sizeable proportion of respondents with a regulator background (39 per cent). In addition, 68 per cent of participants have worked in public road authorities. Two PUSPs indicated they were acting as debt financier – public authorities in some countries (like Spain) and some international organisations (like the European Bank and Asian Development Bank) would lend to tollroad companies at a lower-than-market interest rate in order to facilitate project delivery.

Often, governments create steering committees to oversee a major project. These committees appoint auditors and evaluators to assure procurement procedures are adhered to. Before being submitted to the Budget Cabinet Committee (or equivalent) for final approval, such governance assurance requires PPP contracts to be audited by a party that is independent from all contractual parties.

Other roles played by PUSPs include internal financial adviser of a road authority, policy adviser of a government PPPs unit, PPP liaison officer responsible for exchanging knowledge between European countries, commercial lawyers acting on behalf of the public sector procurer, financial adviser to government and technical adviser to government.

7.2.2 Private Sector Participants

Among the 60 private sector participants (PVSPs), 93 per cent have first-hand knowledge in bidding for PPP tollroads. A large proportion of the construction companies and almost half the investment banks occupy multiple roles (e.g., primary decision maker, equity investor, tollroad company). Investment banks are also active in assuming financial responsibilities – 18 per cent take on the roles of debt financier and underwriter (Figure 7-4).

Construction companies and investment banks have cumulative expertise in building infrastructure projects, financial power to shoulder the expensive bidding costs, and the financial strength to sustain these mega investments. Most bidding consortia are led by one of these two players (or both).[45] If successful, they will subsequently incorporate into a tollroad company (the SPV) to manage the construction, as well as operate and maintain the facility. They will also have a good proportion of equity stake in the project in order to entice financial interest from the market. Most debt financiers, in particular in the aftermath of the GFC, require the sponsor to bear a considerable share of equity risk.

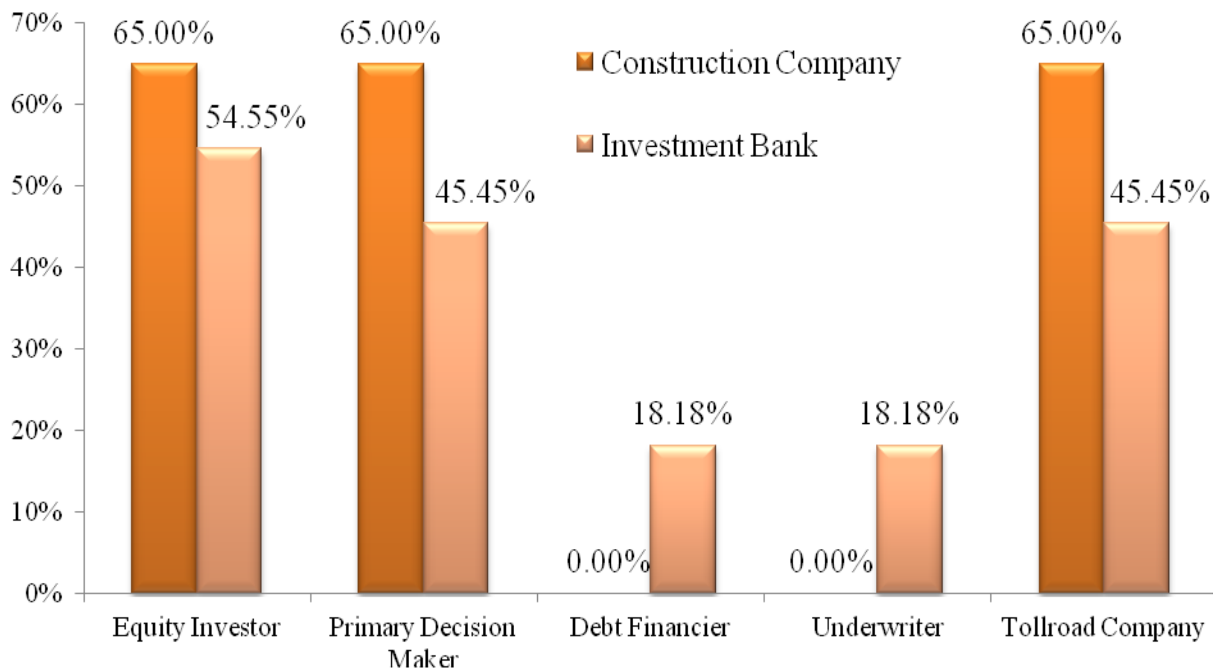


Figure 7-4: Stake in PPP Tollroads - Construction Company vs. Investment Bank

[45] Different arms of the same construction group will form different consortium to partner with other interested parties to bid for a project. This strategy will increase the group's chance of winning.

In PPP road projects, bidding costs for any private proponent can be well over three per cent of the project's capital value (Dudkin and Välilä, 2005). Theses transaction costs constitute an obvious hurdle for new entrants, with the potential impact of undermining the disciplining power of *ex ante* competition. Evidence from the UK suggests that prohibitive transaction costs do indeed deter competition (NAO, 2007).

A number of participants complained that high transaction costs result in PPP roads being predominantly the market for construction companies and investment banks[46]:

> P_a: *High cost of bidding for PPP projects makes it untenable for new players to enter the market.*

In the opinion of other participants, costs were inflated by governments' procurement processes:

> P_b: *Tendering costs are too expensive... financial close documentations are far too rigid.*

> P_c: *Governments will need to be open to processes that reduce upfront bid costs (and associated agency costs on the bidding consortia) and progress to a negotiated style of outcome as has been seen in the US. This can be done effectively to achieve the same commercial, political and financial outcomes for all parties but will reduce the upfront bidding costs. Reducing the upfront bidding costs will also attract offshore D&C contractors and other investors who see the bid costs as a real barrier to entering the [country's] market.*

> P_d: *Project implementation must consider streamlining procurement processes to reduce time and cost for all parties.*

There are many success stories of PPP tollroads being built and operated by construction company-led consortia. However, Australia has recently seen a number of high profile projects experiencing severe financial difficulties. These failures are considered inevitable due to the short-term approach taken by some of these consortia:

[46] The quotations are provided by participants in the comment section on the last screen of the survey (see Appendix E).

P_e: *PPPs procured with consortia dominated by [construction companies] (most of those procured in the past) can suffer from a short-term perspective.*

P_f: *Constructors and short-term financial sponsors have too much influence over long-term contractual matters to the detriment of the project's viability.*

P_g: *[The resultant] PPPs create a tension between the need to create a winning bid scenario and the most likely ongoing operating conditions.*

Other roles and organisations of PVSPs include financial adviser, legal adviser, general counsel of a tollroad company, bond issuer of an investment bank, investment fund manager (acting mainly as equity sponsor), operations and maintenance contractor, engineering adviser and commercial bank (acting mainly as debt financier).

Some participants had been independent directors of investment banks, where their role was meant to exert prudential governance to ensure the bank did not undertake aggressive investment decisions. The effectiveness of this governance measure was weakened at the time when there was an abundant supply of private capital, as noted by one participant:

P_h: *In the recent projects, the private sector mispriced the risks therefore resulting huge losses to them. The aggressive bidding process by the private consortium was driven by the desire to win a small number of projects offered to the market in an environment where there was over-supply of private capital.*

7.2.3 Comparison: PUSPs versus PVSPs

7.2.3.1 Experience in PPPs

The wealth of experience and knowledge that participants brought to this study makes the sample a very good cross-section of real-world practitioners, adding substantial credibility to the evidence obtained from the survey.

Compared to PUSPs, PVSPs seem to be much more experienced in dealing with PPP projects (Figure 7-5). On average, project experience in any PPP is 30 per cent (20 vs. 14) higher for PVSPs, with project experience specific to PPP tollroads double (50 per cent) for PVSPs (12 vs. 6). However, this should not be interpreted as the private sector being better at the bargaining table, because the difference in number of years of experience are marginal (PVSPs are only 15 per cent, i.e., 13 vs. 11, more experienced in any type of PPP and 18 per cent, i.e., 11 vs. 9, more experienced in PPP tollroads).

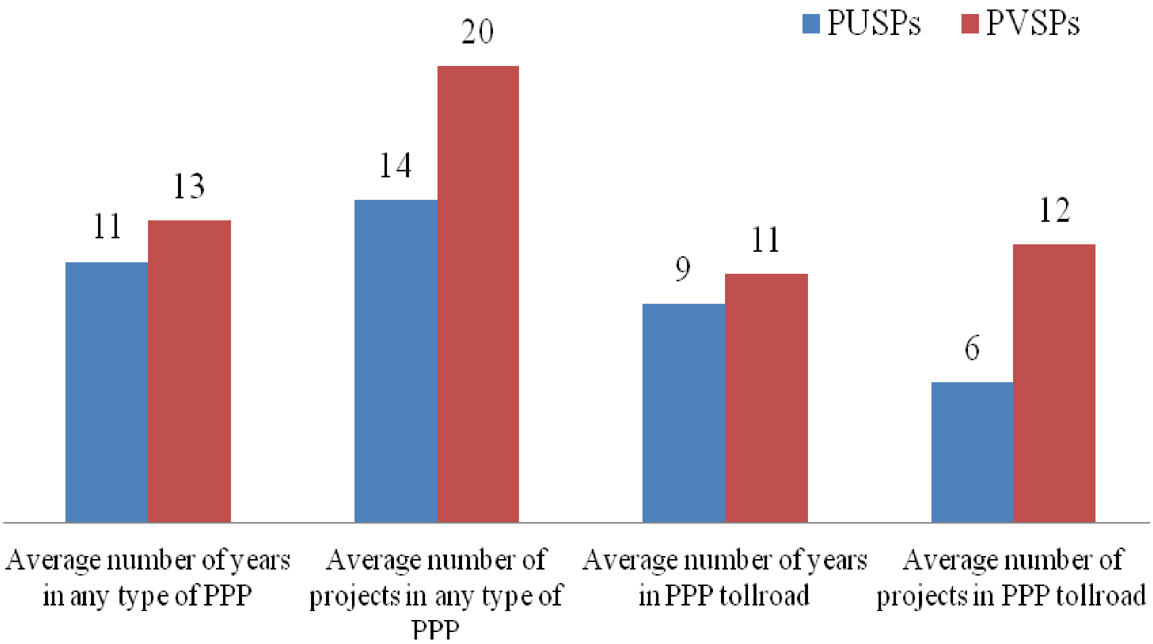


Figure 7-5: Overall Experience in PPPs – PUSPs vs. PVSPs

In terms of the experience and knowledge of primary decision makers (34 per cent of the 101 participants, see Figure 7-2), they have, on average, 14 years or 19 projects experience in any type of PPPs, of which nearly 12 years or 11 projects experience are specific to PPP tollroads (Table 7-1).

Table 7-1: Experience - Primary Decision Makers (All Participants)

	N	Mean	Min	Max	Median	Std. Deviation
No. of years in any type of PPP	34	14	5	46	14	7.53
No. of projects in any type of PPP	34	19	2	120	10	28.58
No. of years in PPP tollroad	34	12	1	24	13	6.28
No. of projects in PPP tollroad	34	11	1	90	6	18.38

Figure 7-6 compares the experience of primary decision makers from the public sector versus those from the private sector. Similar to the results in Figure 7-5, while primary decision makers in the private sector are considerably more experienced in terms of number of projects, they are only marginally more experienced in terms of number of years – 13 per cent (15 vs. 13) in any PPP years and 17 per cent (12 vs. 10) in PPP tollroad years.

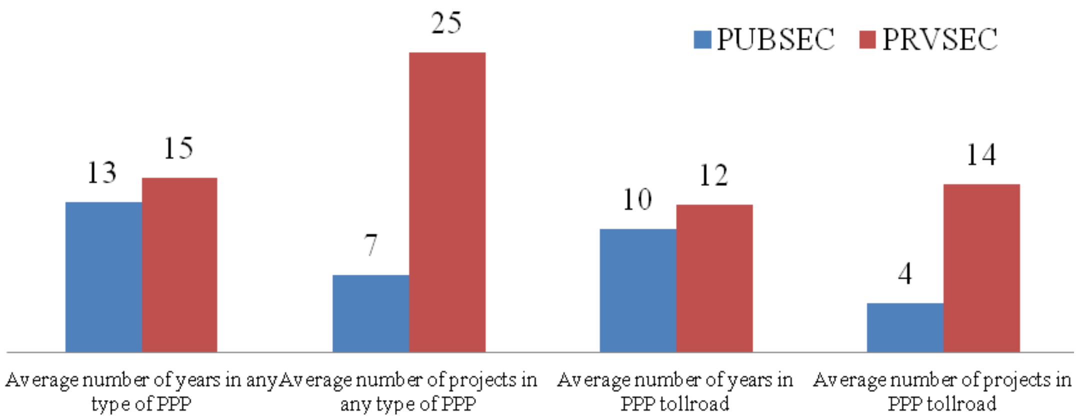


Figure 7-6: Experience - Primary Decision Makers (PUSPs vs. PVSPs)

7.2.3.2 Involvement in Tollroad Projects

Participants were asked to list the three most recent projects they had been involved in: 83 respondents listed 3, while 18 had experience in 2 or fewer projects. Of these 18 participants, 9 had experience in a single project.

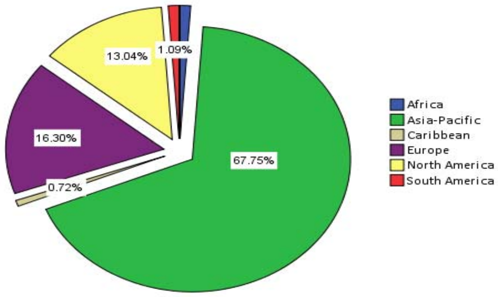


Figure 7-7: PPP Tollroad Projects that You Have Been Involved In (All, in Regions)

Table 7-2: Experience with Tollroad Projects (Regions and Countries)

REGION	COUNTRY
Africa (2 countries)	South Africa Mozambique
Asia-Pacific (9 countries)	Australia Bangladesh India Indonesia Korea New Zealand Russia Thailand Vietnam
Caribbean (2 countries)	Jamaica Puerto Rico
Europe (13 countries)	Austria Belgium Croatia

REGION	COUNTRY
Europe (continued)	France Greece Hungry Ireland Italy Netherlands Poland Portugal Spain UK
North America (3 countries)	Canada Mexico USA
South America (3 countries)	Chile Brazil Colombia
Total	32

As presented in Figure 7-7 and Table 7-2, the locations of projects are diverse, covering six geographic regions and 32 countries. This shows that the PPP is an important and popular procurement method of road infrastructure across the world, regardless of the differences in jurisdiction, culture and economic development of the regions.

Figure 7-8 shows that the private sector is exposed to PPP projects in many more jurisdictions (166) than the public sector (110). This evidence adds to the support for PPPs; some pundits arguing that PPPs offer government the opportunity to exploit economies of scale and scope by pooling knowledgeable resources abundantly available in the market (Parker and Hartley, 2003) and benefit from PVSPs' international experience.

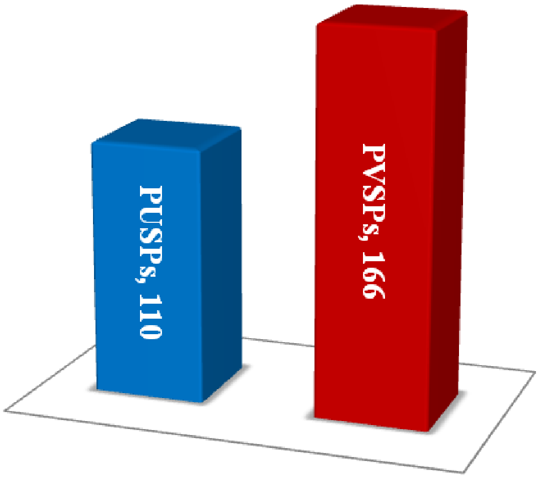


Figure 7-8: Number of Countries of Involvement – PUSPs vs. PVSPs

Nevertheless, a couple of respondents qualified this finding in light of experience encountered in developing economies:

> P_i: *For developing countries, PPPs are difficult to procure, [their] under-developed legal framework [presents] higher risk.*

> P_j: *In developing economies they [PPPs] provide facility for a government to implement infrastructure projects which they might not otherwise be able to afford - through increased participation of private sector investment. However ability to pay in these instances is problematic and government subsidy may be required.*

These comments support our propositions established in earlier chapters: i) sovereign risk is a concern to the private sector, and this is particularly so in developing countries; and ii) PPPs are in essence a financing instrument all over the world.

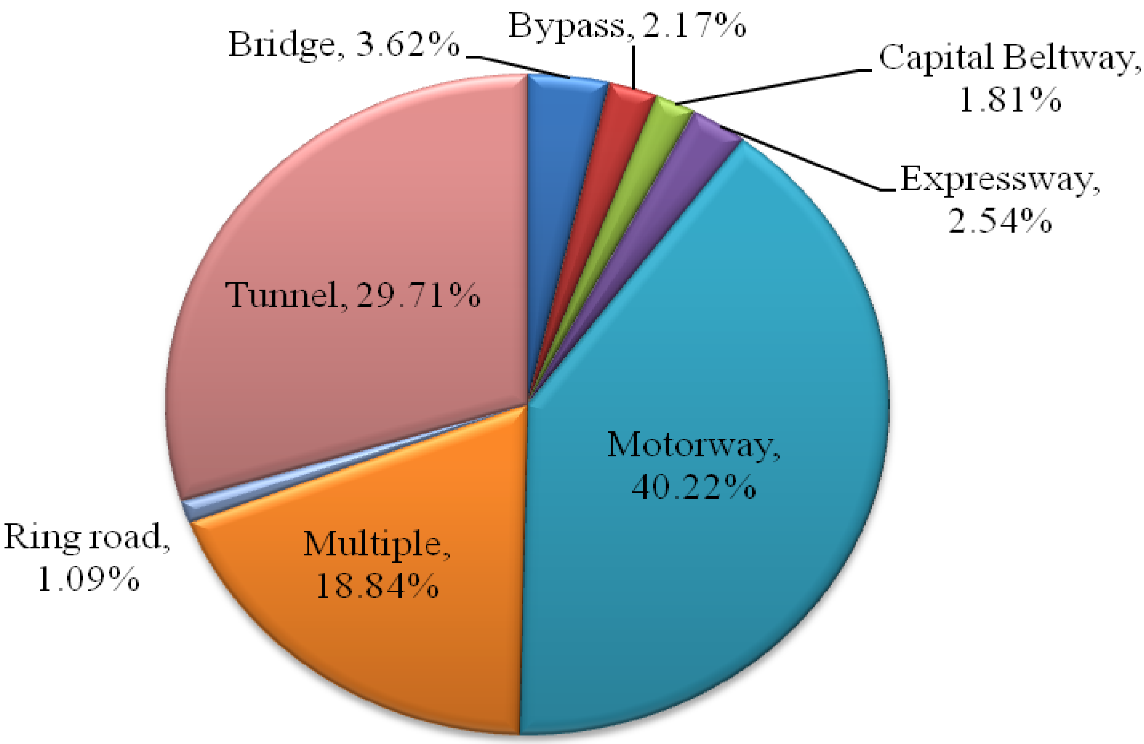


Figure 7-9: Involvement in Types of PPP Tollroads

Eight types of PPP tollroads are identified by all participants (Figure 7-9). Motorways top the list (40.22 per cent), followed by tunnel (29.71 per cent), and multiple (18.84 per cent)[47] . The type of project experience is divided into four categories (see Figure 7-10): new infrastructure (63.77 per cent), existing infrastructure (32.61 per cent)[48], other (2.17 per cent)[49], and missing link (1.45 per cent). The spike in new infrastructure confirms that a large share of roads would not have been available for motorists if private finance were not sought.

[47] This group includes motorway, tunnel and bridge.

[48] Includes upgrade, widening, extension, refinancing and acquisition of an existing infrastructure.

[49] Includes upgrading a segment of existing infrastructure plus adding a portion of new infrastructure.

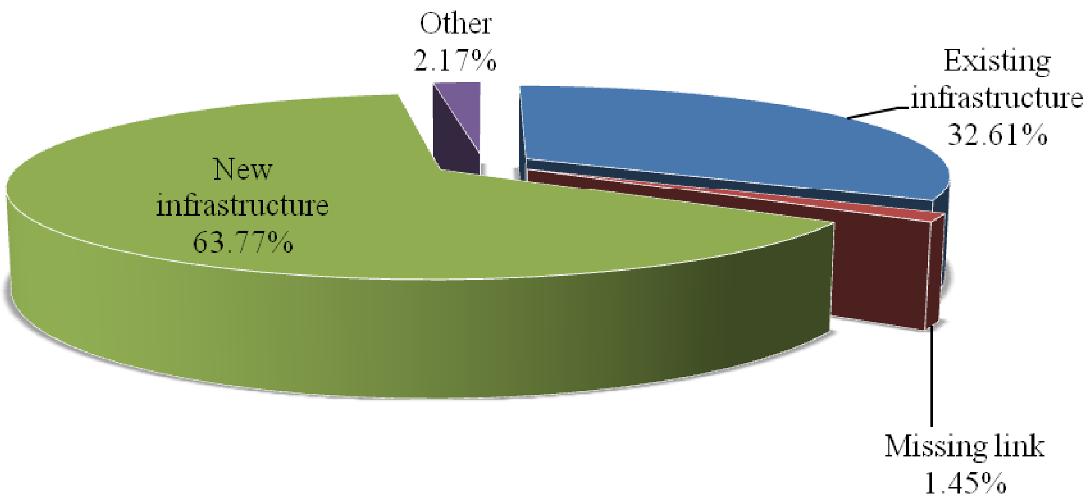


Figure 7-10: Involvement in the Nature of PPP tollroads

Figure 7-11 illustrates the tolling schemes that participants have been involved in. A little less than one half of project experience (46.38 per cent) applies to fixed tolls, among which are three in South Africa that charge a fixed toll with a discounting regime; one in Australia and another in South Korea that are paid by a fixed toll and revenue guarantee; one in Canada that is charged to natural gas companies only; and one in Belgium where the pricing level change is subject to return on private capital. This is followed by 23.91 per cent of project experience charging distance-based tolls and 9.06 per cent charging an availability payment. Located in Canada and Russia, 8.70 per cent charge distance plus time-based variable tolls.

Only one project (located in the US) applies the HOT (mentioned by five participants). The 'No new tolls' category accounts for two refinancing projects, while the 'Other' category includes two projects in Canada that charge an availability payment plus a fixed toll; one in Hungary that started with a distance-based variable toll but changed to an availability payment in 2003; one in Canada that uses an availability payment plus 16 per cent of shadow toll; and one in the US that applies a distance-based variable toll as well as a fixed toll. Only three projects apply shadow toll, one each in Canada, Portugal[50] and Spain, accounting for 1.09 per cent of total project experience. The combination of shadow and availability payment

[50] Portugal is one of the pioneers that embarked on a shadow tollroad program on an aggressive scale; it proved unsustainable as the government found the program difficult to budget for and unaffordable, and it was unable to pay for the usage of these roads.

regimes (2.54 per cent) is only seen in the UK. Time-based variable toll represents 2.54 per cent of total project experience, over half of which (57 per cent) are in Spain.

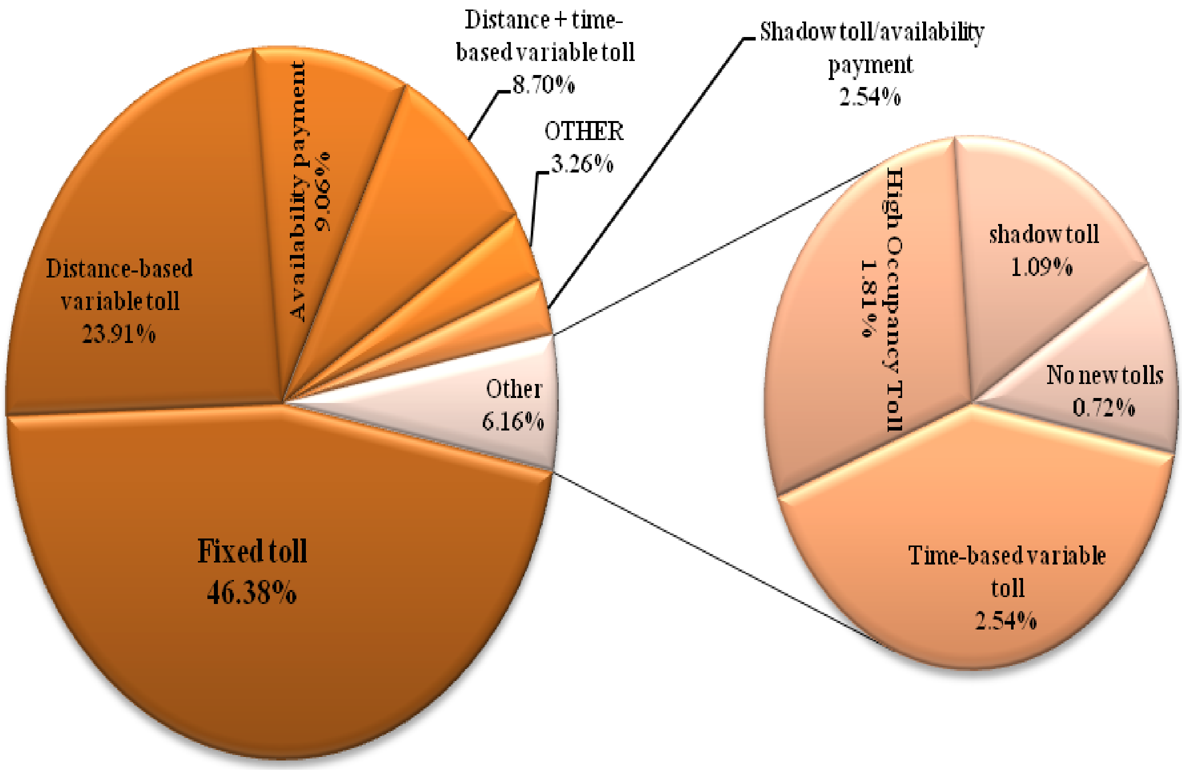


Figure 7-11: Involvement in Tolling Schemes

No systematic relationships are found between tolling scheme, type of project and nature of project. It appears that toll price is primarily used to pay for the project rather than being implemented as a traffic demand management device. This observation highlights the potential failure of PPPs to fully exploit the market for the purpose of allocative efficiency in managing road space. However, this is not the failure of the PPP scheme *per se*, but rather the outcome of political intent to bypass fiscal constraint. A retired director of a road authority succinctly pinpointed the problem:

> *P_k:* *To get the best outcome for the community each party should bear the risk that is in their position to do so. Unfortunately this is not happening in reality. Financing cost, tolls, and length of the concession are more than they should be. These were set in the view of not adding public debt.*

He was joined by others:

P_l: *Design, Build, Operate & Maintain [method] brings all the benefits of a PPP without having major transaction costs + high risk profile - the only major benefit [of PPPs] is having finance that State Governments do not want to borrow or go into debt.*

P_m: *[PPP] is a function of western democracies needing to use stretched balance sheets to provide services that cannot be funded by the private sector e.g., police, hospital and health services and school services.*

P_n: *Currently, due to restrictions in public budget, one could tend to overestimate the benefits of PPP.*

Some commented further on the myopic view of politics that may have compromised the social benefits of PPPs:

P_o: *30-year concession period leads to big efficiency savings, [as long as it can] avoid political interference (e.g., refusing to increase tolls).*

P_p: *There should however be opportunities [in contracts] for using pricing mechanisms to manage the network (i.e. tolls not linked to CPI).*

Most PUSPs who acted in the capacity of regulator admitted that toll pricing is a sensitive matter and therefore its level and escalation clause must be closely regulated by government. The contract for the first PPP tollroad in Toronto, Canada (Motorway 407) did not provide for the regulation of toll escalation. Within their legal rights, the private operator increased the toll price a number of times. The price hikes were seen as maximising private profit at the expense of the public purse.

The high volume of traffic on Motorway 407 created mounting pressure on government, because it meant a bad deal for public users. The government later attempted to stop the toll escalation, but lost the law suit to the private operator. Cognisant of the 407's poor publicity, some PUSPs, especially those in Canada, have shown a high level of averseness to projects that would yield financial gains to the private operator.

Many governments impose strong clauses in contracts to limit the private operator's capacity to set and vary toll prices. Figure 7-12 shows that only 13 per cent of project experience to some extent applies the pricing structure (e.g., time variable, HOT) that is linked to traffic demand management, compared to an 87 per cent share of other tolling schemes.

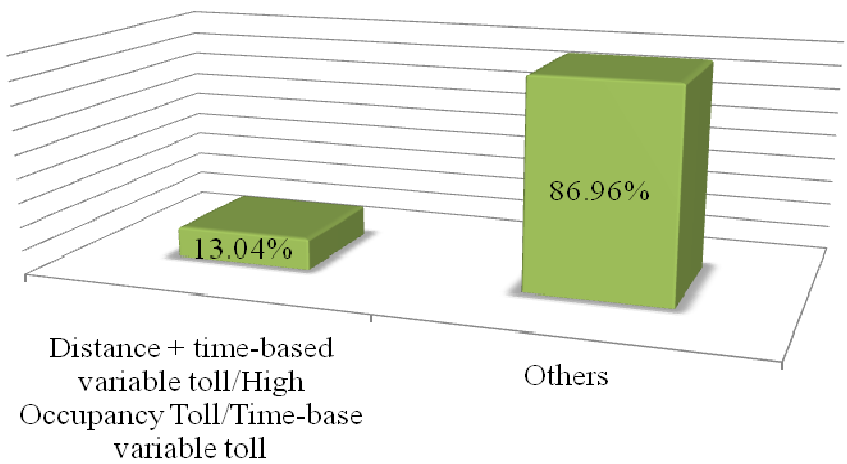


Figure 7-12: Tolling Scheme – Traffic Management vs. Others

The lack of consistency in tolling schemes has caused unintended consequences for society and for infrastructure planning, as one of the PUSPs commented:

> P_q: *In [some jurisdictions] the piecemeal process of tollroad development has led to unintended consequences for road users where there is inequality in the cost of [using] roads. The benefit of the tollroad methodology coupled with user demand management could deliver the funding capability to significantly enhance [the city's] public and private transport requirements.*

The power of pricing mechanisms is often overlooked (strategically in some cases). Consequences of toll pricing regulation are only narrowly considered at the project level. One participant noted:

> *P_r:* *Spain recently in 2007 passed a legislation that the annual escalation of toll prices can only be up to 85 per cent of the inflation index. Because the government believed that the life-cycle benefit of operating the tollroad should be incorporated in the reduced toll price. I think this is a controversial issue.*

Among the countries that embrace time-related variable tolling, Canada and Spain each account for 33.33 per cent; followed by France, Mexico, Russia and the US, each accounting for 8.33 per cent (Figure 7-13).

A few governments are fond of the idea of using a tolling structure to manage roads, albeit not for the same purpose. Consistent with our findings in Chapter 2, some government officials candidly maintained that the tolling scheme should be aligned with the project objective. A tolling scheme can help remove budget uncertainty. Greenfield projects where traffic demand is unknown should be funded by an availability fee whereas brownfield projects where there is an established traffic pattern can be paid by shadow tolls. Different tolling schemes should be applied to roads that make up the integrated transport network: a real toll is charged on segments where government wants to ensure a smooth flow of traffic, while shadow and availability tolls are used on segments where patronage should be encouraged.

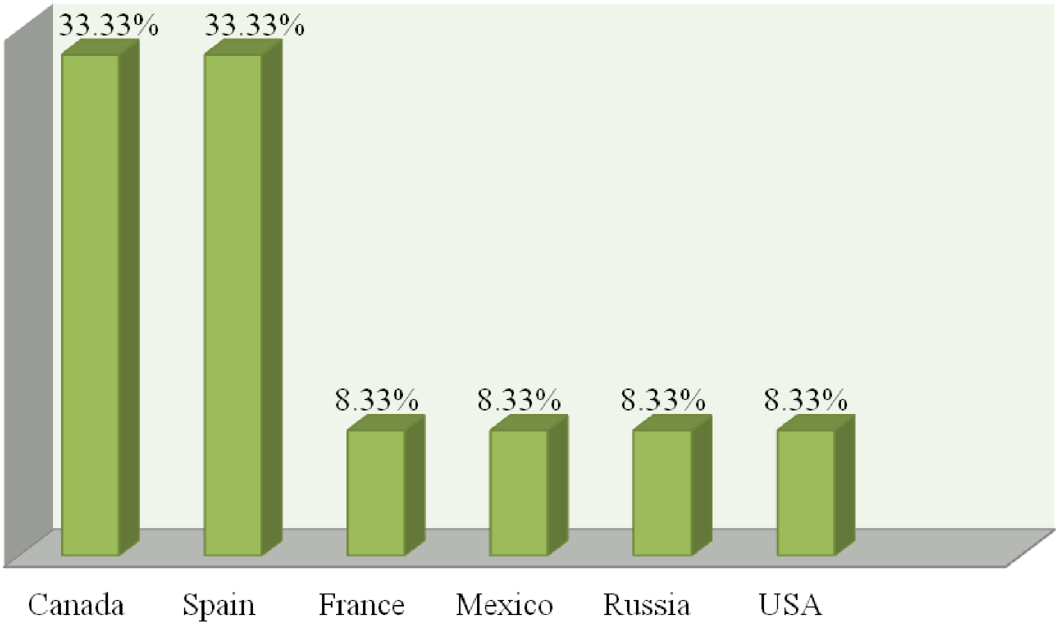


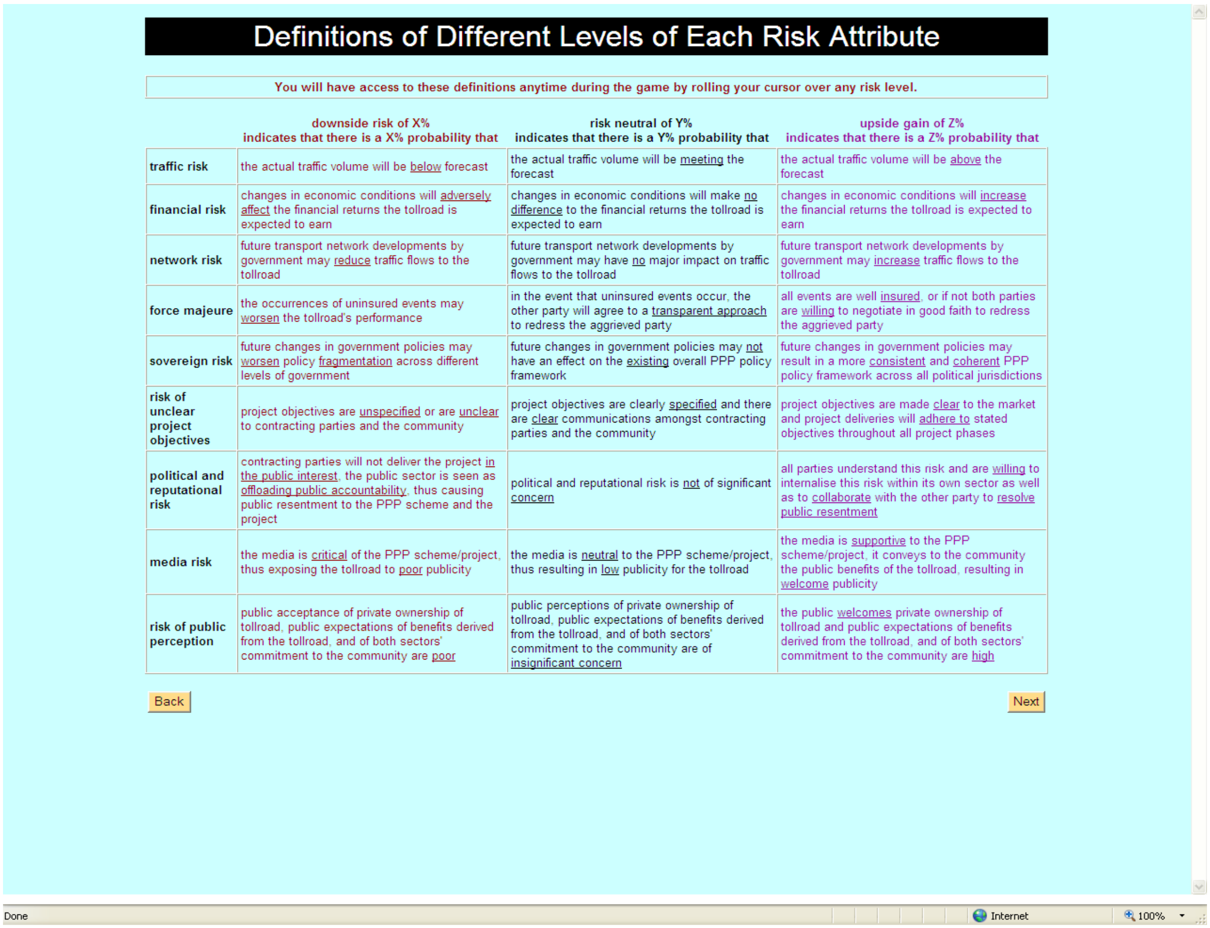
Figure 7-13: Countries Using Toll Pricing for Traffic Demand Management

The Dutch government is exploring the financial advantage of PPPs while maintaining an independent tolling scheme to manage driving behaviour; as described by one of the road authority officials:

> P_s: *PPP is now promoted by the government, but without the private tolling part. We will pay the concessionaires on availability of the road. A national electronic tolling system is expected in about 2014 on all roads both public and private: the revenues will be for the public sector ([to manage] demand). There is no direct link between the tolls and revenues to the private operator. The so tolled revenues will go to the treasury therefore reduce tax on new vehicles and vehicle ownership. [This is] a new way to manage traffic demand, by implementing time-based variable tolls and making more expensive to drive a vehicle than owning a vehicle.*

7.3 Choice of Contracts

We have provided in Figure 7-14 the survey screen that contains full definitions of the nine risks and their associated levels. The screen is located immediately after the Instructions screen depicted in Figure 6-1. The full definition of each risk level is also offered in a callout balloon, which will appear on the screen when the mouse cursor is pointed to the risk level. It was discovered later during the experiment that these balloons were hardly called out, as all participants were very familiar with the risks. This experience has confirmed two important aspects of the chosen research methodology: (a) the in-depth interview study on which this choice experiment is based has captured the right information, so we are confident that the experiments mimic the real-world scenarios of PPP tollroads; and (b) we have chosen a highly relevant set of participants for the study.



Definitions of Different Levels of Each Risk Attribute

You will have access to these definitions anytime during the game by rolling your cursor over any risk level.

	downside risk of X% indicates that there is a X% probability that	risk neutral of Y% indicates that there is a Y% probability that	upside gain of Z% indicates that there is a Z% probability that
traffic risk	the actual traffic volume will be below forecast	the actual traffic volume will be meeting the forecast	the actual traffic volume will be above the forecast
financial risk	changes in economic conditions will adversely affect the financial returns the tollroad is expected to earn	changes in economic conditions will make no difference to the financial returns the tollroad is expected to earn	changes in economic conditions will increase the financial returns the tollroad is expected to earn
network risk	future transport network developments by government may reduce traffic flows to the tollroad	future transport network developments by government may have no major impact on traffic flows to the tollroad	future transport network developments by government may increase traffic flows to the tollroad
force majeure	the occurrences of uninsured events may worsen the tollroad's performance	in the event that uninsured events occur, the other party will agree to a transparent approach to redress the aggrieved party	all events are well insured, or if not both parties are willing to negotiate in good faith to redress the aggrieved party
sovereign risk	future changes in government policies may worsen policy fragmentation across different levels of government	future changes in government policies may not have an effect on the existing overall PPP policy framework	future changes in government policies may result in a more consistent and coherent PPP policy framework across all political jurisdictions
risk of unclear project objectives	project objectives are unspecified or are unclear to contracting parties and the community	project objectives are clearly specified and there are clear communications amongst contracting parties and the community	project objectives are made clear to the market and project deliveries will adhere to stated objectives throughout all project phases
political and reputational risk	contracting parties will not deliver the project in the public interest, the public sector is seen as offloading public accountability, thus causing public resentment to the PPP scheme and the project	political and reputational risk is not of significant concern	all parties understand this risk and are willing to internalise this risk within its own sector as well as to collaborate with the other party to resolve public resentment
media risk	the media is critical of the PPP scheme/project, thus exposing the tollroad to poor publicity	the media is neutral to the PPP scheme/project, thus resulting in low publicity for the tollroad	the media is supportive to the PPP scheme/project, it conveys to the community the public benefits of the tollroad, resulting in welcome publicity
risk of public perception	public acceptance of private ownership of tollroad, public expectations of benefits derived from the tollroad, and of both sectors' commitment to the community are poor	public perceptions of private ownership of tollroad, public expectations of benefits derived from the tollroad, and of both sectors' commitment to the community are of insignificant concern	the public welcomes private ownership of tollroad and public expectations of benefits derived from the tollroad, and of both sectors' commitment to the community are high

Figure 7-14: The Stated Choice Experiment – Definitions Screen

7.3.1 Contract Choice

In each of the five choice situations played by 101 participants, participants were asked to consider contract A and contract B and, based on each contract's risk profile, indicate which contract they think a private consortia would prefer ('1st row' in Figure 7-15) and the contract they believe a public agency would prefer ('2nd row' in Figure 7-15). In more than half (57 per cent or 290 cases) of the 505 choice situations, participants believed that both parties would prefer the same contract. Of these, a vast majority of 57 per cent (165 cases) of participants are PVSPs. It suggests that PVSPs are comparatively more confident about reaching an agreement with the road authority. Such confidence may have accumulated from their exposure to more projects and a greater number of countries.

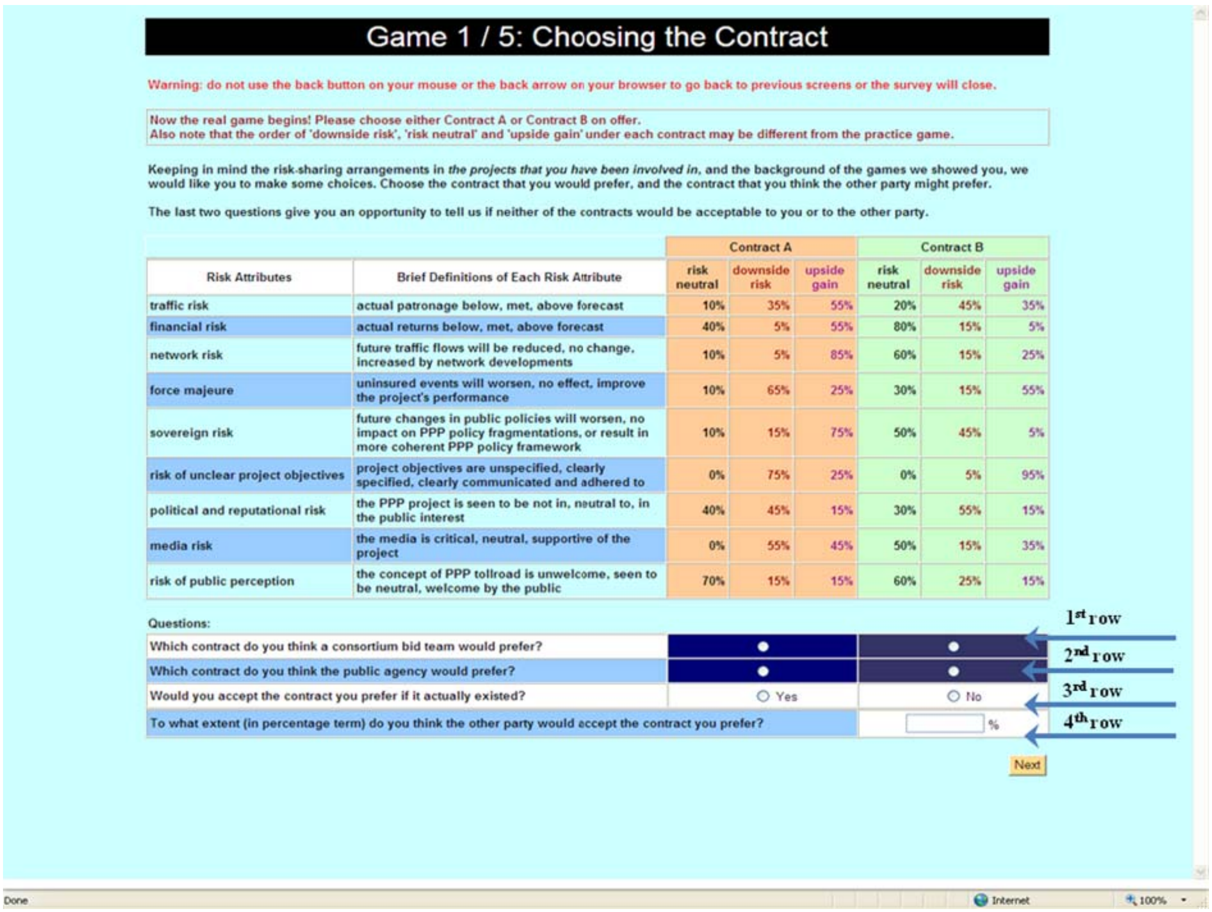


Figure 7-15: The Stated Choice Experiment – Contract Choice

After choosing their preferred contract, participants were asked whether they would accept that contract if it actually existed ('3rd row' in Figure 7-15). In 54 per cent of 505 cases, participants indicated they would accept the preferred contract; 60 per cent of participants came from the private sector. It is evident that most PUSPs favour inaction over action. This status quo bias implies that when making decisions about whether or not to enter into a procurement contract, PUSPs are highly loss-averse, preferring avoidance of risks (Kahneman *et al.*, 1991; Tversky and Kahneman, 1991). A similar observation was made in Tetlock and Boettger (1994), that pressures of accountability increase the status quo bias and other manifestations of loss aversion.

Figure 7-16[51] shows that consultants would most likely accept the preferred contract if it existed, closely followed by stakeholders from tollroad companies. Interest in tollroads from construction companies remains strong, while interest from pension funds has overtaken that of investment banks. Investment banks are the least likely to accept the preferred contract, even though in the past they had a highly active role in the field. This dramatic change in appetite toward tollroads may be related to the failure of a number of high-profile tollroads worldwide. Each of these failed projects involved a large proportion of stake from investment banks. One such experience has resulted in the restructure of an Australian-based international tollroad company that was backed by an investment bank. Subsequently, the new entity now only manages the existing tollroad assets, and no longer engages in acquiring new tollroads.

In terms of participants' appetite for tollroads, consultants, who have the highest incidence of accepting the preferred contract if it existed, are the most aggressive in their investment decisions. This is to be expected given that consultants do not bear any project risks. One consultant informed the author that they were typically paid a set fee by the bidding consortium regardless the outcome of the bid, or a percentage of the project cost if the consortium won the project. The latter has fuelled a strong desire to take aggressive measures.

Construction companies and pension fund managers are slightly behind consultants in their respective incidence of accepting the preferred contract if it existed. Winning a project will generate construction revenues for constructors, many of whom do not tend to hold the asset for the long term; therefore, tollroads are fairly safe investments for these players.

[51] Multiplications of roles and organisations have been removed from the numbers reported in Figure 7-17. Each category has been examined carefully by cross-referencing to notes taken during the survey and conversations recorded, to determine the primary role/organisation of the respondent for the survey purpose.

This observation leads us to expect that Hypothesis 3 (*The leader of the bidding consortium is less risk-averse compared with the other members of the consortium bid team)* may hold. We will confirm this in Chapter 8. Pension funds prefer PPPs because they have a maturity similar to the fund's liabilities; moreover, PPP projects are the only component of public infrastructure that offer ownership of the asset to private capital.

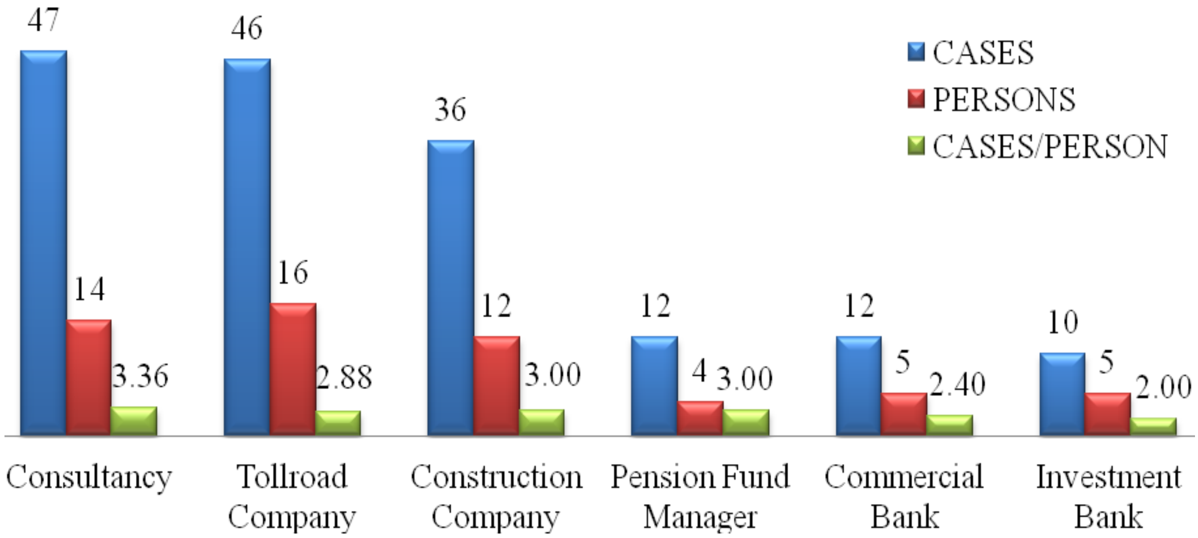


Figure 7-16: Would Accept the Contract If It Existed – Private Sector

In Table 7-3, the average extent to which individual participants consider that the other party in the scheme would accept the contract that they prefer ('4th row' in Figure 7-15) is shown to be 55.28 per cent. The average of PUSPs (55.50 per cent) is very close to that of the PVSPs (55.13 per cent). However, PVSPs (66.67 per cent) are more likely to believe that the public sector party would definitely accept the contract they prefer. That shows that the PVSPs are more optimistic in terms of reaching a deal with public authorities. Interview data confirm that many PVSPs consider that they are willing to take on any risks as long as they will be adequately compensated for.

Table 7-3: Extent that the Other Party Would Accept the Contract I Prefer

	ALL %	PUSPs %	% of choosing min/max	PVSPs %	% of choosing
Mean	55.28	55.50		55.13	
Median	60.00	60.00		52.50	
Mode	50.00	50.00		50.00	
Std. Deviation	26.34	26.01		26.59	
Minimum	0.00	0.00	33.33	0.00	66.67
Maximum	100.00	100.00	33.33	100.00	66.67

7.3.2 Attribute Processing Strategies

In Section 6.2.2 we explained the ramifications of failing to account for APS heterogeneity in the processing of choice experiments and the reason to include supplementary, self-stated response questions on whether particular attributes were ignored.

Following each choice situation, participants were shown the screen containing attribute levels that were exactly the same as in the situation that they had just played. They were asked to select the attribute levels that they ignored ('ignored by self') during the experiment, as well as the attribute levels they thought that the other party would ignore ('ignored by other'). In giving reasons why an attribute was ignored, statements provided by participants indicate that various APSs were used to select the preferred choice. The most common reasons are:

- the risk hardly materialises, e.g., *force majeure* (upside)
- the risk has been transferred out
- the risk exists regardless, e.g., public perception
- the risk is beyond their control, e.g., political risk (mainly with politicians, not with public sector authorities or private consortium)
- the risk is too trivial to be of concern, e.g., five per cent
- the risk levels are identical in both contracts

The statistics shows that in 19 per cent of cases, of which 56 per cent are from PUSPs, stated that they considered all attribute levels in their decision making. Again, this result confirms that PUSPs are (slightly) more cautious in committing to long-term contracts. Unlike the private operator, who has the option to sell their right to manage the tollroad facility anytime before the concession ends, the public sector's options to make alternative use of the facility are constrained by the specificity of the asset once it is built. It seems that the public sector is more likely to be confronted with TCE's lock-in problems (see Section 4.4.3.3).

In stating their own ANA (Figure 7-17), both cohorts exhibited the same levels of attention (indicated by the numbers inside the columns) to traffic, financial and network risks. The fact that participants from both sectors gave the same levels of attention to these three risks refutes what is often construed: that the public sector does not care about the economic benefits of a project because many of the related risks are transferred out. Interview data confirm that the economics of all projects had been carefully evaluated by government before tenders were put to the market. Most PUSPs maintained that only projects that have the potential to self-sustain economically – an important criterion to minimise budget uncertainty – would be targeted for PPP procurement.

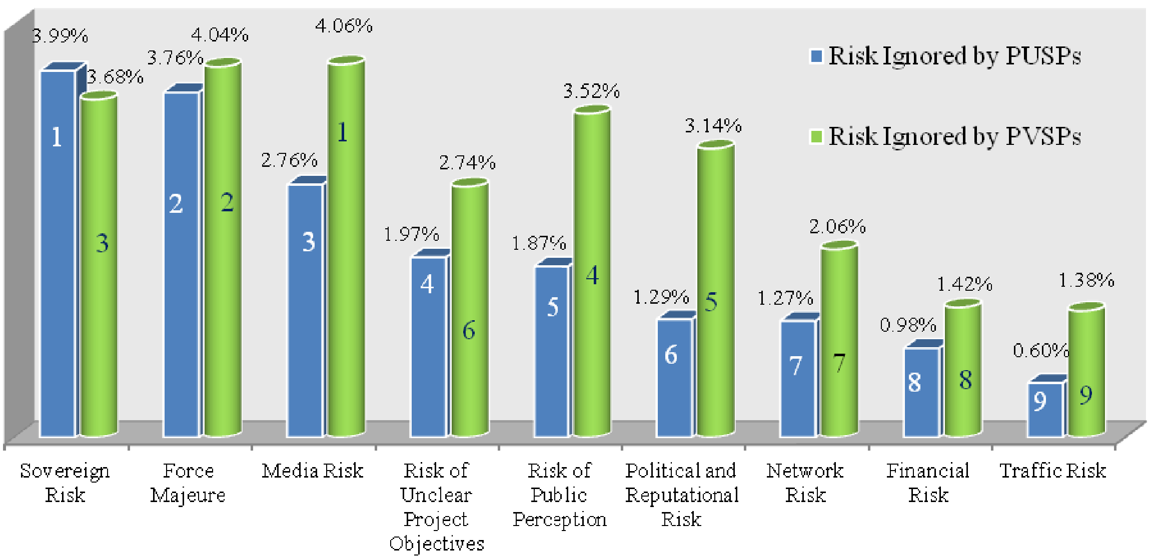


Figure 7-17: Ignored by Self – PUSPs vs. PVSPs

There are discernable misalignments in levels of attention given to sovereign risk, media risk and risk of unclear project objectives. Most PUSPs who have only worked for one government did not consider sovereignty a risk. But sovereign risk is the matter of most concern for PVSPs; many maintained that they would not invest in a politically unstable environment. The reason that this strong averseness to sovereign risk is not clearly shown in the data is because 97 per cent of PVSPs insisted that they only invested in countries where there is a well-developed legal system to ensure their contracts with the state are honoured. From time to time, sections of the media place government under public scrutiny, which has a powerful influence on the public's voting preference. The extent of public exposure of the private sector in the media is not as strong, hence it becomes the most ignored risk by PVSPs.

There exists, unfortunately, as illustrated in Figure 7-18 and Figure 7-19, noticeable disparity in perceptions of non-attendance to risk attributes by the other party. The degree of misunderstanding by PVSPs with respect to PUSPs' preference is much larger than its counterpart – up to five times for traffic risk (i.e., 3.24 per cent vs. 0.6 per cent, see Figure 7-18).

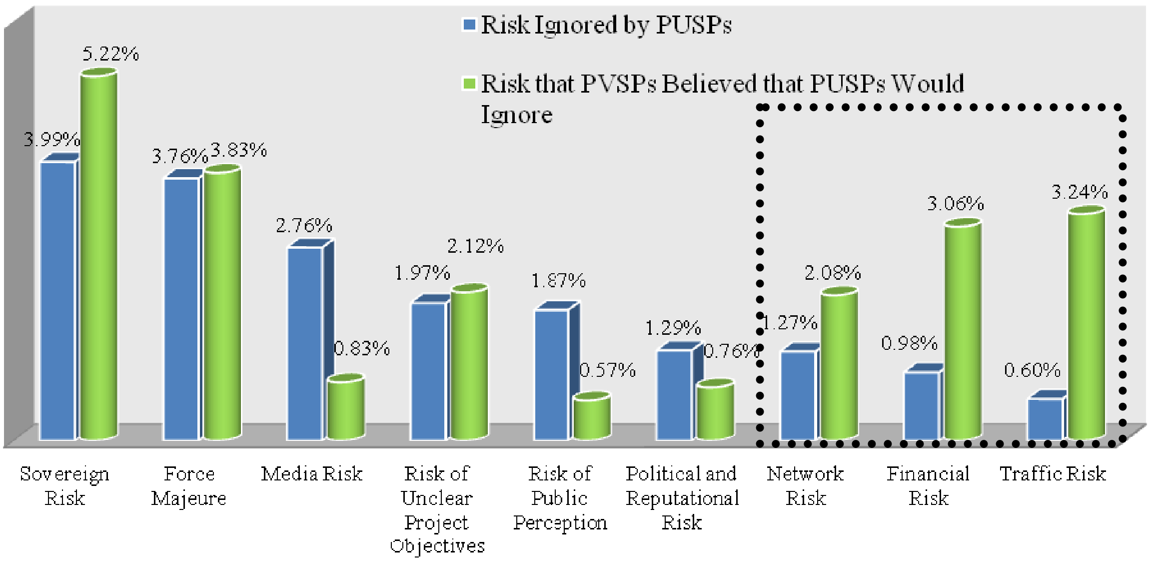


Figure 7-18: Risk Ignored by PUSPs – By Self vs. By Other

PVSPs believed that PUSPs would care most about social risks, such as risk of public perception, political and reputational risk and media risk. But contrary to PVSPs' perception, PUSPs paid as much attention to project-specific risks as their private counterparts. Participants from road authorities impressed upon us that their risk analysis was dictated by the desire for certainty in budget and project delivery (hence the explanation for their focus on risk neutral – more in the next section). Only projects with sufficient financial viability and economic benefit would be considered for procurement via the partnership option. Consequently, all projects that are placed in the market for public tendering must have undergone in-house feasibility analysis to ensure that they are economically attractive to private investment; thus, before a procurement method decision is made, their primary focus is on project risks.

Figure 7-19 shows that PUSPs misunderstood the importance of sovereign risk to the private sector – it was ranked by PUSPs the least-attended risk. The 3.57% in the blue column associated with Sovereign Risk is the highest among the percentages associated with other blue columns. Interview data have confirmed that many PUSPs have strong confidence that their jurisdiction offers a safe and stable PPP environment for private investment.

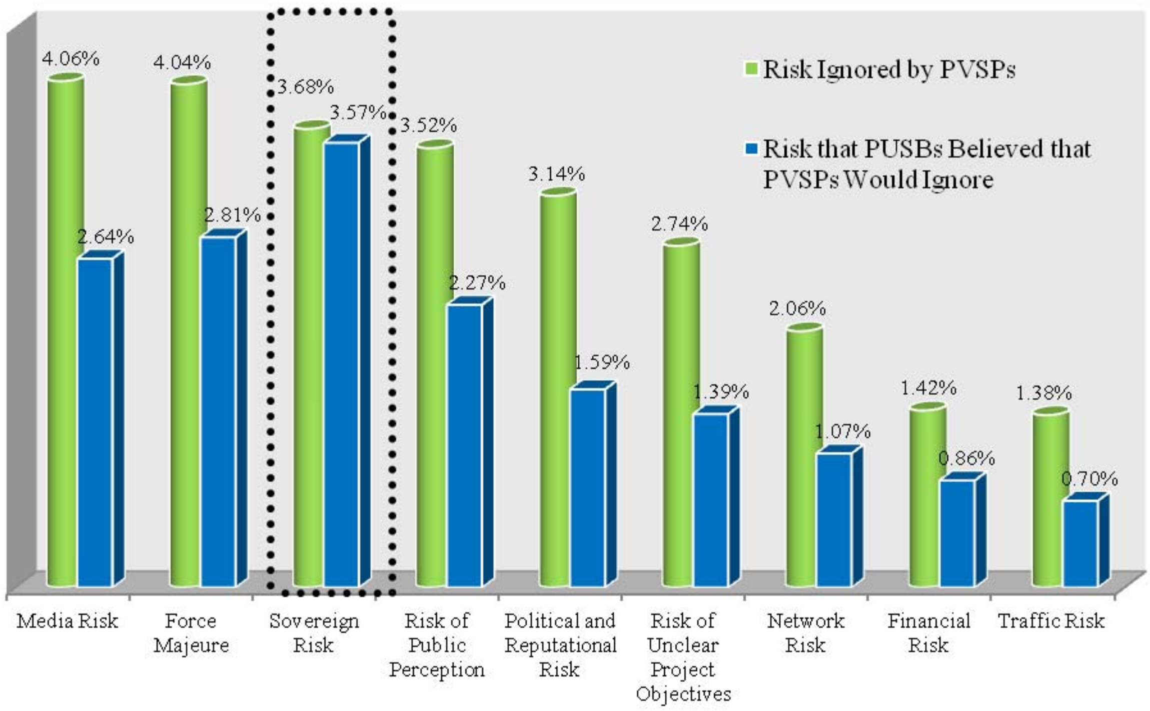


Figure 7-19: Risk Ignored by PVSPs – By Self vs. By Other

7.3.3 Levels of Focus

After identifying the levels of attributes they ignored, participants were asked to further rank the levels of risk that they foucused on (the screen is provided in Figure 7-20; 3=most focus, 1=least focus). This was repeated for each choice situation, and each time participants were reminded that their ranking should be related to the choice situation they just played.

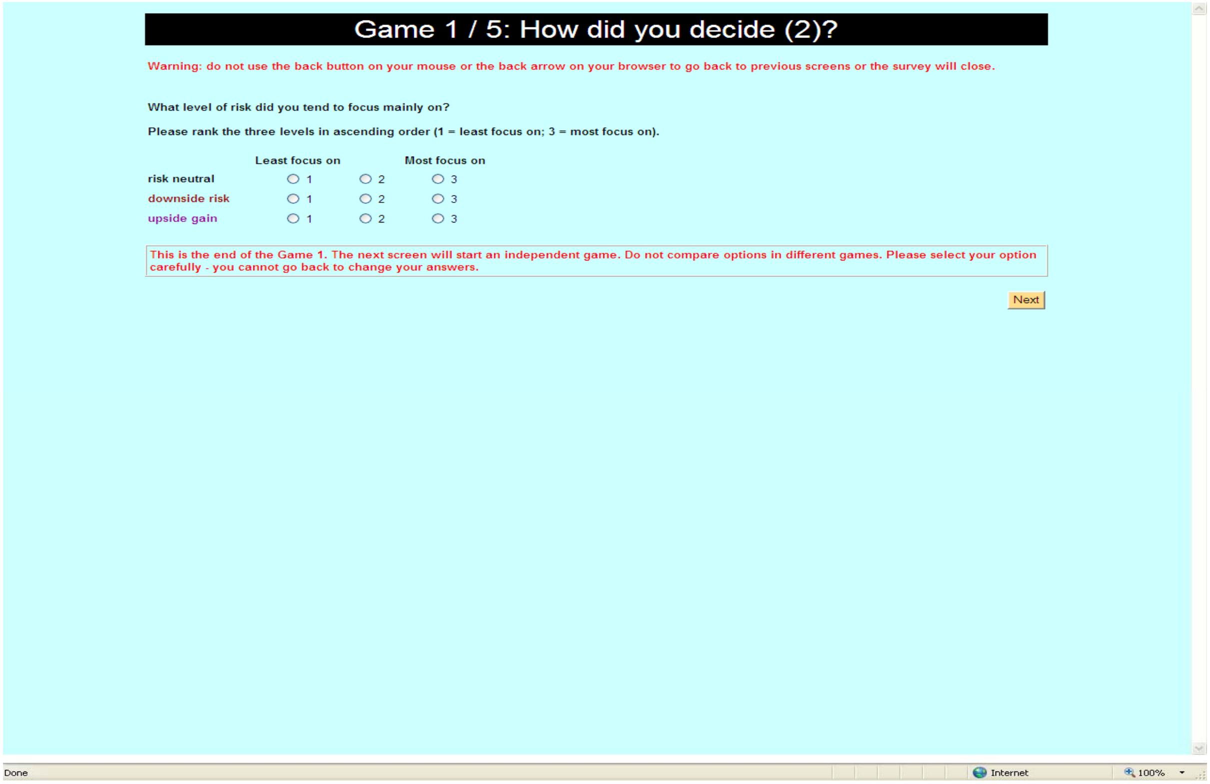


Figure 7-20: Level of Focus

As clearly shown in a cluster of figures (from Figure 7-21 to Figure 7-22) below, although participants from different sectors share a similar averseness to downside risk, there are large differences in the distribution of attention to risk levels by each sector.

In the ‘ALL’ category illustrated in Figure 7-21, downside risk draws the greatest amount of attention in the most focused group (focus level=3, 24.95 per cent); upside gain tops the ranking in the ‘focus level=2’ group (15.05 per cent); and risk neutral takes out the highest proportion in the least-focused group (focus level=1, 18.15 per cent).

About a quarter (24.95 per cent) of participants devoted their focus to downside risk (most focus=3), of which a majority (64.29 per cent) is from the private sector. The smallest difference in the distribution of attention level is found in ‘least focused on downside risk’ (55.56 per cent vs. 44.44 per cent) and ‘most focused on upside gain’ (55.42 per cent vs. 44.58 per cent). Only 2.38 per cent of participants did not care about downside risk as much (least focus=1). Being focused on upside gain implies risk-seeking behaviour, with an almost equal proportion of PUSPs and PVSPs, i.e., 55.42 per cent and 44.58 per cent, ranking this category as the highest level (upside gain: 3), albeit their reasons of choice being quite the opposite of each other. PUSPs feared that too much financial upside gain in the project will draw poor publicity because there have been cases in which the public perceived the government as handing over a money-making project to profit-making private operator, such as for Motorway 407 in Toronto. Instead, the project should be retained in public hands and procured via traditional methods rather than a PPP. On the other hand, PVSPs believed that a project's upside gain is the risk premium that rewards the private sector for taking on project risks.

As we have identified in Chapter 2, some private consortia believed that upside gains are a good selling point to raise project finance; it is particularly appealing to equity investors (such belief has at times translated into optimism bias), and our data support this.

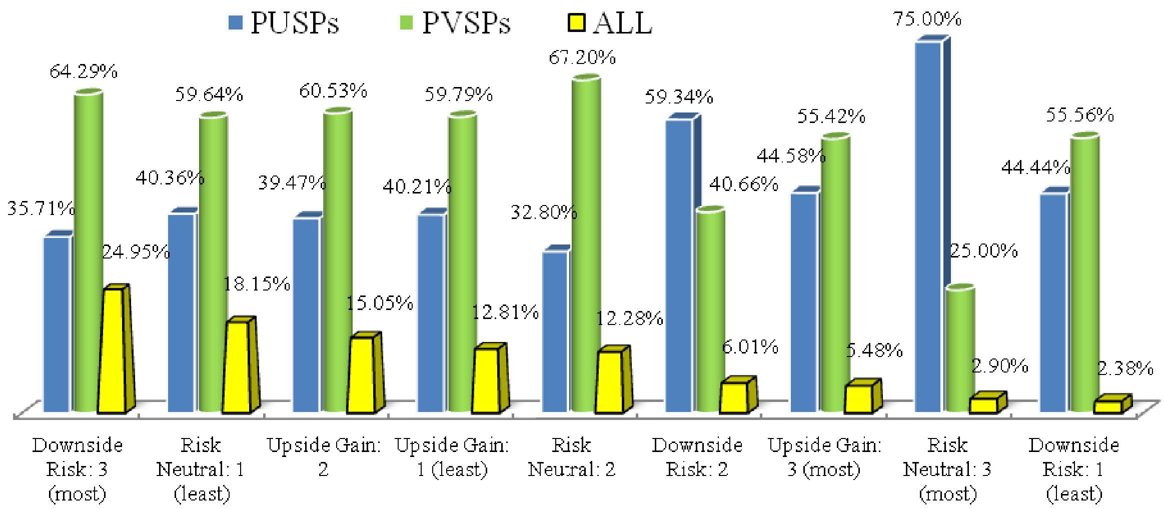


Figure 7-21: Ranking of Focus Level –Distributions of PUSPs and PVSPs in Each Level

Many participants commented to the author that construction companies and investment banks displayed a risk-seeking tendency in their evaluation of PPP tollroads; but this is not shown in the data. According to Figure 7-22, consultants are more likely to be risk seekers. We will follow up this point in Chapter 8.

Results in Figure 7-21 and Figure 7-23 are consistent with the public sector's procurement strategy in which certainty is the priority. In fact, of the 2.90 per cent who have focused most on risk neutral, 75 per cent are PUSPs (see Figure 7-21). PVSPs' focus on downside risk, and the little attention paid to downside risk by PUSPs are as expected. As explained in Chapters 2 and 3, in recent times the model of economic PPPs is to transfer risk to the private sector as much as possible.

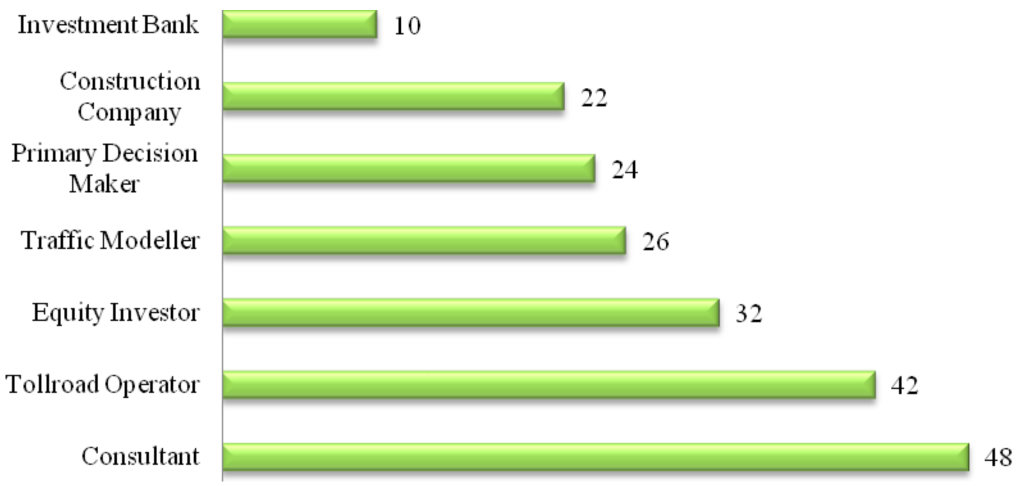


Figure 7-22: Ranking of Focus On Upside Gain = 3 by PVSPs[52]

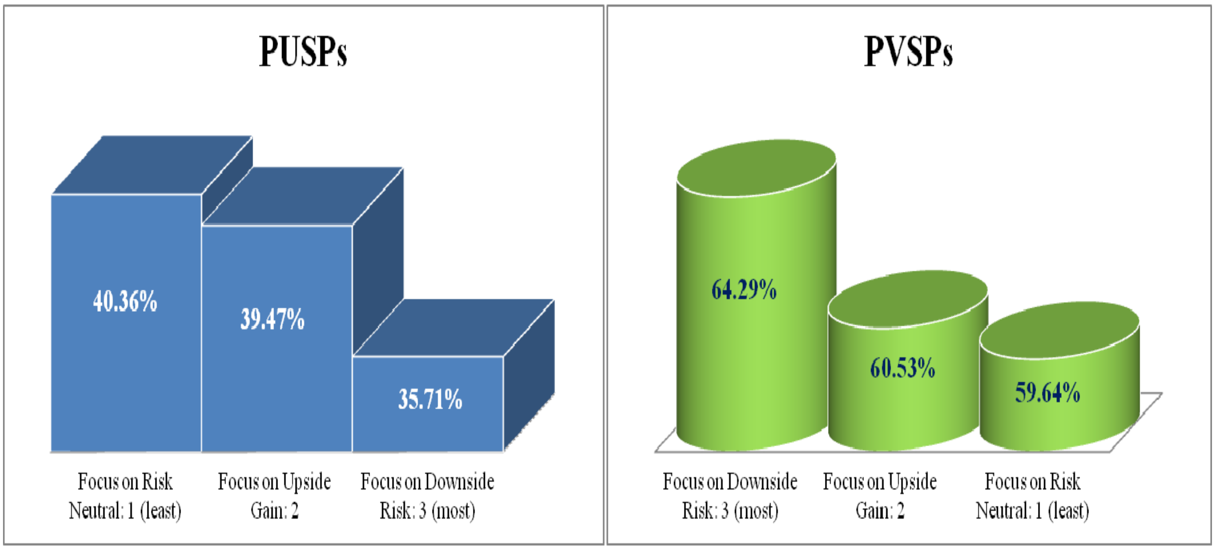


Figure 7-23: Ranking of Focus Levels – PUBSEC vs. PRVSEC

[52] Only the seven highest numbers that rank upside gain=3 are displayed.

7.4 Prior Experience

Following the choice situations, participants were given the opportunity to tell us about their real experience in terms of risk borne (refer to Figure 6-3).

Table 7-4 contrasts the mean value of PUSPs and that of PVSPs for each risk attribute. The contrast shows that participants have experienced inequitable risk-sharing. The PVSPs have mostly borne downside risks associated with traffic volume and financial return, with their shares of the related upside gain being far less than the losses they have suffered. Such outcomes are consistent with the risk allocation paradigm in PPP roadtoll programs in which the private sector is primarily responsible for these risks. Downside risk of unclear project objecitves appears to have a much worse impact on PUSPs (33.24 per cent) relative to PVSPs (18.60 per cent). The higher mean values associated with PUSPs for downside risks of a social dimension, such as political and reputational, media and public perception, suggest that these risks rest mainly with the public sector.

Table 7-4: Prior Experience of Risk Borne (Contrast of Mean)

	PUSPs	**PVSPs**	**Difference in Mean**
	Mean (%)	Mean (%)	PUSPs – PVSPs (%)
Traffic_downside risk (TRA_D)	14.15	54.07	-39.92
Traffic_upside gain (TRA_U)	11.37	17.38	-6.02
Financial_downside risk (FIN_D)	13.41	45.47	-32.05
Financial_upside gain (FIN_U)	15.20	22.30	-7.10
Network_downside risk (NET_D)	19.32	22.78	-3.47
Network_upside gain (NET_U)	21.15	31.50	-10.35
*Force majeure*_downside risk (FOR_D)	21.88	14.57	7.31
*Force majeure*_upside gain (FOR_U)	5.98	8.12	-2.14
Sovereign_downside risk (SOV_D)	23.90	17.40	6.50
Sovereign_upside gain (SOV_U)	7.93	9.63	-1.71
Unclear project objectives_downside risk (UNC_D)	33.24	18.60	14.64
Unclear project objectives_upside gain (UNC_U)	12.20	16.43	-4.24
Political and reputational_downside risk (POL_D)	39.20	21.87	17.33
Political and reputational_upside gain (POL_U)	13.41	21.03	-7.62
Media_downside risk (MED_D)	41.17	25.13	16.04
Media_upside gain (MED_U)	13.10	18.05	-4.95
Public perception_downside risk (PUB_D)	45.37	27.63	17.73
Public perception_upside gain (PUB_U)	12.68	20.57	-7.88

In Table 7-5 we compare the risk percentage with the highest count between the two sector participants, revealing that 13.33 per cent of PVSPs have suffered the consequence of traffic demand being 60 per cent lower than forecast (see TRA_D under PVSPs). *Prima facie*, the real gain for the private sector stems from an innovative financing solution – the number of PVSPs who have reaped the benefit from financial upside gain, i.e. 18.33 per cent (see FIN_U under PVSPs) is 3.33 per cent higher than the number of PVSPs who have suffered from financial downside risk, i.e., 15 per cent (see FIN_D under PVSPs). Network risk, however, has generated a negative experience for a greater number of PVSPs (28.33 percent, see 'NET_D' in PVSPs column) than the number of PVSPs (16.67 percent, see 'NET_U' in PVSPs column) who have gained from changes made to the surrounding transport network by government. The majority of the PUSPs on the other hand, have experienced little gain or loss in matters related to traffic numbers, project finance and network developments.

Table 7-5: Prior Experience of Risk Borne
(Comparison of Risk Percentage with the Highest Count)

	PUSPs			PVSPs		
	risk % with the highest count	count	%=count/41	risk % with the highest count	count	%=count/60
TRA_D	0	20	48.78	60	8	13.33
TRA_U	0	18	43.90	0	13	21.67
FIN_D	0	21	51.22	20	9	15.00
FIN_U	0	13	31.71	20	11	18.33
NET_D	0	10	24.39	10	17	28.33
NET_U	0	10	24.39	10	10	16.67
FOR_D	0	17	41.46	0	21	35.00
FOR_U	0	31	75.61	0	33	55.00
SOV_D	0	12	29.27	0	21	35.00
SOV_U	0	27	65.85	0	29	48.33
UNC_D	0	7	17.07	0	14	23.33
UNC_U	0	22	53.66	0	19	31.67
POL_D	10	6	14.63	20	14	23.33
POL_U	0	14	34.15	0	16	26.67
MED_D	50	9	21.95	10	11	18.33
MED_U	0	12	29.27	0	19	31.67
PUB_D	10	5	12.20	10	11	18.33
PUB_U	10	13	31.71	0	19	31.67

A number of interesting observations can be made from the evidence in Table 7-5. Adverse public opinion toward a project has a greater impact on PVSPs, as indicated by the higher proportion of PVSPs in categories of 'POL_D' and 'PUB_D'. Media exposure has negatively affected both sectors, although the effect was felt more deeply by PUSPs (see 'MED_D' under

PUSPs). Neither sector had any significant experience in outcomes of positive media exposure.

We will revisit the effects of these risks on partcipants' choice of procurement methods in Chapter 8 through the testing of Hypothesis 7 (*Institutional factors will significantly influence the choice of procurement methods, i.e., PPPs versus other methods)*.

7.5 Attitudinal Questions

7.5.1 Views on Optimal Risk-sharing

The chart in Figure 7-24 contrasts the mean values of the PUSPs' ratings with those of the PVSPs. The largest difference exists in their views on traffic risk: views of PVSPs on optimal sharing of traffic risk are well distributed across the seven-point scale, whereas opinions shared among the PUSPs are quite different (see Figure 7-25). Participants provided a number of accounts for the differing views.

(1=not well at all, 7=very well)

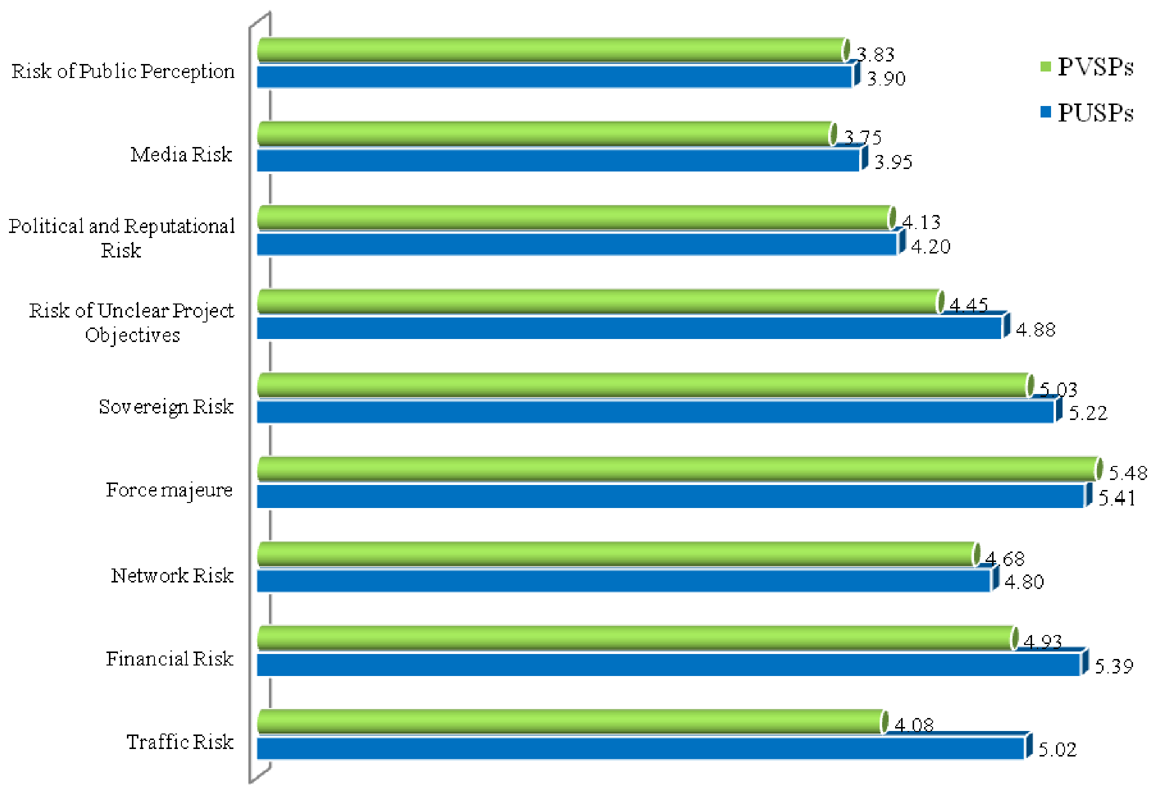


Figure 7-24: Personal View on Risk-Sharing – Mean Values Contrast

Some PUSPs believed that over-transferring traffic risk to the private sector would be to the detriment of the PPP policy. Although benefiting the government, transferring too much risk to the private sector is not good for the whole road network, or the PPP, and government should consider the bigger picture. Some PUSPs considered that technical error was partly to be blamed for the poor handling of traffic risk in contracts. Others critiqued that traffic demand was driven by strategic motivations associated with the structure of the consortium and bidding process, leading to unrealistic traffic forecasts.

(1=not well at all, 7=very well)

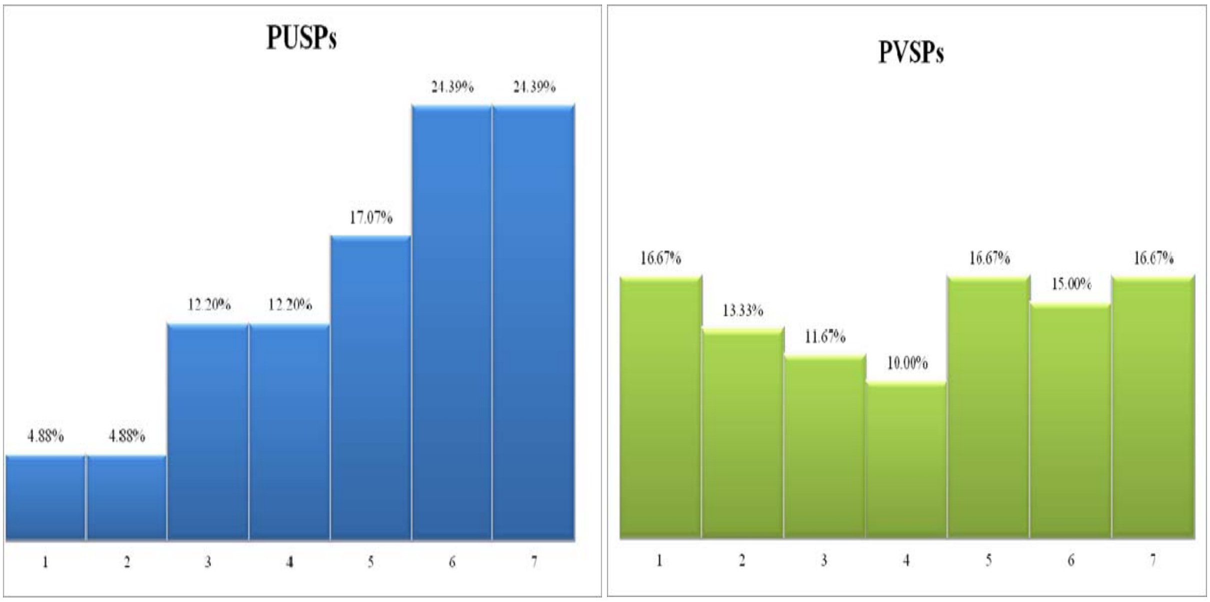


Figure 7-25: Personal Views about Optimal Sharing of Traffic Risk – PUSPs vs. PVSPs

7.5.2 Preferred Procurement Method

On average, PUSPs – with a mean value of 3.49 compared with 2.37 for PVSPs – appear to be more in favour of PPPs over other methods. But Figure 7-26 shows that there is a much higher proportion of PVSPs who prefer PPPs (71.67 per cent in ratings 1 and 2 combined) than PUSPs (24.39 per cent in ratings 1 and 2 combined). The rating is related to any PPP project, not just tollroads. Many respondents held the view that the choice of procurement method should depend on the project, its characteristics, and the availability of government funding.

To investigate further what affects participants' choice of procurement methods, we will test a range of variables against the choice of procurement as the dependent variable through Hypotheses 2a(iii), 2b, 4b and 7 in Chapter 8.

(1=PPP the most preferred model, 7=PPP the least preferred model)

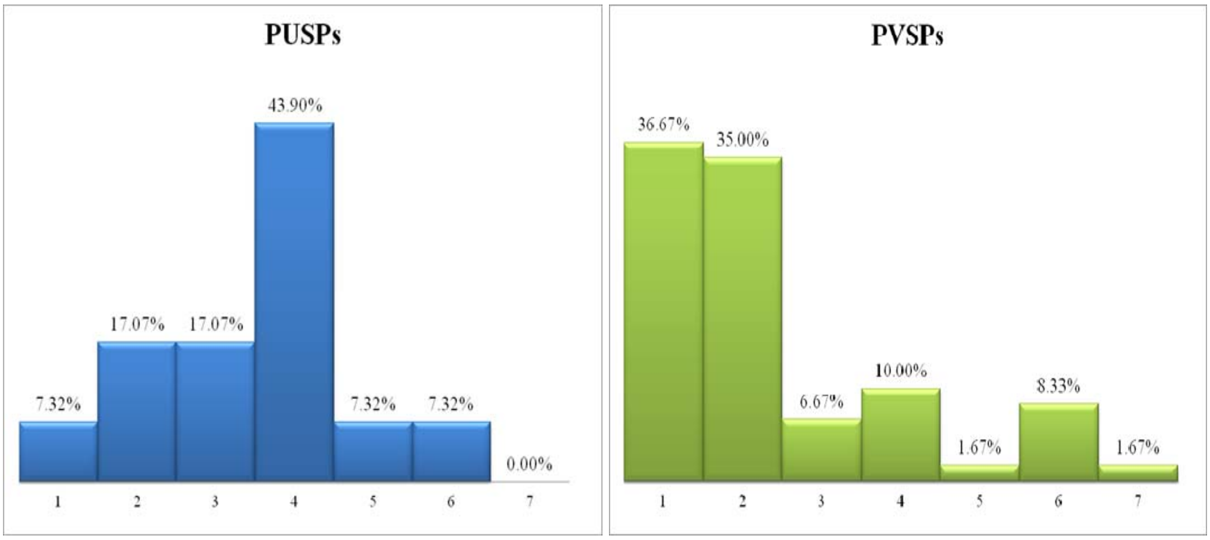


Figure 7-26: Prefer Procurement Method – PUSPs vs. PVSPs

7.6 Other Factors

This is part six of the online survey (refer to Section 6.2); data were collected through the screen depicted in Figure 7-27.

We acknowledge that in addition to risks pertinent to PPP tollroads, there are a number of considerations that may influence stakeholder decisions on entering into a contract. At the time of survey design, the world was experiencing a significant economic downturn caused by the GFC. In particular, the crisis substantially impacted on a lender's ability and willingness to invest. Further, during the pilot study, it was drawn to our attention that the availability model and land acquisition responsibility are two important considerations in countries outside Australia. The addition of these two variables to our factor list has enhanced the relevance of the study to the international community. The mean values[53] reported in Table 7-6 show that PUSPs and PVSPs share similar views on the importance of these factors.

[53] The data were collected through a 1-to-7 likert scale: 1 indicates that the factor is very unimportant, whereas 7 indicates that the factor is very important.

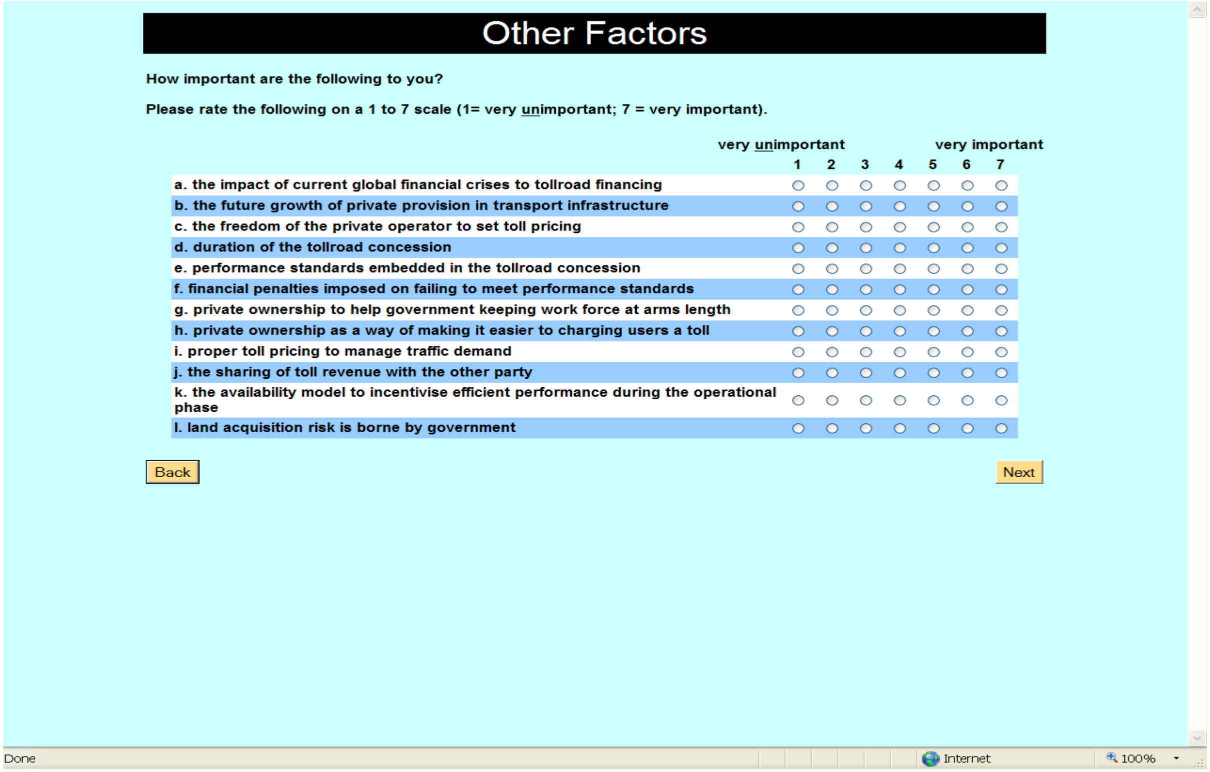


Figure 7-27: Other Factors of Influence

Table 7-6: Other Factors – PUSPs vs. PVSPs

	PUSPs (mean)	PVSPs (mean)
Global financial crisis (GFC)	5.51	5.83
Future growth of private provision in transport infrastructure (FGROWTH)	5.12	5.62
Freedom of the private operator to set toll pricing (FREETOLL)	3.07	4.05
Duration of the tollroad concession (DURATION)	4.59	5.05
Performance standards embedded in the tollroad concession (PERSDR)	5.90	5.47
Financial penalties imposed on failing to meet performance standards (FPENALTY)	5.44	5.03
Private ownership to help government keeping workforce at arms length (PVOWNW)	3.10	4.18
Private ownership as a way of making it easier to charge users a toll (PVOWNT)	3.15	3.58
Proper toll pricing to manage traffic demand (TPRICETD)	5.83	5.32
The sharing of toll revenue with the other party (TRSHARE))	4.17	4.05
The availability model to incentivise efficient performance during the operational phase (AM)	4.75	4.00
Land acquisition risk is borne by government (LAND)	5.63	5.50

7.7 Summary of Chapter

In this chapter, we have reported in great detail the descriptive statistics of the data collected. A number of interesting findings were made from participants' comments. They confirm that a PPP is perceived by participants from both sectors as primarily a financing instrument, notwithstanding the rhetoric of VFM under which the scheme has been actively promoted. This mirrors our concern raised in Chapter 3 that the benefit of PPPs, i.e., bringing in market discipline to regulate demand and supply for road space, may not have been exploited to its fullest. Such failure is not that of PPPs *per se*; rather, the exploitation of market is being obscured by political intent to bypass fiscal constraint.

Other findings in this chapter have shed preliminary light on some of the propositions we formulated in Chapter 4. The descriptive evidence hints at the evidence likely to emanate from testing the set of hypotheses more formally within the setting of discrete choice modelling, covered in the next chapter.

CHAPTER 8: RESULTS OF HYPOTHESIS TESTING

8.1 Introduction

The objective of this chapter is to empirically test the risk preferences of stakeholders engaging in PPP tollroad contracts, in order to address Research Question Three: *What are the risk preferences of stakeholders engaging in PPP tollroad projects and how are these preferences affected by factors at contract, policy and institutional levels?* The analysis emphasises the comparison and the contrast of different dimensions of risk perceived by public and private sector representatives. Our evidence has confirmed that the experience the participants have accumulated over their years of engagement in PPP tollroads has led to the profound differences exhibited in terms of their risk preferences. We conclude, based on simulation of Prior Experience data, that differences in risk preferences can be minimised through equitable risk-sharing. We will test how variables at the contract level and institutional level (see Section 7.6) can affect the risk preferences of participants surveyed. In doing so, we investigate ways of optimising risk-sharing between the parties from these two sectors.

The chapter is divided into seven parts. The next section reports on estimates from a series of choice models, namely the MNL and the LCM designed to obtain a preliminary understanding of the role of each risk dimension in revealing the contract preferences of public-sector and private-sector stakeholders. We have chosen the LCM with full attendance to all attributes as our preferred parameterised, attribute-based, contract preference model because it yields the best model fit for our data compared with other models we estimated.

In Section 8.3, the parameter estimates of the preferred LCM are applied to empirically derive two risk indices, one for the public sector authorities (PUBRI) and the other for private sector agents (PRVRI). The derived risk indices are then used to test the hypotheses related to the agency theory underpinning the PPP rationale (Section 8.4); the hypotheses associated with incomplete contract theory (Section 8.5); and the hypotheses related to transaction cost economics (Section 8.6). The final section presents the main findings and reflects on the limitations of contracting theories in analysing PPPs. The following table (Table 8-1) lists the models of estimation and tests for each hypothesis.

Table 8-1: Models of Estimation for Hypothesis Testing

Hypothesis	Model/Test	Notes
1 *Contracting parties of a PPP tollroad have different risk preferences toward different risks.*	Confidence interval (CI) test: $\beta_{k_{PUSPs}} \neq \beta_{k_{PVSPs}}$	Based on parameter estimates of LCM, CIs are generated using the Krinsky and Robb (1986) procedure.
2a(i) *At the aggregate level, the public sector authorities and the private sector agents have different tastes in risk.*	t-test: $t_n = \frac{\bar{x}_{PUBRI} - \bar{x}_{PRVRI}}{\sqrt{se^2_{PUBRI} + se^2_{PRVRI}}}$	t-test of two means (PUBRI and PRVRI are derived from parameter estimates of LCM multiplied by RP data of Prior Experience).
2a(ii) *Private sector agents are more risk-averse than public sector authorities.*	Same as Hypothesis 2a(i).	
2a(iii) *Private sector agents who are risk-averse would prefer PPPs to other procurement methods.*	Ordered logit model: $y_i^* = \beta_0 + \beta_1 \cdot PRVRI$ y_i^* is the latent 'preference' variable and is not observed. The observed counterpart to is y_i = "choice of PPP", a continuous latent utility observed in discrete form through a censoring mechanism: y_i = 0 if $y_i^* \leq \mu_0$, = 1 if $\mu_0 < y_i^* \leq \mu_1$, = 2 if $\mu_1 < y_i^* \leq \mu_2$, = ... = 7 if $y_i^* > \mu_6$. μ_s is the threshold parameter (Greene and Hensher, 2010)	PRVRI is derived from parameter estimates of LCM multiplied by RP data of Prior Experience; see Figure 6-5 and Section 7.5.2 for data of Choice of PPP, which are ordinal and were captured by a 1-7 likert scale.

Hypothesis		Model/Test	Notes
2b	*Public sector authorities who are less risk-averse would prefer PPPs to other procurement methods.*	Ordered logit model: $y_i^* = \beta_0 + \beta_1 \cdot PUBRI$ y_i^* is the latent 'preference' variable and is not observed. The observed counterpart to y_i^* is y_i = "choice of PPP".	PUBRI is derived from parameter estimates of LCM multiplied by RP data of Prior Experience; see Figure 6-5 and Section 7.5.2 for data of Choice of PPP, which are ordinal and were captured by a 1-7 likert scale.
2c	*The more risk-averse the private sector agents, the less effective is the availability model to incentivise efficient performance during the operational phase.*	Ordered logit model: $\varphi_i^* = \beta_0 + \beta_1 \cdot PRVRI$ φ_i^* is the latent 'preference' variable and is not observed. The observed counterpart to φ_i^* is φ_i = "AM".	Data of AM are defined in Table 7-6, which are ordinal and were capture by a 1-7 likert scale; PRVRI is derived from parameter estimates of LCM multiplied by RP data of Prior Experience.
3	*The leader of the bidding consortium is less risk-averse compared with the other members of the consortium bid team.*	Multivariate linear regression model: PRVRI = $\beta_0 + \beta_1 \cdot Construction\ Company$ $+\beta_2 \cdot Consultancy + \beta_3 \cdot Investment\ Bank$ $+\beta_4 \cdot Tollroad\ Company + \beta_5 \cdot Other\ Organisation$	PRVRI is derived from parameter estimates of LCM multiplied by RP data of Prior Experience.
4a	*Unclear project objectives will increase private sector agents' risk aversion.*	Multivariate linear regression model for Hypothesis 4a, 5a and 6a: PRVRI = $\beta_0 + \beta_1 \cdot UNC_{D2} + \beta_2 \cdot FREETOLL_{D2}$ $+\beta_3 \cdot PVOWNW_{D2}$	PRVRI is derived from parameter estimates of LCM multiplied by RP data of Prior Experience; UNC_{D2} are data from Prior Experience by PVSPs (see Table 7-4); $FREETOLL_{D2}$ and $PVOWNW_{D2}$ are data captured by a 1-7 likert scale (see Table 7-6) and are coded into dummy variables; subscript D2 denotes downside risk experienced by/associated with PUSPs.

Hypothesis		Model/Test	Notes
4b	*The higher the risk of unclear project objectives, the more preferred is the PPP method by private sector agents.*	Ordered logit model: $y_i^* = \beta_0 + \beta_1 \cdot UNC_{D2_i}$ y_i^* is the latent 'preference' variable and is not observed. The observed counterpart to y_i^* is y_i = "choice of PPP".	UNC_{D2} are data from Prior Experience by PVSPs (see Table 7-4); see Figure 6-5 and Section 7.5.2 for data of Choice of PPP, which are ordinal and were captured by a 1-7 likert scale.
4c	*Unclear project objectives will increase public sector authorities' risk aversion.*	Multivariate linear regression model for Hypothesis 4c, 5b and 6b: PUBRI $= \beta_0 + \beta_1 \cdot UNC_{D1} + \beta_2 \cdot FREETOLL_{D1}$ $+ \beta_3 \cdot PVOWNW_{D1}$	PUBRI is derived from parameter estimates of LCM multiplied by RP data of Prior Experience; UNC_{D1} are data from Prior Experience by PUSPs (see Table 7-4); $FREETOLL_{D1}$ and $PVOWNW_{D1}$ are data captured by a 1-7 likert scale (see Table 7-6) and are coded into dummy variables; subscript D1 denotes downside risk experienced by/associated with PUSPs.
5a	*Private sector agents are in favour of the option of having the freedom to set toll pricing, i.e., the freedom will reduce private sector agents' risk aversion.*	Same as Hypothesis 4a.	
5b	*Public sector authorities are in favour of the option of granting the private sector agents the freedom to set toll pricing, i.e., the granting of the right will reduce public sector authorities' risk aversion.*	Same as Hypothesis 4c.	

Hypothesis		Model/Test	Notes
6a	*The public perception that ownership transfer is seen to transfer ownership-related risk arising from workforce dispute will reduce the risk aversion of private sector agents.*	Same as Hypothesis 4a.	
6b	*The public perception that ownership transfer is seen to transfer ownership-related risk arising from workforce dispute will increase the risk aversion of public sector authorities.*	Same as Hypothesis 4c.	
7	*Institutional factors will significantly influence the choice of procurement methods by all parties, i.e., PPPs versus other methods.*	Ordered logit model: $y^*_{i_{PVSPs(PUSPs)}} = \beta_0 + \beta_1 \cdot FOR_{D2(D1)_i} + \beta_2 \cdot SOV_{D2(D1)_i}$ $+\beta_3 \cdot UNC_{D2(D1)_i} + \beta_4 \cdot POL_{D2(D1)_i} + \beta_5 \cdot MED_{D2(D1)_i}$ $+\beta_6 \cdot PUB_{D2(D1)_i}$ y^*_i is the latent 'preference' variable and is not observed. The observed counterpart to y^*_i is y_i = "choice of PPP".	The independent variables are data from Prior Experience by PVSPs (PUSPs) (see Table 7-4); see Figure 6-5 and Section 7.5.2 for data of "choice of PPP" which are ordinal and were captured by a 1-7 likert scale.

Hypothesis		Model/Test	Notes
8a	*Contractual conditions and institutional variables will significantly affect the risk preferences of contracting parties.*	Multivariate linear regression model: PRVRI (PUBRI) = $\beta_0 + \beta_1 \cdot GFC_{D2(D1)_2}$ $+\beta_2 \cdot FGROWTH_{D2(D1)_2} + \beta_3 \cdot TPRICETD_{D2(D1)_2}$ $+\beta_4 \cdot FREETOLL_{D2(D1)_2} + \beta_5 \cdot DURATION_{D2(D1)_2}$ $+\beta_6 \cdot PERSDR_{D2(D1)_2} + \beta_7 \cdot FPENALTY_{D2(D1)_2}$ $+\beta_8 \cdot TSHARE_{D2(D1)_2} + \beta_9 \cdot LAND_{D2(D1)_2}$	PRVRI (PUBRI) is derived from parameter estimates of LCM multiplied by RP data of Prior Experience; independent variables are those defined in Table 7-6 and dummy-coded.
8b	*Sovereign risk will significantly increase the risk aversion of private sector agents.*	Multivariate linear regression model for Hypothesis 8b and 9: PRVRI = $\beta_0 + \beta_1 \cdot SOV_{D2} + \beta_2 \cdot MED_{D2}$	PRVRI is derived from parameter estimates of LCM multiplied by RP data of Prior Experience; the independent variables are data from Prior Experience by PVSPs (see Table 7-4).
9	*Private sector agents who are actively engaging in PPP contracts value their reputation effect.*	Same as Hypothesis 8b.	
10	*Risk preferences are significantly affected by how risks are shared.*	t-test: $t_{PUBRI} = \dfrac{\bar{x}_{PUBRI\ (AFTER)} - \bar{x}_{PUBRI\ (BEFORE)}}{\sqrt{se^2_{PUBRI\ (AFTER)} + se^2_{PUBRI\ (BEFORE)}}}$ $t_{PRVRI} = \dfrac{\bar{x}_{PRVRI\ (AFTER)} - \bar{x}_{PRVRI\ (BEFORE)}}{\sqrt{se^2_{PRVRI\ (AFTER)} + se^2_{PRVRI\ (BEFORE)}}}$	t-test of two means (PUBRI and PRVRI derived from parameter estimates of LCM multiplied by RP data of Prior Experience) before and after data simulation of Prior Experience.

8.2 Choice Models of Parameter Estimates for Weights

SC data collected through the five choice situations allow for the production of a rich set of parameter estimates associated with each risk attribute. We estimated four choice models, two MNLs and two LCMs. Each model was jointly estimated by pooling both segments (PVSPs and PUSPs) of the data. The results are presented in Table 8-2.

8.2.1 Multinominal Logit Model

As explained in Section 5.4.1, the starting point of any choice analysis often involves the estimation of a simple MNL so as to gain a preliminary understanding of the data. In Table 8-2, the results of model 1, which is an MNL without conditioning for ANA, show that 10 out of 12 parameters that are significant at the 10 per cent level are of the expected signs (we expected negative sign for downside parameter estimates and positive sign for upside parameter estimates). The two significant parameters that are of unexpected signs are FOR_{U2} and PUB_{U2}. The descriptive analysis of ANAN illustrated in Figure 7-18 and Figure 7-19 strongly indicates that PUSPs and PVSPs adopted different attribute processing rules in choosing their preferred contract. We estimated a further MNL to account for ANA (model 2). The results are similar to model 1, with some changes (highlighted in red in the table) in the level of significance for SOV_{U1} (it becomes significant in model 2 but remains of an unexpected sign); TRA_{U2} (it becomes significant in model 2 with the expected sign); and FOR_{U2} (it becomes insignificant in model 2 with an unexpected sign); and improvements in model fit on Akaike Information Criterion (AIC) and Log-likelihood (LL) function. This outcome reinforces our concern about the possible BR of participants that was raised in Section 6.2.2, and suggests that the MNL accounting for APSs seems to better explain our data.

We noted in Chapter 5 that the MNL's limitation on handling preference heterogeneity has hindered its relevance to the current research. LCM, on the other hand, relaxes the preference homogeneity restriction imposed by the MNL, suggesting that LCM could be a superior model for analysing our data.

Table 8-2: Parameter Estimates

Parameter Estimates: Public Sector Participants

Model	MNL 1	MNL 2	LCM (2 classes) 3 Class 1 (p = 0.00)	LCM (2 classes) 3 Class 2 (p = 0.00)	LCM (2 classes) 4 Class 1 (p = 0.00)	LCM (2 classes) 4 Class 2 (p = 0.00)
TRA_{D1}	-0.01989	-0.01402	-0.03700	-0.08007	-0.01518	-0.16901
	(-3.24)	(-2.36)	(-2.59)	(-1.87)	(-0.98)	(-0.35)
TRA_{U1}	-0.007	-0.0052	0.00862	-0.09079	0.41191E-04	-0.11484
	(-1.13)	(-0.83)	(0.80)	(-2.05)	(0.00)	(-0.40)
FIN_{D1}	-0.01708	-0.01308	-0.02462	-0.06314	-0.03668	0.29779
	(-2.53)	(-1.98)	(-1.99)	(-1.65)	(-1.21)	(0.31)
FIN_{U1}	-0.00883	-0.00341	-0.00078	-0.09455	-0.02869	0.21908
	(-1.33)	(-0.49)	(-0.07)	(-2.15)	(-0.99)	(0.22)
NET_{D1}	-0.00434	-0.00085	0.00539	-0.07872	-0.00267	-0.14642
	(-0.78)	(-0.14)	(0.52)	(-1.70)	(-0.19)	(-0.25)
NET_{U1}	0.00429	0.00365	0.02230	-0.06979	0.00128	-0.10319
	(0.78)	(0.60)	(2.14)	(-1.62)	(0.09)	(-0.15)
FOR_{D1}	-0.00385	-0.01031	-0.00379	-0.07886	0.01655	-0.28213
	(-0.61)	(-1.23)	(-0.34)	(-1.98)	(0.37)	(-0.17)
FOR_{U1}	-0.00082	0.00275	0.00131	-0.01321	-0.00297	-0.02607
	(-0.14)	(0.38)	(0.13)	(-0.51)	(-0.12)	(-0.04)
SOV_{D1}	-0.00774	-0.00997	0.03265	-0.12031	-0.02470	-0.55967
	(-1.23)	(-1.27)	(1.73)	(-2.14)	(-0.88)	(-0.41)
SOV_{U1}	-0.00813	-0.01882	0.02290	-0.1402	-0.03005	-0.50147
	(-1.33)	(-2.33)	(1.86)	(-2.15)	(-0.66)	(-0.24)
UNC_{D1}	-0.00698	-0.00912	-0.01941	-0.05915	0.00461	-0.26139
	(-1.21)	(-1.41)	(-1.74)	(-1.65)	(0.22)	(-0.53)
UNC_{U1}	0.00341	0.00564	-0.00632	0.02399	0.02162	0.14003
	(0.59)	(0.80)	(-0.60)	(0.93)	(0.76)	(0.20)
POL_{D1}	-0.02383	-0.02334	-0.04100	0.00841	-0.02334	-0.39352
	(-4.05)	(-3.70)	(-3.60)	(0.30)	(-0.61)	(-0.32)

Parameter Estimates: Private Sector Participants

Model	MNL 1	MNL 2	LCM (2 classes) 3 Class 1 (p = 0.00)	LCM (2 classes) 3 Class 2 (p = 0.00)	LCM (2 classes) 4 Class 1 (p = 0.00)	LCM (2 classes) 4 Class 2 (p = 0.00)
TRA_{D2}	-0.043	-0.05091	-0.17224	-0.1157	-0.08241	-0.34417
	(-6.44)	(-6.43)	(-3.97)	(-3.13)	(-2.48)	(-0.84)
TRA_{U2}	0.0082	0.0119	0.04848	-0.03383	0.02035	0.23806
	(1.58)	(2.01)	(2.69)	(-1.95)	(0.62)	(0.52)
FIN_{D2}	-0.044	-0.05471	-0.18267	-0.07313	-0.08351	-0.32921
	(-5.88)	(-6.43)	(-3.83)	(-2.93)	(-2.34)	(-0.91)
FIN_{U2}	0.0038	0.00823	0.05950	-0.03439	0.05284	-0.1908
	(0.62)	(1.25)	(2.81)	(-2.23)	(2.24)	(-0.51)
NET_{D2}	-0.015	-0.02078	-0.15676	0.02921	-0.04464	0.00653
	(-2.56)	(-3.28)	(-3.89)	(1.81)	(-2.32)	(0.04)
NET_{U2}	0.0034	0.00701	-0.06101	0.02742	0.00949	0.18579
	(0.57)	(1.04)	(-2.69)	(1.53)	(0.45)	(0.74)
FOR_{D2}	-0.003	-0.00675	-0.06129	-0.01539	-0.01470	-0.16431
	(-0.57)	(-0.96)	(-2.78)	(-0.77)	(-0.62)	(-0.83)
FOR_{U2}	-0.011	-0.01121	-0.03688	-0.01812	-0.02025	0.23462
	(-1.88)	(-1.53)	(-2.02)	(-0.97)	(-1.12)	(0.33)
SOV_{D2}	-0.024	-0.03496	-0.03380	-0.13908	-0.04298	-0.48015
	(-3.52)	(-4.00)	(-1.66)	(-3.42)	(-1.25)	(-0.71)
SOV_{U2}	-0.006	-0.00513	0.04036	-0.0773	0.03626	-0.25914
	(-0.98)	(-0.73)	(1.97)	(-3.08)	(1.53)	(-0.65)
UNC_{D2}	-0.005	-0.00686	0.01615	-0.01368	0.02910	-0.27154
	(-0.76)	(-1.00)	(0.99)	(-0.76)	(1.17)	(-0.75)
UNC_{U2}	0.0043	0.00774	0.04990	-0.0107	0.01654	-0.03331
	(0.77)	(1.08)	(2.80)	(-0.65)	(1.05)	(-0.28)
POL_{D2}	-0.001	-0.00683	-0.01158	-0.01785	-0.03967	0.21376
	(-0.20)	(-1.09)	(-0.76)	(-0.98)	(-2.13)	(0.76)

	MNL		LCM (2 classes)			
Model	1	2	3		4	
			Class 1	Class 2	Class 1	Class 2
			(p = 0.00)	*(p = 0.00)*	*(p = 0.00)*	*(p = 0.00)*
Parameter estimates: Public Sector						
POL_{U1}	0.00529	0.00852	0.00310	0.12581	-0.00735	0.29317
	(0.94)	(1.43)	(0.35)	(2.09)	(-0.32)	(0.27)
MED_{D1}	0.0006	0.00129	-0.29084E-04	-0.00323	-0.01286	0.37928
	(0.11)	(0.20)	(0.00)	(-0.06)	(-0.39)	(0.29)
MED_{U1}	0.00819	0.00575	0.02143	0.00192	-0.01489	0.54899
	(1.29)	(0.78)	(1.97)	(0.04)	(-0.38)	(0.62)
PUB_{D1}	-0.01863	-0.01618	-0.02684	-0.06366	-0.02872	-0.15985
	(-2.90)	(-2.53)	(-2.28)	(-1.71)	(-1.44)	(-0.16)
PUB_{U1}	-0.00167	0.00142	0.00900	-0.06204	-0.00737	-0.10826
	(-0.26)	(0.21)	(0.82)	(-1.48)	(-0.25)	(-0.22)
Estimated latent class probabilities						
			0.66042	0.33958	0.63498	0.36502
			(10.00)	(5.14)	(6.64)	(3.82)
Model fit						
AIC	*538.606*	*520.555*		*499.140*		*508.392*
LL function	*-233.303*	*-224.278*		*-176.570*		*-181.196*
No. Of observations		*1010*		*1010*		

	MNL		LCM (2 classes)			
Model	1	2	3		4	
			Class 1	Class 2	Class 1	Class 2
			(p = 0.00)	*(p = 0.00)*	*(p = 0.00)*	*(p = 0.00)*
Parameter estimates: Private Sector						
POL_{U2}	0.0062	0.00449	0.00838	-0.02235	0.02199	-0.0528
	(1.12)	(0.64)	(0.52)	(-1.26)	(0.90)	(-0.32)
MED_{D2}	-0.013	-0.01752	-0.03468	-0.01337	0.00799	-0.39744
	(-2.51)	(-2.56)	(-2.21)	(-0.81)	(0.45)	(-0.65)
MED_{U2}	-0.004	-0.00214	-0.00887	0.00419	0.00700	-0.33228
	(-0.73)	(-0.29)	(-0.40)	(0.32)	(0.21)	(-0.61)
PUB_{D2}	-0.016	-0.02263	-0.06199	-0.07312	-0.04412	-0.19192
	(-2.39)	(-2.90)	(-2.26)	(-2.28)	(-1.10)	(-0.63)
PUB_{U2}	-0.015	-0.02231	-0.11907	-0.00715	-0.04666	-0.13482
	(-2.27)	(-2.64)	(-3.33)	(-0.45)	(-0.91)	(-0.52)

Note:
1) models that are estimated on all attributes are 1 and 3; models that exclude non-attendance attributes are 2 and 4
2) t values are in brackets
3) nnnnn.E-xx or E+xx => multiply by 10 to -xx or +xx
4) Acronyms:
XXX_D = downside risk; XXX_U = upside gain; 1 = public sector; 2 = private sector; TRA = traffic risk
FIN = financial risk; NET = network risk; FOR = *force majeure*; SOV = sovereign risk
POL = political risk; UNC = risk of unclear project objectives; MED = media risk
PUB = risk of public perception

8.2.2 Latent Class Model

We estimated two LCMs, one assumes full attendance of all attributes while the second allows for ANA. In each model, we specified two classes[54]. The results in Table 8-2 demonstrate that model 3, which is an LCM assuming full attribute attendance, produces better outcomes in terms of the number of significant parameter estimates and model fit measured by AIC and the LL function, compared with model 4, which is an LCM allowing for ANA. In our case, a simple LCM yields better results in terms of explaining our data. Whether this holds true at a broader level of application and on other data sets is an issue for future research. Since model 3 is the best model in terms of model fit among all models of estimate (model 1 to model 4), we will derive the PPPRI using the parameter estimates obtained from model 3.

8.3 Public-Private-Partnership Risk Index

The PPPRI is based on the sentiment of the HSQI framework discussed in Chapter 5. The index is calculated by the application of the utility expression in Equation (5.2), and the actual levels of risk allocation that each sampled stakeholder has experienced, captured by the RP data input for Prior Experience. After the weights are identified using model 3, we multiply each attribute level associated with Prior Experience by the relevant weight, and sum these calculations across all attributes to produce the sector-specific risk indices.

8.3.1 Sector-specific Risk Indices

The values of PUBRI are in the range -18.53 per cent and zero per cent, with a mean value of -7.26 percent. The range of PRVRI lies between -56.98 per cent and -3.47 per cent with a mean value of -23.15 percent. For easy interpretation, we have standardised these indices into the positive range by normalising the value to a base of zero for the participant with the highest relative index (see Figure 8-1)[55]. The index values suggest that all participants (except one who displays risk neutrality) are risk-averse. None displays a risk-seeking preference, not even consultants or construction companies, as we suspected in Section 7.3.3 (also see Figure 7-22). This may be due to the GFC bias, as the online survey was conducted in the tail of the crisis. These index values are the important source of information for hypothesis testing (refer to the Model/Test column in Table 8-1 for details). This is the subject of discussion in the remaining sections.

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[54] Changes in classes did not improve model fit, nor did this increase the number of significant parameters.

[55] From this point onward, all analysis will be based on normalised indices, i.e., risk aversion indices are presented in positive values; higher value means greater risk aversion.

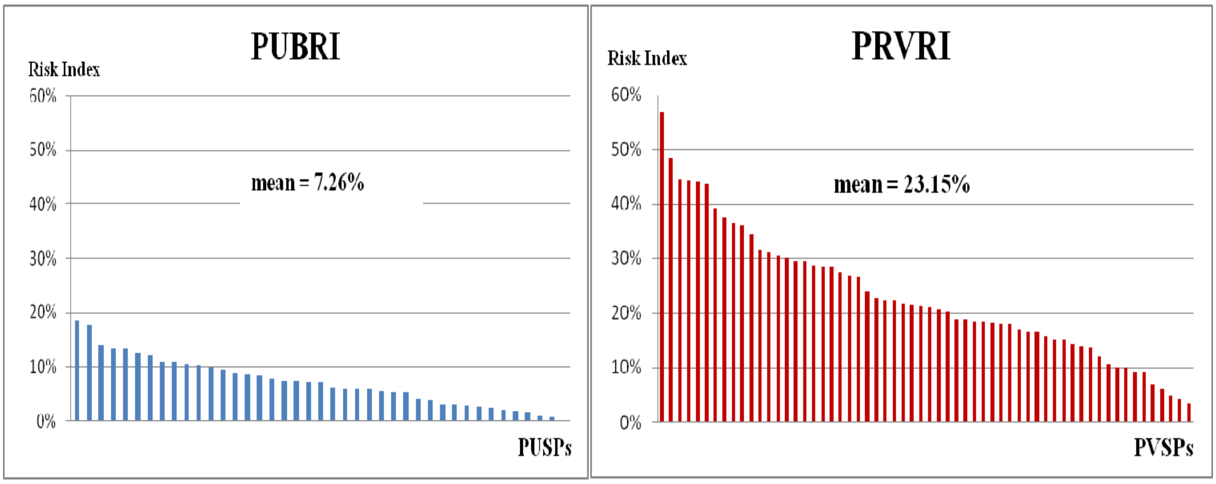


Figure 8-1: Risk Index – PUBRI versus PRVRI

8.4 Agency Theory

8.4.1 Differences in Risk Preference

The sector-specific risk indices were derived based on participants' past experience related to risk-sharing in tollroad concession. Evidence presented in Section 7.4 shows that risks have not been equitably shared in the projects that participants have experience in. To test Hypothesis 1 using the parameter estimates of model 3, we converted each risk attribute from two classes, i.e., $\beta_{k|q_1}$ and $\beta_{k|q_2}$, into a single β_k , and applied the Krinsky and Robb (1986) procedure[56] to generate CIs for $\beta_{k_{PUSPs}}$ and $\beta_{k_{PVSPs}}$ in order to test whether $\beta_{k_{PUSPs}} = \beta_{k_{PVSPs}}$. The mean value as well as the CIs, i.e., upper bound of 97.5 percentiles and lower bound of 2.5 percentiles of each risk attribute, are reported in Table 8-3. The table shows that 94 per cent or 17 out of 18 parameter estimates associated with PVSPs are significant at the five per cent level (the only insignificant parameter is POL_{U2}), but only 44 per cent or eight out of 18 parameter estimates associated with PUSPs are significant (the eight significant parameters being TRA_{D1}, FIN_{D1}, UNC_{U1}, POL_{D1}, POL_{U1}, MED_{D1}, MED_{U1} and PUB_{D1}). Eighty four per cent or 21 out of 25 significant parameter estimates (PVSPs and PUSPs combined) are of the expected sign, i.e., downside risks have the negative sign and upside gains have the positive sign. UNC_{D2} was expected to have a positive sign, see the implication of ICT on PPPs under Section 4.3.2 and discussion below. A negative parameter indicates the risk attribute will

[56] Assistance from Matthew Beck of ITLS to perform the Krinsky and Robb procedure is much appreciated.

lower the decision-maker's utility level while a positive parameter indicates that exposure to the risk attribute will increase the decision-maker's utility.

Table 8-3: Risk Attributes – post Krinksy and Robb Procedure

	PUSPs				**PVSPs**		
$\beta_{k_{PUSPs}}$	mean	Lower	Upper	$\beta_{k_{PVSPs}}$	mean	Lower	Upper
TRA_{D1}	**-0.03828**	**-0.05093**	**-0.02602**	**TRA_{D2}**	**-0.13318**	**-0.15205**	**-0.11426**
TRA_{U1}	*-0.00749*	*-0.02422*	*0.00861*	TRA_{U2}	0.02798	0.02092	0.03485
FIN_{D1}	**-0.02294**	**-0.03693**	**-0.00940**	**FIN_{D2}**	**-0.12545**	**-0.14448**	**-0.10621**
FIN_{U1}	*-0.01189*	*-0.03154*	*0.00695*	FIN_{U2}	0.03750	0.02812	0.04675
NET_{D1}	*-0.00358*	*-0.02213*	*0.01394*	NET_{D2}	-0.08368	-0.09313	-0.07394
NET_{U1}	*0.01192*	*-0.00787*	*0.03069*	NET_{U2}	-0.01783	-0.03033	-0.00521
FOR_{D1}	*-0.00863*	*-0.02819*	*0.00997*	FOR_{D2}	-0.03298	-0.04506	-0.02105
FOR_{U1}	*0.00949*	*-0.00294*	*0.02144*	FOR_{U2}	-0.01623	-0.02978	-0.00285
SOV_{D1}	*0.00668*	*-0.01791*	*0.02994*	SOV_{D2}	-0.05570	-0.06883	-0.04316
SOV_{U1}	*-0.00200*	*-0.03087*	*0.02531*	SOV_{U2}	0.01211	0.00101	0.02298
UNC_{D1}	*-0.01441*	*-0.03192*	*0.00211*	UNC_{D2}	0.01510	0.00648	0.02355
UNC_{U1}	**0.01309**	**0.00444**	**0.02148**	**UNC_{U2}**	**0.04047**	**0.02990**	**0.05076**
POL_{D1}	**-0.02153**	**-0.02409**	**-0.01883**	**POL_{D2}**	**-0.01261**	**-0.01364**	**-0.01176**
POL_{U1}	0.03126	0.01979	0.04402	*POL_{U2}*	*0.01113*	*-0.00140*	*0.02369*
MED_{D1}	**-0.00233**	**-0.00327**	**-0.00115**	**MED_{D2}**	**-0.02611**	**-0.02739**	**-0.02461**
MED_{U1}	**0.01415**	**0.01389**	**0.01475**	**MED_{U2}**	**-0.00783**	**-0.01127**	**-0.00460**
PUB_{D1}	**-0.02720**	**-0.03871**	**-0.01603**	**PUB_{D2}**	**-0.04124**	**-0.06454**	**-0.01799**
PUB_{U1}	*-0.00220*	*-0.01445*	*0.00963*	PUB_{U2}	-0.06015	-0.08004	-0.03977

Note: Values in bold text are statistically significant estimates across both data segments, italicised values are statistically insignificant estimates for at least one segment.

The significant parameters of unexpected signs are all associated with PVSPs; possible explanations are as follows. With regard to the NET_{U2} (negative) parameter, the findings are seemingly contrary to our qualitative findings in Chapter 3. One explanation for this is that the perceived upside gain from network redevelopment around the private toll facility signals that the public would view the project as a vehicle to transfer user costs to private gains. As the CCT experience demonstrates, such perception has generated significant unwelcome repercussions for the PPP scheme. This reason may explain PVSPs' aversion to the upside attribute.

The FOR_{U2} parameter is also negative when it is expected to be positive. During the survey, participants informed the author that they did not believe the risk of *force majeure* will have upside gain, and none of them had experienced upside benefit from this category. Their disbelief may have resulted in the unexpected sign associated with FOR_{U2}.

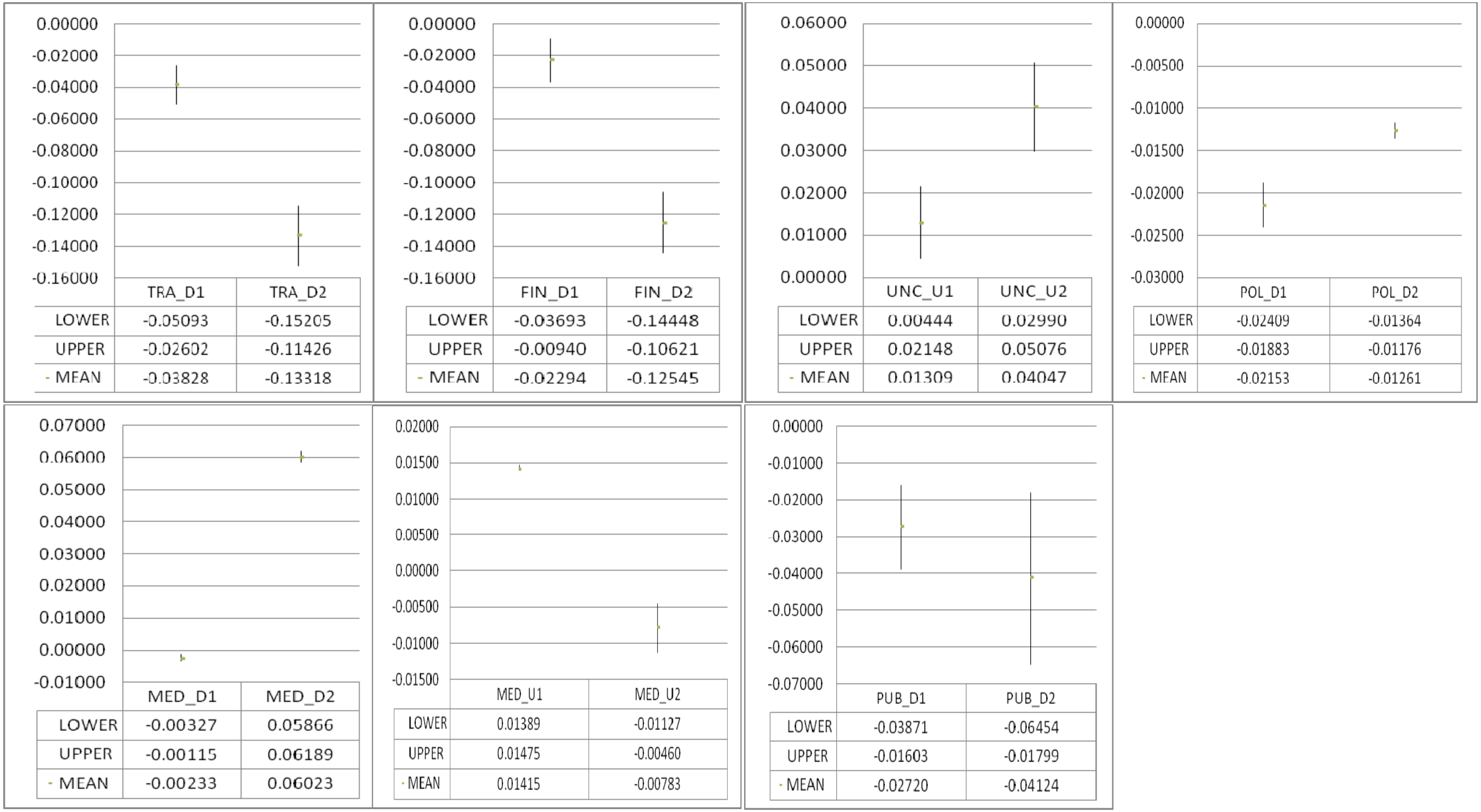
In terms of the expected positive sign of the parameter estimate associated with UNC_{D2}, we have argued in Section 4.3.2 that ownership transfer in PPPs shields the private sector from this risk. Empirically, a number of PVSPs revealed to the author during the experiment that the public sector having unclear project objectives has in the past provided them with greater opportunities to exercise their own discretion in terms of project scope and delivery. This outcome is consistent with the problem of opportunism identified by Coase (1993) and Williamson (1993) (see Section 4.3.3.1.1) where in complex and long-term contracts, it is difficult to include precise provisions to curtain opportunism.

With regard to the MED_{U2} and PUB_{U2} parameters, which are both negative, their significance indicates that PVSPs acknowledge that media and the public are important factors influencing the success of their projects. The negative sign may be justified on the grounds that PVSPs prefer less public exposure because open appraisal of project success may encourage new entrants and therefore increase competition.

The results depicted in Figure 8-2 were generated using the estimated CIs. The figure plots the parameter estimates that are significant for both cohorts, which are highlighted in bold in Table 8-3, to illustrate whether the CIs overlap. The figure shows that six out of seven significant risk preferences associated with PUSPs are significantly different from their PVSP counterparts at the five per cent level i.e., 95 per cent of CIs of the two data segments do not cross. In order to make a comparison, we scaled the mean value of $\beta_{k_{PUSPs}}$ by the ratio of $\frac{RANGE_{x_{D1}}}{RANGE_{x_{D2}}}$, and multiplied the inverse of this ratio by the mean value of $\beta_{k_{PVSPs}}$. Results are presented in the following table (Table 8-4).

Table 8-4: Degree of Differences in Risk Preferences

	Column A: $\frac{RANGE_{x_{D1}}}{RANGE_{x_{D2}}}$	Column B: $\frac{\beta_{k_{PUSPs}}}{Column\ A}$	Column C: $\frac{\beta_{k_{PVSPs}}}{Column\ B}$
TRA_D	0.66	-0.06	2.29
FIN_D	0.72	-0.03	3.93
UNC_U	0.82	0.02	2.53
POL_D	2.80	-0.01	1.64
MED_D	0.02	-0.09	-0.64
MED_U	0.01	1.28	0.05



	TRA_D1	TRA_D2
LOWER	-0.05093	-0.15205
UPPER	-0.02602	-0.11426
MEAN	-0.03828	-0.13318

	FIN_D1	FIN_D2
LOWER	-0.03693	-0.14448
UPPER	-0.00940	-0.10621
MEAN	-0.02294	-0.12545

	UNC_U1	UNC_U2
LOWER	0.00444	0.02990
UPPER	0.02148	0.05076
MEAN	0.01309	0.04047

	POL_D1	POL_D2
LOWER	-0.02409	-0.01364
UPPER	-0.01883	-0.01176
MEAN	-0.02153	-0.01261

	MED_D1	MED_D2
LOWER	-0.00327	0.05866
UPPER	-0.00115	0.06189
MEAN	-0.00233	0.06023

	MED_U1	MED_U2
LOWER	0.01389	-0.01127
UPPER	0.01475	-0.00460
MEAN	0.01415	-0.00783

	PUB_D1	PUB_D2
LOWER	-0.03871	-0.06454
UPPER	-0.01603	-0.01799
MEAN	-0.02720	-0.04124

Figure 8-2: Confidence Intervals – Test of Risk Preferences (PUSPs vs. PVSPs)

As suggested by Table 8-4, after scaling, the differences associated with MED_D and MED_U become negligible; however, significant differences remain in each cohort's risk preference in TRA_D, FIN_D, UNC_U and POL_D. Therefore, we cannot reject Hypothesis 1 with respect to TRA_D, FIN_D, UNC_U, and POL_D. The implications are as follows.

Traffic risk downside (TRA_D)

Both sector participants are averse to this risk, but they are significantly different in terms of their degree of risk aversion – results in Table 8-4 suggest that PVSPs are 2.3 times more averse to the risk than PUSPs.

Financial risk downside (FIN_D)

PVSPs are overwhelmingly (four times) more averse to financial downside risk compared with PUSPs. Examination of Figure 8-2 reveals that the largest difference between the two cohorts lies in this category. This is not a surprising result. It is consistent with our findings in Chapters 3 and 7, that PPPs are essentially a means of project finance, and financial risk is one that governments want to divest the most, therefore exposing private capital to a great deal of risk.

Unclear project objectives upside (UNC_U)

PVSPs are three times more *in favour* of well-defined projects compared with PUSPs. This finding is consistent with our conclusion drawn in Chapter 2. It sends a strong message to public procurers. Projects with good planning and clear objectives include a well thought-out risk allocation strategy to facilitate the fulfilment of policy goals. A favourable perception from PVSPs suggests that such projects can drive risk premiums down; so clear project objectives are a key driver of VFM.

Political and reputational risk downside (POL_D)

Here, the difference between the two cohorts arises as the result of PUSPs being almost twice as averse to the risk than PVSPs. This finding reinforces our conclusion drawn in Chapter 3 that both sectors were wary of the repercussions from political backlash due to the controversial nature of the PPP scheme. It signals to both sectors that the scheme's welcomeness, to a large extent, can be enhanced through having ongoing dialogue with users and with the community.

8.4.2 Risk Indices as the Function of Testing

After confirming preference heterogeneity in terms of risk-bearing with respect to different risks, we want to understand whether in aggregate, the average levels of the risk preferences of participants from the two sectors are different (Hypothesis 2a(i)) and whether PVSPs are more risk-averse than PUSPs (Hypothesis 2a(ii)) as postulated in AT.

We have graphed the PUBRI and PRVRI derived in Section 8.3 in Figure 8-1, which clearly illustrates that the private sector agents are on average much more risk-averse than the principal (public sector authorities); the average risk index of the agent (23.15 per cent) is more than three times higher than that of the principal (7.26 per cent). The t-test in Equation (8.1) supports the finding that the two index values are statistically different from each other at the one per cent level. Therefore, neither Hypothesis 2a(i) nor Hypothesis 2a(ii) can be rejected.

$$t_n = \frac{\bar{x}_{PUBRI} - \bar{x}_{PRVRI}}{\sqrt{se_{PUBRI}^2 + se_{PRVRI}^2}} = \frac{7.26 - 23.15}{\sqrt{(0.00711)^2 + (0.01533)^2}} = |-9.40| > 2.575 \qquad \textbf{(8.1)}$$

Two reasons contribute to the profound difference between PUBRI and PRVRI. We have demonstrated in model 3 and the testing of Hypothesis 1 that PUSPs and PVSPs have different preferences toward different risks. Furthermore, the analysis of RP data on Prior Experience shown in Table 7-4 and Table 7-5 has confirmed that the experience of the two segments is also profoundly different from each other. It is logical that feeding the parameter estimates from model 3 which clearly demonstrate that there are differences in risk preferences of the two segments through different RP levels will produce significantly different risk indices. This outcome nevertheless represents a milestone in that it sets the scene for our investigation of optimising risk-sharing. Section 8.6.4 will explore ways of aligning the risk indices of the two cohorts by simulating the RP data in Prior Experience.

We posited in Section 4.4.1, Hypothesis 2a(iii) that if agents are more risk-averse compared with the principal, i.e., Hypothesis 2a(ii) is not rejected, then the risk-sharing rationale in PPPs implies that private sector agents would prefer the PPP method to other procurement methods. Participants' choices of procurement method, as described in Section 7.5.2 and

Figure 7-26, are presented in an ordered outcome scale of seven levels. Testing a hypothesis that has an ordered scale as dependent variable requires an ordered response model that recognises the nonlinearity of a ranking scale and defines points on the observed rating scale as thresholds.

The ordered logit model allows the inclusion of ordinal dependent variables in the outcome model in a way that explicitly recognises their ordinarity and avoids arbitrary assumptions about their scale. The essence of the approach is an assumed probability distribution of the continuous variable that underlies the observed ordinal dependent variable (Jones and Hensher, 2004). In specifying an appropriate model, we assume that the seven-point ranking scale is a monotonic transformation of an unobserved interval variable. Thus, one or more values of an interval-level variable are mapped into the same value of a transformed ordinal variable. An underlying continuous variable is mapped into categories that are ordered but are separated by unknown distances. We cannot, for example, say that the difference between ranks 1 and 2 is identical to the difference between 2 and 3. Estimates can be obtained for the parameters associated with each of the independent variables (one, i.e., PRVRI only in Hypothesis 2a(iii)), and the threshold parameters. The threshold parameters indicate the extent to which the categories of the ranking scale are equally spaced in the logit scale. They are essentially constants that redefine the utility scale across the set of outcomes to recognise that the utility scale is nonlinear between outcomes.

To estimate an ordered logit model in NLOGIT 4.0, the model specification must include a constant term as the first right hand side variable. Since the equation does include a constant term, one of the threshold parameters (μ_s) is not identified, so μ_0 is normalised to 0. The dependent variable is coded 1, 2, …, M, and there must be at least three values. The results of testing Hypothesis 2a(iii) using NLOGIT 4.0 are reported in Table 8-5.

A direct interpretation of the parameter estimates in Table 8-5 is not possible given the logit transformation of the outcome dependent variable required for model estimation. We therefore provide in the table the marginal effects of the two ends of the scale, i.e., Prob(Y=1) (PPP is the most preferred method) and Prob(Y=7) (PPP is the least preferred method). These are defined as the derivatives of the probabilities, to explain the influence a one unit change in an independent variable, i.e., risk aversion, has on the probability of selecting a particular outcome, i.e., choice of procurement method, *ceteris paribus*.

Table 8-5: PPP Method versus PRVRI

Dependent Variable	Independent Variable		Parameter	t-value	Hypothesis	Reject	Model
Choice of PPP Procurement Method	Constant		-0.00114	(-0.01)	2a(iii)	YES	Ordered logit
	PRVRI		2.41940	(3.77)			
	Threshold parameters						
	μ (1 to 2)	MU (1)	0				
	μ (2 to 3)	MU (2)	1.50508	(18.22)			
	μ (3 to 4)	MU (3)	1.86967	(20.15)			
	μ (4 to 5)	MU (4)	2.61391	(21.14)			
	μ (5 to 6)	MU (5)	2.78739	(20.98)			
	μ (6 to 7)	MU (6)	4.67470	(14.69)			
	Marginal effects						
	<u>Independent variable</u>		<u>Prob (Y=1)</u>	<u>t-value</u>	<u>Prob (Y=7)</u>	<u>t-value</u>	
	PRVRI (at mean)		-0.55997	(-3.75)	0.03821	(3.30)	
	AIC		*1787.60500*				
	LL function		*-886.80233*				
	N		*600*	(N= 60PVSPs×5experiments×2contracts)			

The results suggest that PRVRI has a strong statistical impact – both marginal effects are significant at the one per cent level – on the probability of choosing PPP as the most preferred procurement method. The negative marginal effect of Prob(Y=1) indicates that a one unit change in the mean of PRVRI leads to a -0.56 change in the probability of Y=1, i.e., one unit increase in PVSPs' risk aversion reduces the probability of PPP being favoured by them by 56 percent, *ceteris paribus*. The positive marginal effect of Prob(Y=7) suggests otherwise, although at a much lower magnitude, i.e., increase in one unit of the risk aversion increases the odds of non-PPP methods being chosen by four percent, *ceteris paribus*.

Overall, the results suggest that the greater the risk aversion of private sector agents the <u>*less*</u> preferred is the PPP method, hence Hypothesis 2a(iii) is rejected. The results may imply that an agent who is risk-seeking would prefer the ownership concession method. Reference to interview data confirms that the reason that PVSPs (particularly those from construction companies and pension funds, see Section 7.3.1) prefer PPPs because the ownership entitlement to upside gain. The finding refutes agency theory, to attest that risk-sharing did not incentivise the risk-averse agent; the key incentive element in PPPs that appeals to a risk-seeking agent is not the underlying rationale of risk-sharing, but rather the property rights to *ex post* surplus. This proposition sheds new light on the unpopularity of AM that does not make provision for revenue-sharing. We will confirm this when testing Hypothesis 2c.

Our proposition is confirmed by the results of an ordered logit model shown in Table 8-6, which used simulated data to increase the share of upside gains by PVSPs in traffic and financial risks in Prior Experience. After the simulation, the risk indices of two PVSPs (both are tollroad operators) became positive, i.e., their risk preference changed from risk-averse to risk-seeking. The magnitude of marginal effect associated with Prob(Y=1) in Table 8-6 (-0.51405) decreased by 15 per cent compared with the marginal effect of Prob(Y=1) before the simulation (-0.55997 in Table 8-5). This result suggests that an agent with a propensity for risk-seeking will have a 15 per cent more chance of favouring the PPP method compared with an agent who is risk-averse, *ceteris paribus*. Although of trivial magnitude, the finding opens up a research opportunity to strengthen the proposition; this can be achieved by iterations in data simulation to seek the risk-sharing outcome that may change the risk preference of other PVSPs' to risk-seeking.

Table 8-6: PPP Method versus PRVRI (with increases in upside gains)

Dependent Variable	Independent Variable		Parameter	t-value			Model
Choice of PPP Procurement Method	Constant		0.05799	(0.37)			Ordered logit
	PRVRI		2.22072	(3.72)			
	Threshold parameters						
	μ (1 to 2)	MU (1)	0				
	μ (2 to 3)	MU (2)	1.50462	(18.22)			
	μ (3 to 4)	MU (3)	1.86920	(20.15)			
	μ (4 to 5)	MU (4)	2.61315	(21.13)			
	μ (5 to 6)	MU (5)	2.78651	(20.97)			
	μ (6 to 7)	MU (6)	4.67352	(14.69)			
	Marginal effects						
	Independent variable		Prob (Y=1)	t-value	Prob (Y=7)	t-value	
	PRVRI (at mean)		-0.51405	(-3.70)	0.03510	(3.26)	
	AIC		*1788.00300*				
	LL function		*-887.00169*				
	N		*600*	(N= 60PVSPs×5experiments×2contracts)			

With confirmation through Hypothesis 2a(ii) that PUSPs are less risk-averse than PVSPs, we can perform a test to investigate the procurement contracting literature, which predicts that in situations where the agent is more risk-averse than the principal, an incentive contract that emphasises risk-sharing offers an optimal solution for the government principal (McAfee and McMillan, 1986). That is, public sector authorities who are less risk-averse than private sector agents would prefer the PPP method to other methods of procurement.

Table 8-7: PPP model versus PUBRI

Dependent Variable	Independent Variable		Parameter	t-value	Hypothesis	Reject	Model
Choice of PPP Procurement Method	Constant		2.85525	(15.94)	2b	NO	Ordered logit
	PUBRI		-4.30202	(-2.08)			
	Threshold parameters						
	μ (1 to 2)	MU (1)	0				
	μ (2 to 3)	MU (2)	1.41340	(14.08)			
	μ (3 to 4)	MU (3)	2.20078	(22.18)			
	μ (4 to5)	MU (4)	4.31891	(30.55)			
	μ (5 to 6)	MU (5)	5.09460	(26.83)			
	Marginal effects						
	Independent variable		Prob (Y=1)	t-value	Prob (Y=6)	t-value	
	PUBRI (at mean)		0.29074	(2.05)	-0.28862	(-2.03)	
		AIC	*1269.66300*				
		LL function	*-628.83175*				
		N	*410*	(N= 41PUSPs×5experiments×2contracts)			

In Table 8-7, the number of threshold parameters is five instead of six because the ranking scale of seven by PUSPs has zero entries (see Figure 7-26). The parameter estimates of marginal effects are statistically significant at the five per cent level suggesting PUBRI has a substantial impact on PUSPs' choice of procurement methods. The positive marginal effect of Prob(Y=1) (0.29074) and negative marginal effect of Prob(Y=6) (-0.28862) indicate that an increase in PUSPs' risk aversion increases their preference for the PPP method and decreases their preference for other methods at a similar magnitude. For example, a one-unit increase in

PUBRI will increase the probability of PPP being the most preferred method by 29 per cent *ceteris paribus* while decreasing the preference for other methods by 29 per cent *ceteris paribus*. We therefore cannot reject Hypothesis 2b. Combined, the results in Table 8-5 and Table 8-7 reveal that the PPP method has yielded better outcomes for PUSPs in terms of risk-sharing, whereas they have not been viewed favourably by PVSPs.

In relation to PVSPs' preference for the availability model (refer to Section 2.3.1.3 and data captured by the 1-7 likert scale reported in Table 7-6), we cannot reject Hypothesis 2c based on the marginal effects of PRVRI on the AM from an ordered logit model (Table 8-8). The marginal effects of -0.13 for Prob(Y=1) and 0.23 for Prob(Y=7) suggest that the more risk-averse the private sector agents, the less effective is the availability model to induce them to exert greater performance effort.

Table 8-8: Risk Aversion versus Preference for Availability Model

Dependent Variable (see Table 7-6)	Independent Variable		Parameter	t-value	Hypothesis	Reject	Model
AM	Constant		1.63782	(9.48)	2c	NO	Ordered logit
	PRVRI		1.21517	(1.92)			
	Threshold parameters						
	μ (1 to 2)	MU (1)	0				
	μ (2 to 3)	MU (2)	0.75994	(10.31)			
	μ (3 to 4)	MU (3)	1.04253	(13.74)			
	μ (4 to 5)	MU (4)	1.89818	(23.65)			
	μ (5 to 6)	MU (5)	2.26617	(27.30)			
	μ (6 to 7)	MU (6)	3.01077	(30.29)			
	Marginal effects						
	Independent variable		Prob (Y=1)	t-value	Prob (Y=7)	t-value	
	PRVRI (at mean)		-0.13476	(-1.90)	0.22959	(1.92)	
	AIC		*2042.06900*				
	LL function		*-1014.03447*				
	N		*550*				

NB: (N= (60-5)PVSPs×5experiments×2contracts); 5 PVSPs took the pilot survey, questions related to AM and Land (see Figure 7-27) was added as the result of feedback from the pilot.

Figure 8-3 compares the risk index of participants from construction companies, who generally lead the consortium bid team, with that of the other members of the bidding consortium. The comparison shows that the leader is less risk-averse (the mean value is 21.97 per cent) compared with other members of the bid team, whose mean value is 26.09 percent. There is strong evidence of the existence of a second level of agency problem.

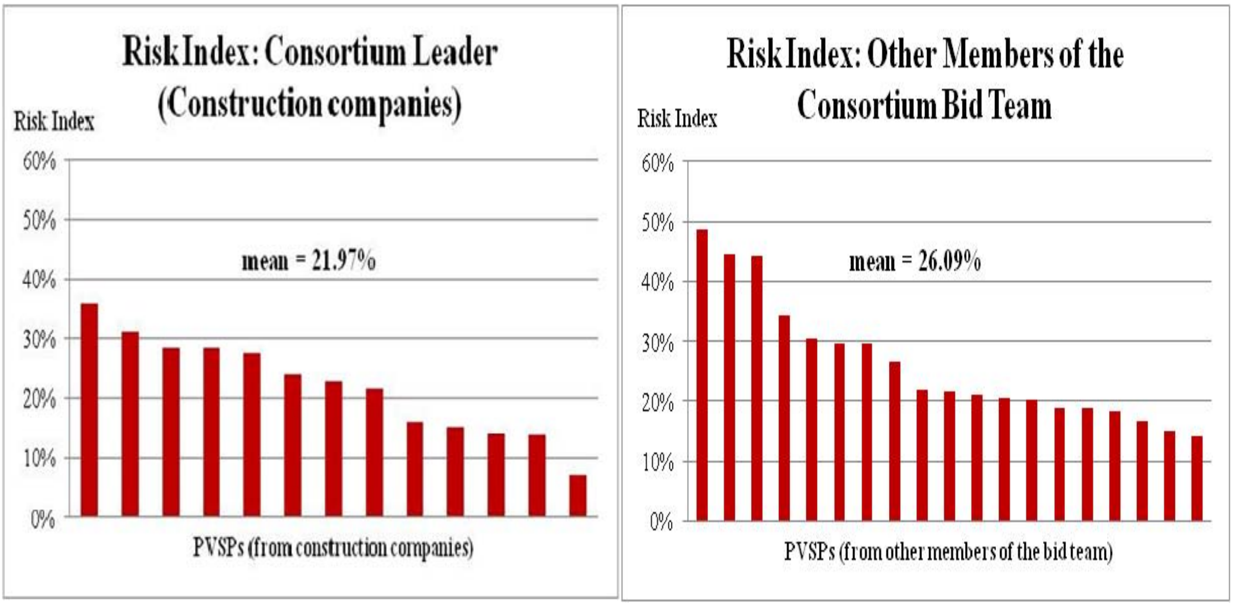


Figure 8-3: Risk Index – Consortium Leader versus Other Members of the Consortium Bid Team

The second level of agency problem is further supported by test results of a linear regression model summarised in Table 8-9, which demonstrates that construction companies are the least risk-averse among all members of the bid team. Thus Hypothesis 3 cannot be rejected. The results are consistent with our analysis in Section 7.3.1 that construction companies and consultants are most aggressive in making investment decisions. This poses an additional risk to the outcomes of PPP projects, as suggested in Jensen and Meckling (1976, p. 334) that as the debt to equity ratio rises, so does the incentive to engage in risky investments. The authors argued that this risk-seeking propensity engendered a distortional outcome of aggressive bidding behaviour, since the risk of bankruptcy was transferred to external investors. In this light, the second level of agency theory well predicts the behavioural pattern of large bidding consortia we identified in Chapter 2.

Table 8-9: 2nd Level of Agency Problem within Members of Consortium Bid Team

Dependent Variable	Independent Variable	Parameter	t-value	Adjusted R^2	Hypothesis	Reject	Model
PRVRI	Constant	0.09580	(16.58)	0.20805	3	NO	Multivariate linear regression
	Construction Company	0.02972	(3.24)				
	Consultancy	0.03581	(4.46)				
	Investment Bank	0.07433	(7.20)				
	Tollroad Company	0.07928	(10.10)				
	Other Organisation	0.08595	(10.03)				
	N	*1010*					

8.5 Theory of Incomplete Contract

The feature of ownership concession in PPPs is premised on ICT's proposition that, in the absence of complete information, property rights have powerful effect on the incentives of contracting parties. We tested this proposition from the agent's perspective in a number of dimensions: (a) ownership effect on protecting the agent from unclear project objectives; (b) ownership effect on the agent's willingness to exercise pricing control; and (c) the agent's reaction to public perception that ownership transfer is seen transferring government's accountability for issues related to labour productivity. Results are reported in Table 8-10. Data of UNC_{D2} are downside risk of unclear project objectives of PVSPs from Prior Experience (see Table 7-4 and Table 7-5). Data of $FREETOLL_{D2}$ and $PVOWNW_{D2}$ are the 1-7 likert scale from Other Factors (see Figure 7-27 and Table 7-6) and have been coded into dummy variables. We used the category of $FREETOLL_{D2}$ in scale=7 to indicate that the participant considered this factor, i.e., the right to price control, was highly influential in their choice of PPP procurement method (where scale=1 means that the factor was considered not important at all). We combined the scales of 5, 6 and 7 of $PVOWNW_{D2}$) for two reasons; there are insufficient counts in each category, and the other combinations did not yield any significant parameter estimate[57] .

[57] A similar reason applies to other hypothesis testing using dummies as the independent variables.

Table 8-10: Ownership Effects on PVSPs

Dependent Variable	Independent Variable	Parameter	t-value	Adjusted R^2	Hypothesis	Reject	Model
PRVRI	Constant	0.20622	(27.54)	0.09180			
	UNC$_{D2}$	0.00180	(7.65)		4a	NO	Multivariate linear regression
	FREETOLL$_{D2}$	0.04292	(2.97)		5a	YES	
	PVOWNW$_{D2}$	-0.02727	(-2.88)		6a	NO	
	N		*600*				
Choice of PPP Procure-ment Method	Constant	0.72181	(6.92)	N/A	4b	NO	Ordered logit
	UNC$_{D2}$	-0.00899	(-2.36)	N/A			
	Threshold parameters						
	μ (1 to 2) MU (1)	0					
	μ (2 to 3) MU (2)	1.48719	(18.15)				
	μ (3 to 4) MU (3)	1.84805	(20.07)				
	μ (4 to 5) MU (4)	2.59356	(21.05)				
	μ (5 to 6) MU (5)	2.76775	(20.90)				
	μ (6 to 7) MU (6)	4.64902	(14.62)				
	Marginal effects						
	Independent variable	Prob (Y=1)	t-value	Prob (Y=7)	t-value		
	UNC$_{D2}$ (at mean)	0.00208	(2.36)	-0.00014	(-2.23)		
	AIC		*1796.03700*				
	LL function		*-891.01858*				
	N		*600*				

The parameter estimate of UNC$_{D2}$ (0.00186) is highly significant at the one per cent level. The positive sign signals that the higher the risk of unclear project objectives by the procuring authority, the greater the risk aversion of the private sector agents; so Hypothesis 4a cannot be rejected. After the significance of UNC$_{D2}$ had been confirmed, we estimated an ordered logit model to analyse whether ownership transfer has the effect of shielding the agents from the risk, by testing UNC$_{D2}$ against their choice of procurement method. The positive (negative) marginal effect of Pro(Y=1) 0.00208 (Prob(Y=7), -0.00014) indicates that the higher the risk of unclear project objectives, the more preferred is the PPP method by PVSPs; hence, Hypothesis 4b is not rejected. This outcome is consistent with our explanation of the positive UNC$_{D2}$ when testing Hypothesis 1 in Section 8.4.1. Unclear project objectives by the public sector have in the past provided PVSPs with greater opportunities to exercise their own discretion in terms of project scope and delivery. The finding coincides with the problem of opportunism identified by Coase (1993) and Williamson (1993), in that complex and long-term contracts come with the difficulty of including precise provisions to curtail opportunism.

The right to price control yields an effect similar to UNC_{D2}. The positive parameter of $FREETOLL_{D2}$ (0.04033)[58], which is significant at the one per cent level, shows that such ownership right increases the private sector agent's risk aversion. We therefore reject Hypothesis 5a and conclude that the private sector agents are reluctant to exercise their entitlement to pricing control. The reason for this could be due to strong public averseness to toll pricing, and the private proponents not wishing to be seen to be using their right to set tolls for private gain at the expense of the public purse, which may have a detrimental effect on patronage.

PPPs are often perceived by the public as a facilitating mechanism for governments to transfer ownership-related risks, such as those arising from workforce disputes (PVOWNW). The parameter estimate of $PVOWNW_{D2}$ is significant at the one per cent level and is of negative sign, which means the higher the public perception, the lower the risk aversion of private sector agents. This outcome lends support to ICT in that the ownership effect does provide the concession owner with a certain degree of flexibility in managing labour productivity, hence enhancing *ex post* efficiency.

Table 8-11 presents the results of testing ICT from the principal's perspective. All parameter estimates in Table 8-11 are significant at the one per cent level, signalling that ownership effects also have a significant impact on the principal. The positive sign of UNC_{D1} (0.00093) confirms that the public sector authorities dislike the risk of unclear project objectives, as the higher the risk, the greater their risk aversion; accordingly, Hypothesis 4c is not rejected.

The positive sign of $FREETOLL_{D1}$ (0.01005) means we reject Hypothesis 5b. ICT argues that when contracting parties are risk-averse, reservation of residual rights is most likely (see Section 4.3.2). Our data strongly upholds this proposition. Both cohorts are confirmed as risk-averse and are found to be restrained to exercise/release the right to price control. This finding

[58] This is interpreted as follows: a PVSP who has a scale of 7=1 has a risk index value that is four per cent greater than a PVSP with a scale of 1, …, 6=1, other things being equal; a similar interpretation applies to other hypothesis testing using dummies as the independent variables.

represents a significant empirical contribution to the literature of property rights as it demonstrates that the effectiveness of ownership assignment as an incentive device hinges on the contracting parties' risk preferences. When both the agent and the principal are risk-averse, property rights to *ex post* surplus have little effect in incentivising the agent, and at the same time secure little support from the principal.

The positive sign of $PVOWNW_{D1}$ (0.04454) suggests that the public perception of ownership transfer is that accountability transfer increases the risk aversion of PUSPs, i.e., such perception will have a negative effect on the political popularity of the PPP method. More needs to be done to correct these misperceptions if PPPs are to gain the public's support.

The outcomes reported in Table 8-11 show the powerful influence of politics surrounding the scheme, which impedes the effectiveness of the ownership concession. Overall, the results in Table 8-10 and Table 8-11 strongly convey the message that compromising government's accountabilities to users and the workforce undermines economic efficiency; therefore policy making to achieve economic efficiency must not ignore public accountability.

Table 8-11: Ownership Effects on PUSPs

Dependent Variable	Independent Variable	Parameter	t-value	Adjusted R^2	Hypothesis	Reject	Model
PUBRI	Constant	0.03760	(16.84)	0.57676			
	UNC_{D1}	0.00093	(19.68)		4c	NO	Multivariate linear regression
	$FREETOLL_{D1}$	0.01005	(3.06)		5b	YES	
	$PVOWNW_{D1}$	0.04454	(4.39)		6b	NO	
	N		*410*				

NB: $FREETOLL_{D1}$ combines scale=5, 6 and 7; $PVOWNW_{D1}$ combines scale=6 and 7.

8.6 Transaction Cost Economics

8.6.1 Shift Parameter Framework

A set of shift parameters (Williamson, 1991) can change the comparative cost of governance, and in some cases shift the form of governance (González-Diaz *et al*., 1998; Oxley, 1999; Arruñada *et al*., 2004; 2009). We extend the notion of institutional parameters defined as the set of fundamental political, social, and legal rules that sets the boundary within which economic activity takes place (North, 1991), to determine a set of shift parameters in the PPP environment. These are sovereign risk (which defines the political environment), *force majeure* (as a proxy of the legal environment), unclear project objectives (proxy of political commitment), political and reputational risk (proxy of reputation and trust), media risk (proxy of the social perspective of PPPs), and public perception risk (proxy of public attitudes toward PPPs). We hypothesised that these shift parameters have a significant effect on the choice of procurement method by all contracting parties (Hypothesis 7). We test this on participants' prior experience. Based on the results summarised in Table 8-12, we cannot reject Hypothesis 7.

For PVSPs, five out of six or 83 per cent of the marginal effects of risks have a strong statistical impact on their preference for PPPs; the only insignificant effect is associated with PUB_D. For PUSPs, only three out of six or half of the marginal effects have a statistical impact on their preference for PPPs. The interpretations are summarised in Table 8-13.

These results confirm that the identified shift parameters have a decisive impact on PVSPs' preference for the PPP procurement method, while the impact on PUSPs' preference is not as strong. One exception is the PUB_D, which is highly significant for PUSPs but insignificant for PVSPs. Given that the choice of procurement method is primarily a policy decision in the hands of public authorities where they must consider the uptake of their decision by the market, these are not unexpected outcomes. The implications of these results are multi-dimensional. To make the policy more welcome to the market and at the same time achieve VFM, public authorities should consider offering a stable political and legal environment. Resources and effort should be invested in identifying policy objectives and maintaining consistency throughout the concession term, and ensuring project details are transparent to the public and the media. An unexpected observation from the study is that PUSPs did not consider that POL_D would affect their choice of PPP as much as their private sector counterparts did. This finding sends an important message to the public sector, particularly politicians, that political and reputational risk needs to be handled carefully if government wants to make the PPP scheme welcome to private investors.

Table 8-12: Shift Parameter Framework

Dependent Variable	Independent Variable		PVSPs ($_{D2}$) Parameter	PVSPs ($_{D2}$) t-value	PUSPs ($_{D1}$) Parameter	PUSPs ($_{D1}$) t-value	Model
Choice of PPP Procurement Method	Constant		0.31036	(1.98)	3.16797	(17.02)	Ordered logit
	FOR_D		0.01881	(5.30)	-0.00829	(-1.88)	
	SOV_D		-0.00718	(-1.78)	-0.00757	(-1.21)	
	UNC_D		-0.02120	(-4.99)	-0.00449	(-0.74)	
	POL_D		0.03185	(4.98)	-0.00445	(-0.65)	
	MED_D		-0.01634	(-2.59)	-0.01535	(-2.23)	
	PUB_D		0.00897	(1.46)	0.01742	(3.12)	
	Threshold parameters (only 5 for PUSPs due to no entries in Y=7)						
	μ (1 to 2)	MU (1)	0		0		
	μ (2 to 3)	MU (2)	1.59530	(18.45)	1.49282	(14.31)	
	μ (3 to 4)	MU (3)	1.98219	(20.50)	2.29667	(22.43)	
	μ (4 to 5)	MU (4)	2.78328	(21.85)	4.52372	(31.28)	
	μ (5 to 6)	MU (5)	2.96870	(21.73)	5.32128	(27.77)	
	μ (6 to 7)	MU (6)	4.88765	(15.29)			
	Marginal effects						
	Independent variable		Prob (Y=1)	t-value	Prob (Y=7)	t-value	
	FOR_{D2} (at mean)		-0.00430	(-5.24)	0.00025	(4.08)	
	SOV_{D2} (at mean)		0.00164	(1.78)	-0.95877E-04	(-1.69)	
	UNC_{D2} (at mean)		0.00485	(4.94)	-0.00028	(-4.04)	
	POL_{D2} (at mean)		-0.00729	(-4.90)	0.00043	(4.00)	
	MED_{D2} (at mean)		0.00374	(2.58)	-0.00022	(-2.44)	
	PUB_{D2} (at mean)		-0.00205	(-1.46)	0.00012	(1.43)	
			Prob (Y=1)	t-value	Prob (Y=6)	t-value	
	FOR_{D1} (at mean)		0.00052	(1.82)	-0.00050	(-1.85)	
	SOV_{D1} (at mean)		0.00047	(1.22)	-0.00045	(-1.19)	
	UNC_{D1} (at mean)		0.00028	(0.73)	-0.00027	(-0.74)	
	POL_{D1} (at mean)		0.00028	(0.65)	-0.00027	(-0.66)	
	MED_{D1} (at mean)		0.00095	(2.21)	-0.00092	(-2.13)	
	PUB_{D1} (at mean)		-0.00108	(-3.00)	0.00105	(2.92)	
	AIC			*1745.12400*		*1248.28000*	
	LL function			*--860.56183*		*-613.41015*	
	N			*600*		*410*	
	Hypothesis 7		**Reject: NO**				

Table 8-13: Interpretation of Marginal Effects in Table 8-12

Shift Parameters	$\underline{\textbf{PVSPs}}_{D2}$ Interpretation (Prob(Y=1))	Interpretation (Prob(Y=7))	$\underline{\textbf{PUSPs}}_{D1}$ Interpretation (Prob(Y=1))	Interpretation (Prob(Y=6))
FOR_D	-0.00430 (-5.24) Significant at 1% level; 1 unit ↑ in the average value of the risk experienced will ↓ PVSPs' preference for PPPs by 0.43%, *ceteris paribus*.	0.00025 (4.08) Significant at 1% level; 1 unit ↑ in the average value of the risk experienced will ↑ PVSPs' preference for non-PPPs by 0.03%, *ceteris paribus*.	0.00052 (1.82) Significant at 10% level; 1 unit ↑ in the average value of the risk experienced will ↑ PUSPs' preference for PPPs by 0.05%, *ceteris paribus*.	-0.00050 (-1.85) Significant at 10% level; 1 unit ↑ in the average value of the risk experienced will ↓ PUSPs' preference for non-PPPs by 0.05%, *ceteris paribus*.
	The results across two segments suggest that in the past, the private sector may have taken on greater shares of the risk. A more balanced sharing of this risk will strengthen the social benefits that the policy can offer. This approach has been taken up by the Peninsula Link project (refer to Section 2.4.5).			
SOV_D	0.00164 (1.78) Significant at 10% level; 1 unit ↑ in the average value of the risk experienced will ↑ PVSPs' preference for PPPs by 0.16%, *ceteris paribus*.	-0.95877E-04 (-1.69) Significant at 10% level; 1 unit ↑ in the average value of the risk experienced will ↓ PVSPs' preference for non-PPPs by 0.01%, *ceteris paribus*.	0.00047 (1.22) Insignificant	-0.00045 (-1.19) Insignificant
	The results imply that the PPP projects experienced by PVSPs occurred in countries where supportive policy and legal frameworks were present.		**This is consistent with our conclusion drawn from Figure 7-19; in fact, all the PUSPs informed the author that they believed that their political frameworks were mature and stable for PPPs.**	
UNC_D	0.00485 (4.94) Significant at 1% level; 1 unit ↑ in the average value of the risk experienced will ↑ PVSPs' preference for PPPs by 0.49%, *ceteris paribus*.	-0.00028 (4.04) Significant at 1% level; 1 unit ↑ in the average value of the risk experienced will ↓ PVSPs' preference for non-PPPs by 0.03%, *ceteris paribus*.	0.00028 (0.73) Insignificant	-0.00027 (-0.74) Insignificant
	The results are consistent with Hypothesis 1 and Hypothesis 4b.		**This indicates that insufficient consideration was given by public authorities to assessing the ramifications of unclear project objectives on government's overall infrastructure planning and policy implementation.**	

Shift Parameters	PVSPs$_{D2}$ Interpretation (Prob(Y=1))	PVSPs$_{D2}$ Interpretation (Prob(Y=7))	PUSPs$_{D1}$ Interpretation (Prob(Y=1))	PUSPs$_{D1}$ Interpretation (Prob(Y=6))
POL$_D$	-0.00729 (-4.90) Significant at 1% level; 1 unit ↑ in the average value of the risk experienced will ↓ PVSPs' preference for PPPs by 0.73%, *ceteris paribus*.	0.00043 (4.00) Significant at 1% level; 1 unit ↑ in the average value of the risk experienced will ↑ PVSPs' preference for non-PPPs by 0.04%, *ceteris paribus*.	0.00028 (0.65) Insignificant	-0.00027 (-0.66) Insignificant
	The results across two segments offer useful insights into understanding how political risk was perceived by PVSPs and PUSPs respectively. For PVSPs, political risk lowers their incentive to invest in PPPs, in particular because PPPs are long-term projects; this perception is also reflected in their investing behaviour revealed by SOV$_D$, explained earlier in this table. On the other hand, PUSPs did not consider POL$_D$ was an important factor; this is not because they did not believe political risk would have a decisive influence on the future of PPPs (in fact they did, as evidenced by the interview data), but rather, the risk was in the hands of politicians and therefore beyond their control.			
MED$_D$	0.00374 (2.58) Significant at 1% level; 1 unit ↑ in the average value of the risk experienced will ↑ PVSPs' preference for PPPs by 0.37%, *ceteris paribus*.	-0.00022 (-2.44) Significant at 5% level; 1 unit ↑ in the average value of the risk experienced will ↓ PVSPs' preference for non-PPPs by 0.02%, *ceteris paribus*.	0.00095 (2.21) Significant at 5% level; 1 unit ↑ in the average value of the risk experienced will ↑ PUSPs' preference for PPPs by 0.10%, *ceteris paribus*.	-0.00092 (-2.13) Significant at 5% level; one unit ↑ in the average value of the risk experienced will ↓ PUSPs' preference for non-PPPs by 0.09%, *ceteris paribus*.
	The results are consistent with Hypothesis 1; i.e., the risk is significant to both cohorts and magnitudes of difference are negligible. The effects of media risk are similar across the two segments, indicating on average that media was supportive of the scheme (taking into account experience was collected from 32 countries). This sends a strong signal to all scheme participants, public and private, that media is one of the powerful influences to either the success or the demise of the scheme.			
PUB$_D$	-0.00205 (-1.46) Insignificant	0.00012 (1.43) Insignificant	-0.00108 (-3.00) Significant at 1% level; 1 unit ↑ in the average value of the risk experienced will ↓ PUSPs' preference for PPPs by 0.11%, *ceteris paribus*.	0.00105 (2.92) Significant at 1% level; one unit ↑ in the average value of the risk experienced will ↑ PUSPs' preference for non-PPPs by 0.11%, *ceteris paribus*.
The results strongly suggest that this risk of social dimension is of primary concern to the public sector. Although past experience related to this risk has not generated any significant impact on PVSPs, it should not be interpreted that this risk should be managed by the public sector only. As we argued in Chapter 3, commitments from the private sector to make the PPP scheme welcome by the community can help in reducing the risk.				

8.6.2 Uncertainty Effect

We postulated that, to a large extent, institutional factors and contractual conditions may help minimise uncertainty. To understand whether greater uncertainty will result in higher risk aversion, we need to call on Chiles and McMackin (1996) model to incorporate variable risk preferences into the TCE framework in order to explain the governance choice as a function of risk preferences (see Section 4.3.3.3). This enables us to test the power of influence of uncertainty exerted by institutional factors and contractual conditions on each of the sector-specific risk indices respectively. Results shown in Table 8-14 confirm that these variables do have some power of influence on uncertainty (all are significant at the 10 per cent level), albeit in different ways with respect to PRVRI and to PUBRI.

For example, the different signs with respect to GFC, FGROWTH, FREETOLL, PERSDR and FPENALTY, suggest that these parameters significantly influence the two cohorts in very different ways. Respectively, the GFC factor and the condition of FREETOLL in contract will increase the risk aversion of PVSPs, *ceteris paribus*. The GFC worsened the market's ability to finance these mega infrastructure projects and we have demonstrated repeatedly that PPPs are perceived as a financing mechanism for governments to circumvent fiscal constraints. As explained in the preceding section, the private partner having the right to set toll pricing will create the public perception that PPP projects accrue benefits to private investors at the cost of users, which will have a detrimental impact on patronage. The private sector understands this ramification and therefore prefers not to exercise this entitlement. The signs of parameter estimates of GFC and FREETOLL for PUSPs are negative[59], and the presence of these conditions will reduce the risk aversion of public sector authorities. The reason for this result is unclear; this could be an area for future research.

The factor of FGROWTH increases the risk aversion of PUSPs but decreases the risk aversion of PVSPs, *ceteris paribus*. The growth factor implies the expansion of the PPP scheme, however, the result here signals that PUSPs do not prefer to see a greater adoption of PPPs in delivering transport infrastructure. This is in contrast to the outcome of Hypothesis 2b, where based on participants' real experience, PUSPs viewed PPPs favourably in the presence of other alternatives. A possible explanation may be that the greater public scrutiny and higher

[59] Note that the scale of $FREETOLL_{D1}$=scale 6=1 in Table 8-14 is different from that used in Table 8-11 (scale=5,6 and 7=1), which may explain why the signs are inconsistent across the two models of estimation.

transaction costs associated with PPPs make them less appealing to PUSPs. These contrasting outcomes demonstrate that behavioural perceptions can be very different from reality. The growth factor has generated a positive impact for the PVSPs (the negative sign associated with PRVRI means risk aversion is lessened), because it signals greater opportunities will open up for private investment.

Table 8-14: Power of Influence of Institutional Factors and Contractual Conditions on Uncertainty

Dependent Variable	PRVRI			PUBRI		
Independent Variables	Parameter	t-value	Adjusted R^2	Parameter	t-value	Adjusted R^2
Constant	0.21421	(15.05)	0.19264	0.09261	(16.87)	0.34738
	Institutional Factors					
$GFC_{D2/D1}$	0.05420	(5.64)		-0.02582	(-3.80)	
$FGROWTH_{D2/D1}$	-0.03779	(-3.02)		0.03326	(3.87)	
$TPRICETD_{D2/D1}$	-0.02957	(-2.22)		-0.01773	(-3.74)	
	Contractual conditions					
$FREETOLL_{D2/D1}$	0.04649	(2.77)		-0.04344	(-4.77)	
$DURATION_{D2/D1}$	0.02458	(2.39)		0.02738	(4.60)	
$PERSDR_{D2/D1}$	0.08740	(5.28)		-0.02832	(-4.61)	
$FPENALTY_{D2/D1}$	-0.10906	(-6.30)		0.00966	(1.83)	
$TRSHARE_{D2/D1}$	0.08967	(5.07)		0.07316	(8.08)	
$LAND_{D2/D1}$	-0.02395	(-1.66)		-0.02332	(-4.42)	
	N	*550*		*N*	*320*	
Hypothesis 8a	**Reject: NO**		**Model: Multivariate linear regression**			

NB: i) N_{PUSPs}=320, 9 PUSPs took the pilot survey in which LAND was not included; and
ii) all dummy variables of PVSPs (with the subscript of D2) = scale 7 =1 except $DURATION_{D2}$=scale 4, 5, 6 and 7=1, and $LAND_{D2}$=scale 5, 6 and 7=1; dummy variables of PUSPs (with the subscript of D1) = scale 7=1 except: $FREETOLL_{D1}$=scale 6=1, $DURATION_{D1}$=scale 5, 6 and 7=1, $FPENALTY_{D1}$=scale5, 6 and 7=1, and $LAND_{D1}$=scale=4, 5, 6 and 7=1.

The finding that the condition of financial penalties reduces the risk aversion of PVSPs (the parameter of FPENALTY has a negative sign), *ceteris paribus,* together with the positive sign of PERSDR, yields a similar outcome to that for Hypothesis 2c (see Table 8-8). The risk-averse PVSPs prefer an outcome-based model that rewards their efforts based on agreed performance standards, with corresponding abatements for failing to adhere to these standards. The negative sign of PERSDR for PUSPs explains their strong desire to have in place clear performance measures to evaluate the outcome of service efforts by PVSPs (the negative sign means embedded performance standards will lower PUSPs' risk aversion *ceteris paribus*). However, the condition of imposing financial penalties on under-performance increases the risk aversion of PUSPs, *ceteris paribus* (their parameter sign of FPENALTY is positive). Some PUSPs explained to the author during their interview that they found this kind of model presented too much operational difficulty because it was difficult to prove that the private proponent had failed to meet the standards and most of their arguments did not get upheld in court. Their view is in line with the proposition of ICT and TCE that public ordering is not a solution to incomplete contracts due to the bounded rationality of the outside arbitrator.

Participants from both sectors are risk averse to the idea of sharing toll revenue, as indicated by the positive parameter estimates of TRSHARE. This is because they do not wish to be perceived as making a financial gain from commuters travelling on the facility, with the ramifications of reduced patronage and political backlash.

The duration of the concession has a negative impact on participants from both sectors (the positive signs of DURATION represent worsening risk aversion due to this condition, *ceteris paribus*). This suggests that it will take longer to recover the costs of investment and higher chance of change in environment factors, hence producing higher uncertainty.

The condition of LAND reduces the risk aversion of participants of both sectors, *ceteris paribus*. Both sector participants believed that government has the power and resources to acquire the necessary land for construction of the underlying facility. Future PPP concessions should consider allowing government to retain this risk, as it will translate into greater VFM by lowering the risk premium charged by the private proponents. This approach has been adopted in a recent project – the Peninsula Link.

Interestingly, the negative parameters of TPRICETD associated with both sector participants hint that both sectors consider toll pricing can do more than just act as a means of finance, as it currently stands (the condition lessens their risk aversion *ceteris paribus*). This is a strong message for politicians, who should consider structural reforms to the PPP tollroad scheme in order to gain a greater benefit at the macroeconomic level. Market discipline can enhance the benefit of pricing mechanisms to help change people's travelling habits (cf., de Palma *et al.*, 2007b; de Palma *et al.*, 2007a), a benefit that is presently not being exploited to its fullest extent.

Not only do these results lead us not to reject Hypothesis 8a, they also offer useful insights into ways of minimising uncertainty. Changes to contractual conditions (which can be negotiated) and prudent financial regulations by government (to avoid further disasters like the GFC) that will make the environment more welcome to private capital investments, can help optimise contractual efficiency.

Among the key arguments of TCE is the power the institutional background has on the uncertainty effect, which channels through to the choice of governance mode, affecting contracting parties' risk preference. Our sample data supports this proposition (Table 8-15), where the positive parameter associated with SOV_{D2} (0.00238) showing that greater sovereign risk causes higher risk aversion of PVSPs leads us to not reject Hypothesis 8b.

Table 8-15: Institutional and Reputational Effects

Dependent Variable	Independent Variable	Parameter	t-value	Adjusted R^2	Hypothesis	Reject	Model
PRVRI	Constant	0.14399	(20.66)	0.35240			Multivariate Linear regression
	SOV_{D2}	0.00238	(13.87)		8b	NO	
	MED_{D2}	0.00184	(8.07)		9	NO	
	N	*600*					

8.6.3 Reputational Effect

TCE maintains that economic actors who engage in repeated transactions value their reputation and trust in their transacting parties. Media is a powerful source of influence on reputational risk. How supportive local media had been to PPPs in the past (captured by Prior Experience) would have an influential impact on the private proponents' risk preference. We cannot reject Hypothesis 9 based on the results in Table 8-15, where the positive parameter estimate of MED_{D2} (0.00184) suggests that a higher risk of media disapproval causes greater risk aversion of PVSPs. Therefore, we confirm that media exposure can help contain opportunistic behaviour by private partners due to the consequent future economic consequences of negative reputational effects.

8.6.4 Risk Preferences versus Contract Structure

Chiles and McMackin model (1996) predicts that there is an interdependence between the choice of governance structure and the risk preferences of transactors with respect to the underlying transaction. Their prediction implies that contractual conditions can change transactors' risk preferences. We argue that in a risk-sharing partnership, the allocation of risks can affect the contracting parties' risk preferences.

We have established in Hypothesis 2a(ii) that private sector agents are much more risk-averse compared with public sector authorities. This implies that governments and users of the facilities are being charged a high risk premium to compensate for the risks undertaken by private sector partners. But what if risks were allocated on a more equitable basis, would that reduce agents' risk aversion? We test this proposition by simulating the risk allocations in the Prior Experience data, where we allocate traffic risk and financial risk 50/50 between the two sectors, i.e., they are shared equally. Figure 8-4 shows that both risk indices have decreased after the simulation. The average PUBRI has dropped slightly (the average value is down by 28 per cent, from 7.26 per cent to 5.24 per cent) while the PRVRI has fallen dramatically (the average value is down by 38 per cent from 23.15 per cent to 14.40 per cent).

The fall in the PRVRI is within expectations, which corresponds to the point we raised earlier that the norm in the current risk-sharing regime is to shift all risks to the private sector. The fall in the PUBRI is also reasonable. Recall the discussion in Section 7.3.2, that most PUSPs cared about project risks simply because they did not want the project to fail. Taking on the responsibility of sharing some of the traffic and financial risks will assure them higher certainty in terms of project success and budget certainty.

Two t-tests in Equations (8.2) and (8.3) indicate that the risk indices after the simulation are significantly different to those prior to the simulation. Hence, we cannot reject Hypothesis 10 at the five per cent significant level, that risk preferences are significantly affected by contractual conditions; in this case, how risks are shared.

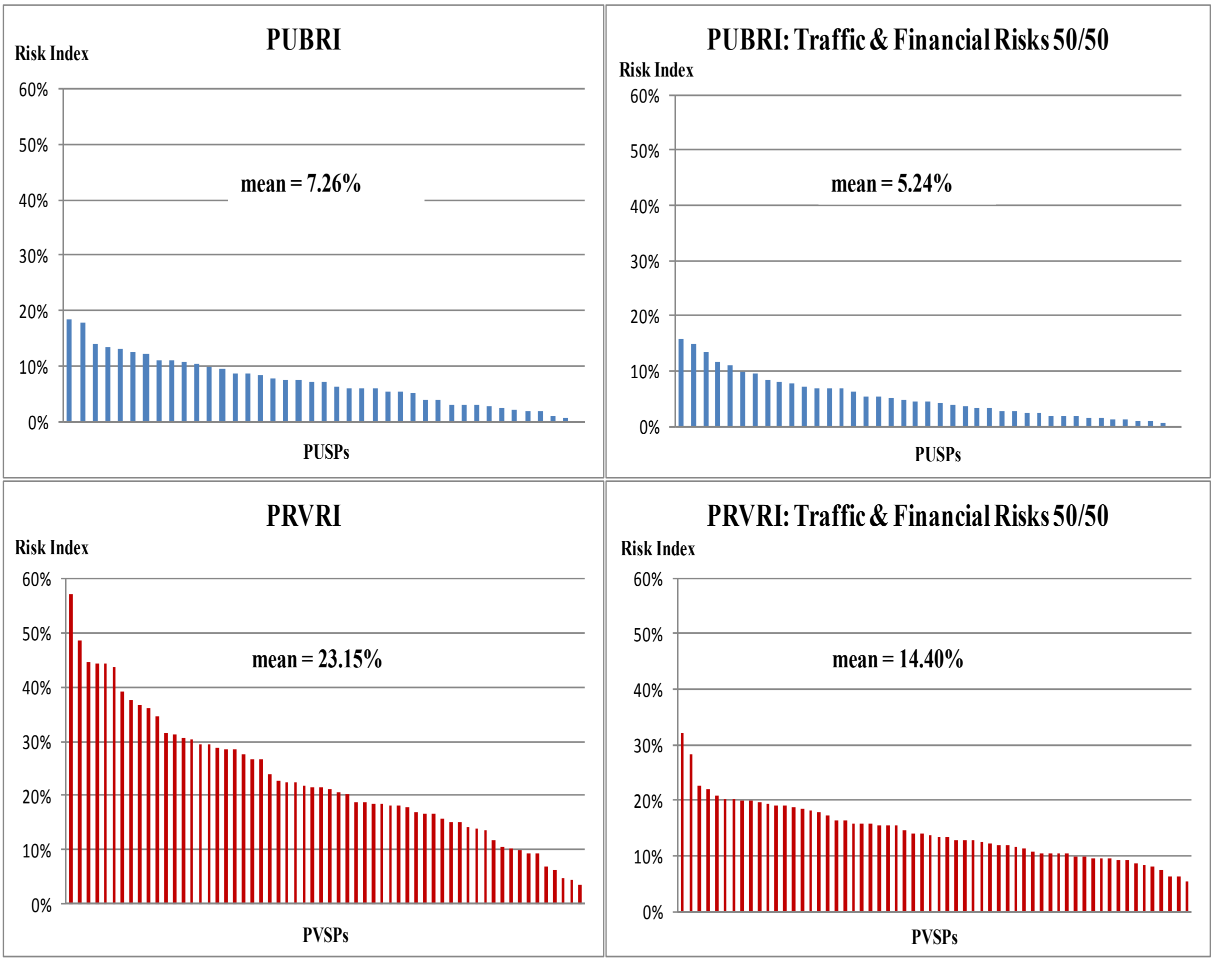


Figure 8-4: Risk Index Comparison – Before versus After Simulation

$$t_{PUBRI} = \frac{\bar{x}_{PUBRI\,(after)} - \bar{x}_{PUBRI\,(before)}}{\sqrt{se^2_{PUBRI\,(after)} + se^2_{PUBRI\,(before)}}} = \frac{5.24\% - 7.26\%}{\sqrt{(0.00624)^2 + (0.00711)^2}} \tag{8.2}$$

$$= |-2.133| > 1.96$$

$$t_{PRVRI} = \frac{\bar{x}_{PRVRI\,(after)} - \bar{x}_{PRVRI\,(before)}}{\sqrt{se^2_{PRVRI\,(after)} + se^2_{PRVRI\,(before)}}} = \frac{14.40\% - 23.15\%}{\sqrt{(0.00682)^2 + (0.01533)^2}} \tag{8.3}$$

$$= |5.21| > 1.96$$

8.7 Concluding Remarks

This chapter has sought to empirically test how PPPs can foster risk-undertaking incentives to facilitate optimum risk allocation between parties that are profoundly different in terms of risk preferences. We have investigated this research question through application of the contracting literature to examine how conditions at the contract level, and to a greater extent, at the institutional level, can significantly affect the risk preferences of the PUSPs and PVSPs respectively.

Many studies that examine contracting parties' choice of contract or choice of compensation scheme either take risk preferences as given, (Allen and Lueck, 1999; Martimort and Pouyet, 2008; Chen and Chiu, 2010) or use self-reported measures (Gaynor and Gertler, 1995; Jin and Doloi, 2008). In this chapter, however, we have quantitatively derived a set of indices to measure risk preferences of all participants, using the sentiment of the HSQI. Our results clearly demonstrate that not only the agent, i.e., PVSP, is risk-averse but the principal, i.e., PUSP, is also risk-averse. This result rejects the well-accepted proposition that prevails in the contracting literature that assumes the principal is risk-neutral, e.g., AT; or that contracting parties are risk-neutral, e.g., TCE. In fact, without modifying TCE using the Chiles and McMackin (1996) framework that allows variable risk preferences, we simply could not carry out our analysis.

Our results show that any economic actor's risk preference is highly context-dependent. Accepting the sweeping belief that a certain category is risk-neutral creates a serious flaw in contracting research, and the resultant outcomes are potentially biased. Our study also casts doubt on studies using self-reported measures. Many participants told the author before the commencement of the survey that they regarded themselves as risk-seeking, but were surprised to realise after survey completion that they acted completely the opposite when confronted with the hypothetical scenarios.

The extent to which our results support contract theory limits to the proposition that contracting parties are indeed heterogeneous in risk preferences, but only in terms of the magnitude of aversion to different risks, as illustrated by our results to Hypothesis 1, 2a(i) and 2a(ii). It is these varying degrees of difference that play a decisive role in participants' choice of contract, and in understanding how the design of contract through allocation of risks, formulation of contractual conditions and changes in policy variables can facility risk-sharing optimisation. A few strong messages emerge from our findings: (a) risk-sharing can be optimised through equitable allocation of project risks, e.g., traffic risk and financial risk; (b) clear project objectives are a key driver of VFM and ownership transfer may induce opportunism; (c) the effectiveness of economic policy hinges strongly on public accountability; and (d) the success of a PPP scheme relies on well-maintained relationships with the public and the media by all the contracting parties.

Based on our empirical results, we make a number of suggestions that are expected to improve the risk-allocation outcome, with the purpose of minimising transaction costs. These are summarised in Table 8-16, presented at the end of the chapter.

8.7.1 Other Limitations of the Contracting Literature

A TCE transactor, albeit rationally bounded, tends to find a solution to minimise costs (see Ménard, 2001 for general criticisms of TCE). There are noticeable gaps in the contracting literature that capture, both theoretically and empirically, the influence of risk preferences on assignment of property rights, and the amplification of BR in the presence of uncertainty.

TCE relies on broad characterisations of BR to make sense of why institutions matter to various types of transactions and the nature of firm, yet it is silent on other important forms of economising BR – the decision process involves heuristic problem-solving – and has failed to explain how decision makers involved in long-term contracts reach agreements without recourse to vertical integration. This is because BR in TCE is not meant to analyse a "decision process response" at the individual agent level (Simon, 1997b), but rather, to develop a theory of organisational choice. An understanding of BR, in particular its ramifications for individual decision making, therefore needs to look beyond the Williamson framework.

If one pursues Hart's (1990) line of reasoning that parties to a contract act rationally, albeit cognitively bounded, to maximise their expected utility, the field of decision making and human cognition may offer a more intuitive explanation for why and how contracts matter. The provision in our survey that makes allowance for the application of various APSs by participants has shown some sign of support for Simon's conjecture that changes in cognition through changes in search processes and information-gathering processes will have effects on the final decision (Cyert *et al.*, 1956; Simon, 1986). Of course, much more work is required before the validity of this conjecture can be established. A major challenge to breaking into this research field lies with the measure of BR.

Many authors (cf., Brousseau and Glachant, 2002) acknowledge that the modelling of BR, in particular with respect to the optimality of contracts (Tirole, 1999), remains a major shortcoming in the contracting literature. The last decade, however, has witnessed some theoretical breakthroughs. MacLeod (2002) integrates the cognitive beliefs of contracting parties into the design of optimal contracts, and shows that the quality of a contract is theoretically an increasing function of the correlation of contracting parties' cognitive abilities with performance evaluation. Another model that incorporates the BR of the decision maker into incentive schemes is provided by Basov (2003). His model shows that influences of social and cultural adaptations on the boundedly rational agent will diminish the attractiveness of the incentive scheme offered by the principal. Intuition suggests that rationality, which is subject to the influences of social and cultural adaptations, can alter the optimality of incentive contracts. Although yet to be empirically tested, these models point to the important role that human cognition plays in the optimal regulation of contractual relationships.

In spite of marginal improvements in modelling human cognition into the formulation of optimal contracts, the challenge of gathering micro data at the level of the actual decision maker has resulted in limited research in the disciplines of individual decision making and cognition (see a literature review on empirical studies by Rindfleisch and Heide, 1997). This thesis has made some empirical progress on this front in the applied field of PPP tollroad concessions. Results reported in this chapter have shown promising signs of exploring the cognitive path that resides in contract theory in order to understand how contract outcomes are reached among agents who have profound heterogeneity in risk preferences.

Table 8-16: Summary of Hypothesis Testing and Suggestions

	Hypothesis	Reject	Suggestion
		Agency Theory	
1	*Contracting parties of a PPP tollroad have different risk preferences toward different risks; i.e., $\beta_{PUSPs} \neq \beta_{PVSPs}$.*	No for TRA_D, FIN_D, UNC_U, and POL_D.	An optimal risk allocation outcome can only be achieved with appropriate identification and acknowledgment of each party's risk preference.
2a(i)	*At the aggregate level, the public sector authorities and the private sector agents have different tastes in risk (as measure by risk indices); i.e., $\beta_{PUSPs}x_1 \neq \beta_{PVSPs}x_2$.*	No	Risk allocation should consider each party's risk preference toward the underlying risk.
2a(ii)	*Private sector agents are more risk-averse than public sector authorities.*	No	Risks should be shared equitably. Transferring all risks to the private sector will result in a high premium cost, which may outweigh the benefits of the partnership.
2a(iii)	*Private sector agents who are risk-averse would prefer PPPs to other procurement methods.*	Yes	The current risk transfer paradigm has led to PPPs being perceived as risky by the market. This finding warrants a major reform to the scheme, which must consider a more equitable risk-sharing approach in order to enhance the VFM that the scheme promises to deliver.
2b	*Public sector authorities who are less risk-averse would prefer PPPs to other procurement methods.*	No	The evidence suggests that PPPs have in the past yielded better outcomes for public sector authorities in terms of risk transfer. Nevertheless, the effectiveness of the procurement policy in achieving its VFM must look beyond the benefits accruing to the responsible procuring authority alone.

	Hypothesis	Reject	Suggestion
2c	*The more risk-averse the private sector agents, the less effective is the availability model to incentivise efficient performance during the operational phase.*	No	An effective compensation structure must be linked to performance outcomes and provide provision to reward effort and penalise shirking. A lack of incentives in the AM will most likely induce shirking behaviour.
3	*The leader of the bidding consortium is less risk-averse compared with the other members of the consortium bid team.*	No	The procuring authority should carefully scrutinise a bid offered by a construction company-led consortium (i.e., its assumptions, cost models, traffic forecast, etc.), which may have a higher risk of optimal bias.
	Theory of Incomplete Contract		
4a	*Unclear project objectives will increase the private sector agents' risk aversion.*	No	All PPP projects should be subject to rigorous due diligence processes before being placed on the market. Alterations to objectives and design should be kept to a minimum. Following a well-defined tendering procedure would minimise this risk.
4b	*The higher the risk of unclear project objectives, the more preferred is the PPP method by private sector agents.*	No	Ownership entitles the private sector to the freedom to manage uncontracted-for-events. However, their mitigating measures may undermine government's planning objective at the higher level, therefore imposing additional costs to taxpayers in the long term.
4c	*Unclear project objectives will increase public sector authorities' risk aversion.*	No	This is a strong message to policy makers at a higher level. Projects with poorly defined objectives are unwelcome to both sector participants. Political independence at the decision-making level should be maintained throughout the planning, procurement and operational processes.
NB: All three hypotheses above demonstrate that clearly defined project objectives are a key driver for VFM.			

	Hypothesis	Reject	Suggestion
5a	*Private sector agents are in favour of the option of having the freedom to set toll pricing, i.e., the freedom will reduce private sector agents' risk aversion.*	Yes	Rejection of Hypotheses 5a and 5b suggests that the incentive of property rights to price control does not hold in our data sample. It confirms that toll pricing is a primary means of project finance rather than a policy means to rationalise road space.
5b	*Public sector authorities are in favour of the option of granting the private sector agents the freedom to set toll pricing, i.e., the granting of the right will reduce public sector authorities' risk aversion.*	Yes	
6a	*The public perception that ownership transfer is seen to transfer ownership-related risk arising from workforce dispute will reduce the risk aversion of private sector agents.*	No	The ownership effect works well in the concession method in incentivising the agent to strive for *ex post* efficiency. However, there may be unintended repercussions for the government principal, as suggested by Hypothesis 6b.
6b	*The public perception that ownership transfer is seen to transfer ownership-related risk arising from workforce dispute will increase the risk aversion of public sector authorities.*	No	The perception will mar the welcomeness of the scheme as well as government's public image. Government should correct this public misperception (through practice, public relations, media, etc.) and offer a more welcome institutional environment for private investment.
	Transaction Cost Economics		
7	*Institutional factors will significantly influence the choice of PPP procurement methods by all parties, i.e., PPPs versus other methods.*	No	PPPs need to be a working partnership between government and the market. To make the scheme welcome by private investors, government should take measures to offer a stable political and legal environment, maintain consistent project objectives, make project details transparent to media, and handle political and reputational risk responsibly. On the other hand, risks of a social dimension should not be left to government alone; commitment from the private sector can help in making the scheme welcome by the public community.

	Hypothesis	Reject	Suggestion
8a	*Contractual conditions and institutional variables will significantly affect the risk preferences of contracting parties.*	No	Both sectors should be more prepared for negotiation. Government should consider policy changes, i.e., to encourage greater private provision in public infrastructure and take on land acquisition risk. On the other hand, more opportunities will be open to the market if the private sector is willing to work with government.
8b	*Sovereign risk will significantly increase the risk aversion of private sector agents.*	No	Governments should bear the risks of policy changes that are under their control and share risks of policy changes that may imposed by upper levels (e.g., federal government). Some projects, such as the Peninsula Link, have made progress in this respect.
9	*Private sector agents who are actively engaging in PPP contracts value their reputation effect.*	No	The public procuring authority should take into account the international reputation of the private proponent in bid offer evaluations.
10	*Risk preferences are significantly affected by how risks are shared.*	No	This confirms that a risk-sharing rationale can deliver VFM, bearing in mind that VFM can only be realised through equitable risk-sharing that takes into consideration each contracting party's risk preferences.

CHAPTER 9: CONCLUSIONS, POLICY IMPLICATIONS AND FUTURE RESEARCH

9.1 Introduction

Optimising risk-sharing among parties that are profoundly different in terms of interests, objectives and risk preferences is the rationale underlying the VFM rhetoric in the current PPP procurement policy. This thesis has brought together the literature in a number of disciplines to investigate the extent to which the risk-sharing rationale in PPPs can facilitate the realisation of VFM, and to search for mechanisms of risk-sharing optimisation. We have carried out the investigation in three incremental steps by dividing the task into three research questions; namely, the need for research on risk-sharing optimisation, the possible ways to realise risk-sharing optimisation, and methods to realise risk-sharing optimisation.

The qualitative and quantitative evidence provided in the preceding chapters has affirmed that risk-sharing is a crucial element in deriving VFM. Current international practice has suggested that risk-sharing remains sub-optimal because risks have not been equitably shared among contracting parties, and the reality that a risk-sharing rationale has not been adhered to in projects is a worldwide phenomenon. The preliminary findings in the early chapters of this thesis make the case for the current research. The conclusions drawn and recommendations made herein are backed up by evidence collected over 32 countries, strengthening the international credentials of this thesis. We believe that this thesis can make a significant contribution to the betterment of policy-making in the private provision of public infrastructure delivery.

In this concluding chapter, we first outline the research findings and the related literature that guided us to the truth-finding path, and present the policy implications arising from our findings for each of the research questions respectively. These are followed by the contributions to the literature. Limitations of the current thesis are acknowledged in the penultimate section; these limitations pave an important way for a future research agenda. The final section concludes the thesis.

9.2 Summary of Findings and Policy Implications

The PPP literature reviewed and case studies examined in Chapter 2 opened up an insightful research avenue that focuses on risk-sharing issues. The chapter outlined the evolution of the PPP scheme over the last two decades, during which concern surfaced about whether project risks should be allocated in a manner aimed at attaining objectives that are beyond a simple road-service solution. An auxiliary finding regarding the importance of project objectives, which were found to anchor the risk-allocation strategies in projects, became instrumental in our understanding of risks related to PPP tollroads in the subsequent chapters.

Chapter 3 adopted the methodology of in-depth interviews with stakeholders who have been engaging in PPPs to investigate Research Question One – the need for a research topic on risk-sharing optimisation. The interviews with participants highly experienced in the field confirmed that problems of risk-sharing in PPPs cause ongoing tension between the public and private sectors. The interview study made clear the important role that risk perception plays in allocating risks and the key risk attributes inferential to tollroad concessions. A major discovery arising from these interviews was that allocating risk to the party that appears best capable of managing the risk may not result in VFM. Risk-sharing optimisation therefore needs to understand risk-bearing behaviour as the function of contracting parties' risk perceptions.

Chapter 3 led the way in the search for mechanisms that facilitate risk-sharing optimisation through incentives alignment. In Chapter 4, the literature on contract theory helped to make sense of the extent to which the inner workings of incentive alignment and risk preferences influence the risk-bearing behaviour of parties whose heterogeneity in interests and objectives are profound. In answering Research Question Two – on the possible ways to realise risk-sharing optimisation from the theoretical perspective of contract – we argued that PPPs mimic the incentive alignment structure of contract theory. Informed by risks defined in Chapter 4, Chapter 4 generated a number of hypotheses from the antecedents in the contracting literature in order to test evidence collected from the PPP domain.

Armed with the knowledge gained from Chapters 2, 3 and 4, in Chapter 5 we developed a conceptual framework of risk-sharing in PPPs, which has set the scope for research design and methods of data collection, and hypothesis testing. Within this framework was the need to develop the PPPRI, which has became an important variable to test the validity of contract theory in explaining a host of issues surrounding PPPs.

Guided by this conceptual framework, Chapter 6 outlined the design of an online survey, within which was a choice experiment setting to collect SC data for the purpose of deriving the PPPRI from the contribution of each underlying dimension of risk to the overall index of perceived risk. The design has provisioned for APSs, such decision being informed by the trait of BR after studying the contracting literature in Chapter 4.

Chapter 7 reported the outcomes of the descriptive analysis on collected data. Consistent with Chapter 3, the empirical analysis supported the significance of public perceptions about PPPs, and emphasised that this risk must be dealt with in a sophisticated way before any project goes ahead. In spite of the VFM rhetoric, the survey data strongly suggested that PPPs were essentially a financing method rather than a procurement method of infrastructure-based service. The caveat is that too much emphasis is being placed on cost savings and budget certainty for the public sector agency without truly acknowledging the power of the pricing mechanism, which can help realise the full capacity of an integrated, multi-modal transport network. A further implication of PPPs being primarily a financing instrument is that it is questionable whether they can deliver VFM in terms of social benefit. PPPs have tended to be selected for projects that are fairly unambiguous about the benefits to the private sector. Thus, investment priorities have been steered toward focusing on projects in corridors that the private sector can understand, and away from networks and systems that ultimately are areas where the overall economic welfare benefit should be identified. These projects in corridors are only a subset of the network, the strong focus on which may result in the rest of the network being either underpriced or neglected.

Chapter 8 presented the results of testing the hypotheses formulated in Chapter 4. The findings have affirmed a number of significant relationships that involve the risk preferences of contracting parties: choice of procurement method, contractual conditions, the institutional environment (which includes the legal system and the political system), the clarity of government's strategic objectives, property rights, and the way in which risks are shared among contracting parties. The primary aim of this thesis is to search for mechanisms of risk-sharing optimisation and, hence, the achievement of VFM in the PPP policy, i.e., Research Question Three. To this end, this thesis has shown, both qualitatively through the in-depth interviews and qualitatively through testing of empirical data, that risk-sharing can be optimised through more equitable risk allocation, better handling of public misperception about the scheme and misperceived social risks associated with ownership transfer, reforms to the PPP environment at the institutional level, and selecting a reputable private partner for a sustainable partnership. These suggestions have been outlined in Table 8-16. The findings also reveal some limitations of contract theory in failing to explain decision-makers' risk-bearing behaviour, and their choice of contract and compensation schemes.

9.3 Contributions to the Body of Knowledge

9.3.1 Contributions to Policy Making

In an effort to understand barriers to cooperation in reaching equitable risk allocation between the public and private sectors in a principal-agent arrangement, this thesis not only quantifies risk preferences but also provides an internally consistent framework in which the trade-off between risks can be identified, and the extent of barriers that might prevent both parties in identifying areas where they may need to compromise can be gauged.

Within this framework is the PPPRI – derived based on the direct experience of stakeholders in a large number of tollroad projects from 32 countries. We have proposed in Chapter 5 that the PPPRI can be incorporated into a contract assessment regime that provides a meaningful measure of how risk preferences can be balanced by modifying the level of contractual conditions as well as institutional variables. Our results in Chapter 8 have demonstrated this potential. This contribution is significant, in that policy makers can now make adjustments to the contract and the procurement policy to influence contracting parties' risk preferences to correspond to the level of risk premium that the procurer is willing to and able to afford.

The conceptual framework developed herein consolidates the cumulative wisdom and experience gained throughout the history of PPP tollroads, the task of investigating areas where things have gone wrong and where there have been disputes about sharing risk and reward being made relatively easy. The framework also offers government a knowledge base to gain an understanding of past historical practice at the global level and some of the issues that have arisen concerning the sharing of risk and reward.

9.3.2 Contributions to the Literature

One of the important empirical gaps in studies of contract pertains to the role that risk plays in the choice of contract. The impediment to performing tests of risk-sharing lies in the difficulty of obtaining data on individual risk preferences. Many empirical studies assume the risk preferences of contracting parties are given (cf., Allen and Lueck, 1999; Martimort and Pouyet, 2008; Chen and Chiu, 2010), or use self-reported measures (Gaynor and Gertler, 1995; Jin and Doloi, 2008). In this thesis, empirical data were collected by way of an SCE capable of capturing stakeholder preferences at the individual decision-maker level. Choice models were employed to estimate a set of risk indices over a set of defined risk attributes; these indices then used to test against a suite of hypotheses to either confirm or refute the risk-sharing theory of PPPs from the contracting perspective. The contribution to the literature is threefold: (a) this is the first empirical study that derives a quantitative measure of risk preferences of the principal and the agent; (b) it is the first to explore the behavioural impact of the decision maker from the public (private) sector on the other party's risk preference; and (c) it introduces to the PPP literature a new theoretical framework to assess risks through the triangulation of theories of risk-sharing in PPPs and theories of contract with models of behavioural choice.

9.4 Limitations and Future Research Opportunities

9.4.1 Theoretical Limitations

Chapters 2 and 3 have identified the compounded agency problem that arises due to the three-level relationships between consumers, for whom the public authority is an agent at the same time as it assumes the principal role in a relationship with the private proponent, making the private proponent also an agent for consumers (Trailer *et al.*, 2004). This thesis examines the principal-agent relationship between the public authority and the private proponent only; hence, it is unable to draw any conclusions on effects on consumers.

Another area of limitation lies with the focus on risk-sharing during contract design. PPPs are long-term contracts; therefore, there will be ongoing issues during the operation and maintenance period. Furthermore, we have not examined post-implementation risks and post-concession risks, which form part of an important line of research on incentive schemes (Gaynor and Gertler, 1995).

Our investigation of the choice of contract by one party as a reaction to the choice behaviour of the other party is primarily based on a study of risk preferences of participants who were divided into two groups. However, it is important to acknowledge that risk preferences are only one of the crucial factors that influence decision-makers' choice outcome; this research does not suggest that other non-risk factors, e.g., trust, are of less significance in determining decision choices.

9.4.2 Methodological Limitations

First in this category are limitations of sample size. There is an unequal spread between PUSPs and PVSPs (40 versus 61). This may yield some results that are significant for PVSPs but not for PUSPs. For example, in testing Hypothesis 1 in Section 8.4.1, the Krinsky and Robb procedure yielded 94 per cent of PVSPs' parameter estimates as being significant in contrast to only 44 per cent of PUSPs' parameter estimates. Further, with only 505 choice situations (101 participants with five choice situations each), it was our expectation to be confronted with a sizeable number of insignificant parameter estimates and estimates with unexpected signs (see Table 8-3). A further limitation of sample size constrains our ability to carry out analysis to test the choice behaviour of participants across subgroups, i.e., how would the choice behaviour of the treasury affect the choice of the procuring agency; and the effect of contractual conditions and external factors, e.g., tolling policy, on a subgroup of participants, e.g., equity investors.

Second, there are limitations due to the timing of data collection. Our results show that all but one of the participants are highly risk-averse. During our data collection, the world was experiencing a recession triggered by the GFC. Given the financing nature of the PPP, participants would have had reservations about the scheme's financial viability; however, such reservations may vary when the world recovers from the recession. Nevertheless, the conceptual framework established in this thesis has provided a research base that policy-makers and researchers can make use of in related investigations in the future.

Third, there are limitations with respect to the modelling of the BR effect. We have acknowledged in Chapter 8 that the field of decision making and human cognition may offer a more intuitive explanation for why and how contracts matter. A provision in our survey makes allowance for the application of various APSs by participants who may be subject to the constraint of BR. This has shown some promising signs of exploring the cognitive path that resides in contract theory in order to understand how contract outcomes are reached among agents who have profound heterogeneity in risk preferences, but a challenge remains in measuring BR. The descriptive evidence in Chapter 7 lends some support to the proposal that participants did adopt various APSs during the experiment. However, the choice analysis conducted both with and without conditioning the data on ANA has yielded mix results. The MNL allowing for ANA yielded superior results in terms of model fit and number of significant parameter estimates, while the LCM allowing for ANA produced the opposite conclusion. The mix of results has a number of implications. First, LCM conditioning on ANA may in fact be capable of handling heterogeneity in attribute processing rules. Why this is not shown in our data requires further investigation, and may have significant implications for the literature on APSs. Second, we have not made sufficient effort in trialling models with different combinations. Third, no consideration has been given to model the effect of BR, which may have decisively influenced the model outputs.

Finally, there are limitations in respect of unexplainable signs in testing the uncertainty effect under the TCE framework. The negative sign associated with GFC for PUSPs (see Section 8.6.2 and Table 8-14) means that the presence of GFC conditions will reduce the risk aversion of PUSPs. This could be a problem of model misspecification or of sample size, or could be due to some related perceptions that we failed to discover from the literature and from our empirical studies, which further supports the imperative of exploring the cognitive research path.

9.4.3 Future Research

In outlining the limitations of this research, we have alluded to opportunities for future research. In addition, there are several avenues to pursue based on the results presented herein. While researchers may be able to build or improve on the methodology and results within this research in many ways, the possibilities that we found to be the most immediate and compelling are outlined as follows.

Given the renewed interest in the AM that places greater emphasis on service provision through embedded performance measures and abatement, the focus on consumer satisfaction is rising, which will in turn affect a project's financial structure. We have identified in Chapter 2 that some PPP tollroad concessions have incorporated abatements linked to key performance indicators that measure users' level of satisfaction. The public's acceptance of this system is yet to be studied.

The typology of de Palma *et al*. (2012) reviewed in Section 4.3.1 foresees that information incompleteness would affect the design of the optimal contract. This prediction follows ICT's assertion that decision makers may intentionally withhold full disclosure of their true preferences toward risk in order to gain greater residual rights over the *ex post* distribution of surplus (Grossman and Hart, 1986). Although we have empirically confirmed the proposition, there is a further research opportunity in modelling a comparison of the utility functions with and without conditioning on ANA. Our experiment design that makes allowance for the APSs presents us with a unique testing environment to pursue this opportunity in the future.

Evidence in Section 7.3.1 presents the propensity for a status quo bias to be displayed by decision makers who are exposed to pressures of accountability. The trade-off between efficiency and public accountability in PPPs has occupied much of the debate in the accounting literature. There is a clear opportunity to explore the extent to which investment decision making is a decision of accountability; the literature in managerial decision making being an avenue worth pursuing.

Section 8.4.2 and Section 8.6.4 have revealed potential avenues of risk-sharing optimisation through data simulation. This is only the beginning of an exciting research agenda; much greater discoveries could be unearthed by extending the process to other risk attributes, contractual as well as institutional conditions.

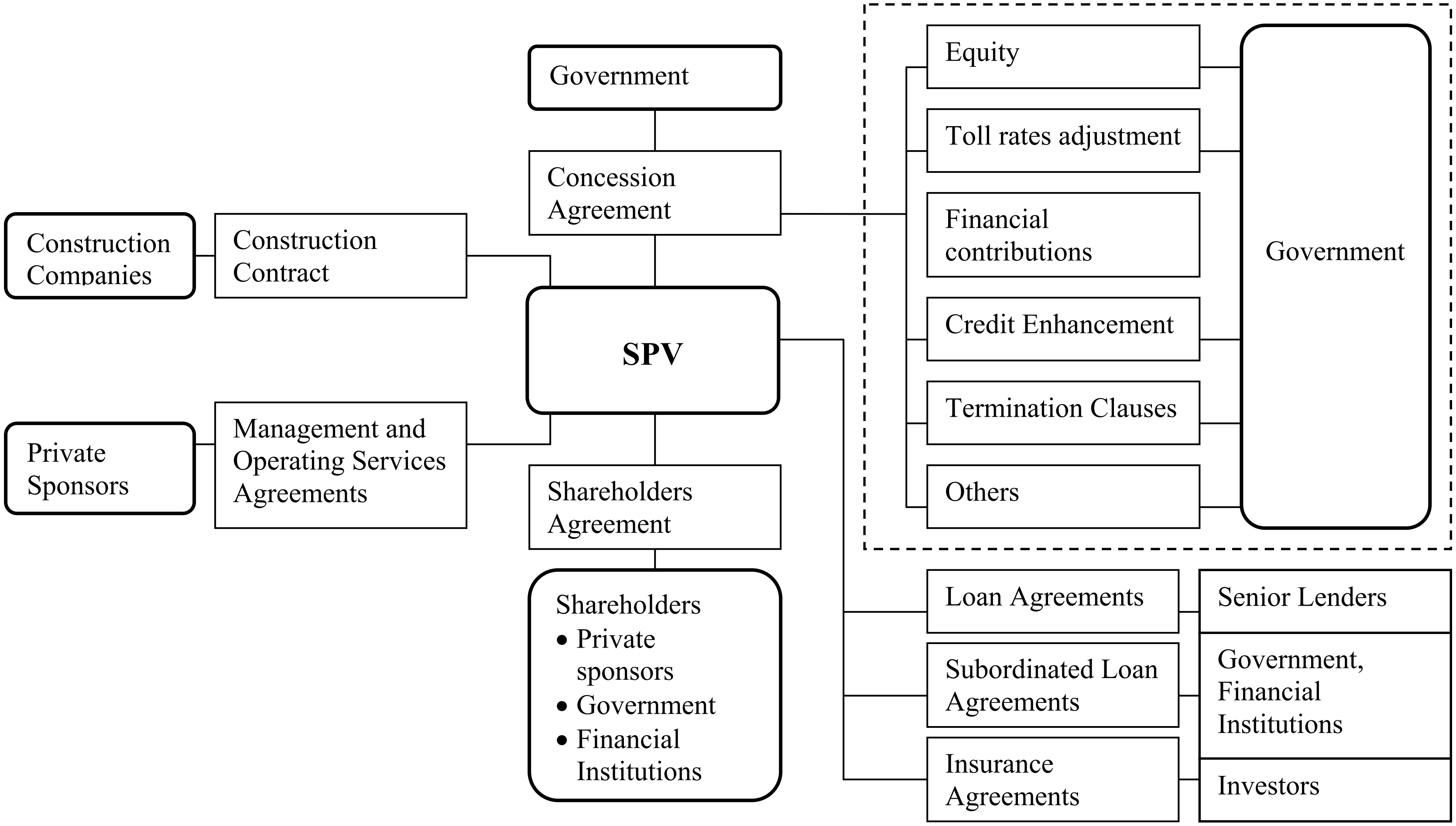
Finally, the concerns identified and empirical progress made in Chapter 8 call for a paradigm that can offer scientific rigour in making sense of why contracts matter at the behavioural level. An appeal to theories of decision making to appreciate the interplay between human factors and uncertainty – in particular, the modelling of BR – with respect to risk allocation in PPP contracts would appear to be a fruitful avenue for future research.

9.5 Concluding Remarks

Above all else, this thesis demonstrates that what many perceive to be significant obstacles in empirical applications can be overcome by building a suitable research framework. Although the contracting literature has tended to avoid investigations that require micro data at the decision-maker level and ignore risk preferences, there are numerous paths one could pursue to accomplish such a task. The methodology developed within this research is only one of many, but we are confident that it offers a bridge to more advanced techniques for modelling risk preferences and behavioural choices of decision makers within experimental settings.

Whether utilising the tools presented herein, or building on these concepts and developing new frameworks, researchers have the opportunity to pursue a range of empirical applications that are generally perceived to be infeasible. While risk perception and the optimisation of risk-sharing in contracts represent areas worthy of significant attention in themselves, there are no bounds to the set of applications to be pursued through a new generation of empirical techniques. Measurement of individuals' risk preferences and contract design represent two pivotal forces within a broad array of decision-making settings, and it is our sincere wish that this research plays a role in the development of successful and powerful techniques that will enable researchers to give these forces the empirical representation they deserve. While it may take time and effort to establish the techniques that prove most effective, we stand to gain a much deeper and more concise understanding of the choices each of us makes every day, whether we act in isolation or are critically dependent on the preferences and influence of others.

Appendix A: Interfaces of DBFO Road Model



Source: **Adapted from Lockwood *et al*., 2000, Exhibit 1, p.78**

Appendix B: DBFO Motorways in NSW and Victoria, Australia

NSW								Victoria		
Sydney Harbour Tunnel (SHT)	**M4 (two sections)**	**M5 (two stages)**	**Hills M2 Motorway (M2)**	**Eastern Distributor M1 (ED)**	**Cross City Tunnel (CCT)**	**Westlink M7 (M7)**	**Lane Cove Tunnel (LCT)**	**CityLink (MCL)**	**EastLink (MEL)**	**Peninsula Link (PL)**
Opening to traffic										
September 1992	15 May 1992	Aug 1992/Sept 1994	May 1997	December 1999	August 2005	December 2005	March 2007	August 1999	29 June 2008	Scheduled to open in early 2013
Contractual Date for opening										
October 1992	15-2-93	28-2-95/Sept 1994	30-12-97	18-8-00	18-10-05	13-8-06	10-5-07	July 2000	November 2008	Scheduled to open in early 2013
Projected Date for handover										
September 2022	Occurred on Monday 15 February 2010	September 2023	May 2042	July 2048	December 2035	February 2037	January 2037	January 2034	December 2043	2038
Concession Period										
30 years	20 years	31 years	36-45 years	48 years	30 years	30 years	30 years	25-54 years	35 years	25 years
Capital Cost[a]										
$683M	$246M	$382M	$616M	$684M	$680M	$2,230M	$1,684.8M	$2,100M	$3,800M	$849M
Upfront Payment by (-ve)/to (+ve) government agency										
-$223M (state loan); +3.5M (underwrit-ing fee for the $345M worth of bonds liability of SHTC	Nil	Nil	-$66.5M (capital payment)	+$10.2M[b]	+$96.8M + gst (RDF + BCF)	+$193M+ gst (RDF + BCF)[c]	+$79M + gst (RDF + BCF)	Nil	+$15M (compensate the state for movem-ents in interest rates between the bid period and the financial close); +$20M (land licences and freeway leases for the state land and works valued at $318M)	Nil

NSW								Victoria		
Sydney Harbour Tunnel (SHT)	**M4 (two sections)**	**M5 (two stages)**	**Hills M2 Motorway (M2)**	**Eastern Distributor M1 (ED)**	**Cross City Tunnel (CCT)**	**Westlink M7 (M7)**	**Lane Cove Tunnel (LCT)**	**CityLink (MCL)**	**EastLink (MEL)**	**Peninsula Link (PL)**
Financial contribution by (-ve) /to (+ve) government agency										
-Revenue top up by ERS	+Land lease: $46.6M paid in advance[(d)]	+Land loan $22M[(d)]; -cash loan $85M; -Construction payment $10M	+Land rent: (basic + incentive); - $215M (see Section 2.4.2)	-$25M; +Land rent (basic $1 + BCF $15M p.a.)[(e)]	+Land rent (basic $1 + incentive)	+Land rent (basic $1 + incentive)	+Land rent (basic $1 + incentive)	-$266M; +annual concession fees in 3 tranches; +incentive rent[(f)]	+incentive rent payable in relevant periods where actual revenue is greater than projected revenue[(g)]	-$107m (land etc from LMA)
Average Daily Traffic (ADT)										
86,800 as of December 2005[(h)]	115,367 the December quarter 2010[(n)]	127,681 average workday trip, the March quarter 2012[(i)]	97,753 average workday trips, the March quarter 2012[(i)]	54,877 average workday trips, the March quarter 2012[(i)]	30, 000 as of June 2007[(j)]	152,377 average workday trips, the March quarter 2012[(i)]	75,637 average workday trips, the March quarter 2012 [(i)]	834,952 average workday transactions, the March quarter 2012[(i)(k)]	194,427 the September quarter 2011[(o)]	N/A
Present Toll (full length cartrip)[(l)]										
$3.00 for all types of vehicles; South-bound direction only	Toll rate as of June 2008: $2.20 (cars) $6.60 (trucks); Tolls were removed on 16 February 2010 when the operation was handed back to the state government.	$4.40 (cars) $8.80 (trucks);	$4.95 (cars) $15.95 (trucks) for the full length and $2.75 (cars) $7.70 (trucks) for Pennant Hills	$5.50 (cars) and $11.50 (trucks); northbound direction only	Eastbound /westbo-und tunnel: $4.70 (cars) and $9.40 (trucks); SJYC exit: $2.22 (cars) and $4.43 (trucks)	Distance-based variable tolls, up to $7.16 one way	$2.93 (cars) $5.87 (trucks) for the full length and $1.47 (cars) $2.93 (trucks) for Military Rd ramp	Distance and time-based variable tolls, up to $7.28 for cars one way and $9.70 for trucks	Distance-based variable tolls, with discounts on weekends and public holidays, up to $5.40 for cars and $14.30 for trucks	N/A

NSW								Victoria		
Sydney Harbour Tunnel (SHT)	**M4 (two sections)**	**M5 (two stages)**	**Hills M2 Motorway (M2)**	**Eastern Distributor M1 (ED)**	**Cross City Tunnel (CCT)**	**Westlink M7 (M7)**	**Lane Cove Tunnel (LCT)**	**CityLink (MCL)**	**EastLink (MEL)**	**Peninsula Link (PL)**
Consortium Partners (major equity holders)										
Transfield Pty Ltd, Kumagai Gumi Corporation	SWR partners, Macquarie Infrastruc-ture (MIG)	MIG, M5 Holdings, Cogent Nominees	Transurban from June 2005; previously Abigroup, Obayashi Corporation	MIG; previously Infrastruct-ure Trust of Australia, Leighton Motorway Investment	ABN Amro, Leighton Holdings from June 2007; previ-ously CKI, Bilfinger Berger, SAS Trustee Cor-poration, JP-Morgan No-minees Australia	MIG, Transur-ban, Abi-group, Leighton Holdings	CKI and Li Ka Shing Foundation from July 2004; previously ABN Amro Australia	Transfield Holdings Pty Ltd, Obayashi Corporation Transurban	Macquarie Bank (financier), Thiess and John Holland (construction), Sociedad Iberica de Construccionnes Electricas, S.A. (tolling system and integration of road-side equipment), Transfield Services Australia Pty Ltd (operations and maintenance services)	Royal Bank of Scotland (financier), Abigroup (D&C), Bilfinger Berger Services (O&M), Bilfinger Berger Project Investments and Access Capital Clients (equity providers)
Operator										
Sydney Harbour Tunnel Company	SWR Opera-tions	Interlink Roads	Tollaust subcontract-ing to The Hills Motorway	Airport Motorway Ltd (AML)	CrossCity Motorway subcontra-cting to Baulder-stone; Hornibro-ok	Westlink Motorway	Lane Cove Tunnel Co subcontract-ing to Transfield Services	Transurban	ConnectEast[o]	Southern Way consortium

Source: CityLink (1995); EastLink (2004); JSCCT (2006a,b); NSWIIG (2005); Hodge (2005); NSWAGO (various years); RTA (Contract Summary, various years); RTA (2007); NSW Government (1987); VAGO (1996a; 1996b; 2005; 2011) Westlink M7 (2005)

(a): Details of the capital cost for each project are as follows:

SHT – $683M (1986 price), which includes construction cost of $554M (NSWAGO, 1994; NSWIIG 2005).

M4 – includes the Western Section missing link: Mays Hill – Prospect and the Eastern Section widening: James Ruse Drive and Silverwater Road east of Parramatta. $246M (1988 price) which consists of construction cost of $110M for both sections and the remaining value includes interest, maintenance and taxation (NSWAGO, 1994).

M5 – includes Stage 1(Beverly Hills – Moorebank) and Stage 2 (Moorebank – Prestons). $382M (1991 price), which is made up of two components: i) M5 main link cost of $317M: cost of land acquisition $22M paid by the RTA and construction cost of $295M that is funded by Interlink (CBA loan $250M) and the RTA ($35M loan and $10M construction payment); ii) M5 Western extension: construction cost of $65M funded by the RTA loan ($50M) and Interlink (CBA loan $15M); the RTA's loans to Interlink (some of which are at concessional interest rates) are subordinated to Interlink's other debt and are not repayable until the end of the project term (NSWAGO, 1994).

M2 – $616M (1994 price), which consists of design and construction cost ($369M), project establishment cost ($26M), overhead expenditure ($6M), distributions to investors ($47M), net project finance costs including interest earned ($33M), debt service reserve ($15M), all are funded by private debt and equity; plus $120M land acquisition paid by the RTA (Hills, 1994; NSWAGO, 1995).

ED – $684M (1997 price), which consists of cost of financing, development, design, construction, fitout and commissioning (NSWAGO, 1997).

CCT – $680M (nominal price), which consists of cost of development, design, construction, fitout and commissioning (NSWAGO, 2006).

M7 – $2,230M (nominal price), which represents the total cost of the project including the cost of connecting roadworks and financing costs, the cost of design and construction for the motorway is $1.54 billion (Westlink M7, 2005).

LCT – $1,684.8M (1999 price), which consists of the cost of development, design and construction, fitout and commissioning that is funded by $542.8M of equity investments and $1,142M of debt finance, the estimated cost of the project was $815M (JSCCT, 2006c).

MCL – $2,100M (1996 price), which consists of $1,800M contribution from Transurban to cover the cost of design, finance, construct and operate the project, and $266M financial cost of the state government to finance associated works, including property acquisition, the widening of the Tullamarine Freeway from Moreland Road to Bulla Road and the implementation of certain agreed traffic management measures (VAGO, 1996a).

MEL – $3,800M (2005 price), which consists of the fixed contract price of the project's design and construction $2,500M, the remaining value includes capital and financial costs (VAGO, 2005, p.194).

PL – $849m net present value in 2009 dollar consists of D&C $652m from concessionaire; and Land, etc $107m from LMA

(b): $10.2M paid by the private operator comprises two cash payments of the concession fee: $2.2m in February 1998; $8m in August 2000.

(c): The federal government contributed $356m towards the M7 project (NSWAGO, 2006b).

(d): Land lease of $46.6m (being a total of 17 years rent for the land on which the tollroad was built) was paid by SWR in two tranches: the sum of $22,094,340.11 on or before the commencement date; and the sum of $24,521,348.11 on 31 May 1991 (NSWAGO, 1994, p.357). RTA land loan was repaid by Interlink in 1997. These two payments are treated as prepayments of the remaining lease over the concession period. They are recorded as liabilities-"unearned revenue" in RTA's book and amortised annually (RTA, 2007, p.142). Note that the nature of these land leases differs from those in later projects. Land leases of M4 & M5 are the rents charged for the land on which the motorways were built. Land rent in later projects was the price concessionaires paid for the right to charge tolls and retain them for their own benefit.

(e): RTA's financial contribution: $5M for the transfer of risk of interest rate movements between the announcement of the preferred proponent and financial close including the risk associated with the issue of indexed bonds by the private proponent; and $20M construction cost to compensate AML for modifications added to the original project proposal, half of which was to ensure the construction of the Sydney Art Gallery landscaped canopy. Up to 65 percent of the land rent can be made in promissory notes, which can be redeemed only after an annual real after-tax return of 10 percent to equity has been earned.

(f): $266 million includes: $107 million expended towards the acquisition of land; $10 million towards the construction of a separate emergency tunnel by Transurban in accordance with the State Works Agreement; and costs associated with works financed by the government (VAGO, 1996b). 3 tranches of annual concession fees payable semi-annually: $95.6M for the first 25 years, $45.2M for years 26 to 34, and $1M for the remaining years, all are payable in non-interest bearing promissory notes if the cumulative real/post-inflation rate of return on equity is less than 10 percent per year and the total dollar amount of promissory notes redeemed in any financial year exceeds 30 percent of the distributable cash flow of the preceding financial year (VAGO, 2007, p.23); +incentive rent payable in relevant periods when actual post-tax real return to private equity is greater than projected return (CityLink, 1995).

(g): The concessionaire ConnectEast is not obliged to pay concession fees to the state for the right to operate the tollroad. In return for the concession right, ConnectEast will build two sections of the new road (a 2-kilometre enhanced bypass of Ringwood and a new 4.75 kilometre bypass of Dandenong) that are non-tolled and hand them over to the Victorian government at no cost once construction is complete (VAGO, 2005, p.193).

(h): Data obtained from RTA website, http://www.rta.nsw.gov.au/constructionmaintenance/completedprojects/sydneyharbourtunnel/index.html, accessed on 11 January 2008.

(i): Data of M5, M2, ED, CCT, M7 and LCT are obtained from ASX Release by Transurban, which holds equity in all these motorways (http://www.transurban.com.au/1098915.pdf, accessed on 15 May 2012).

(j): Clegg and Poljak (2007).

(k): Data include short and long trips.

(l): All are current as of June 2012.

(m): BCF: Business Consideration Fee; EIS: Environment Impact Statement; ERS: Ensured Revenue Stream; RDF: Reimbursement for Development Fee; SJYC: St John Young Crescent.

(n): ADT data for the last quarter just before the handover occurred in February 2010 (http://www.transurban.com.au/807846.pdf, accessed on 5 December 2011)

(o): ADT data for the last quarter just before ConnectEast was acquired by Horizon Roads and ceased trading (http://www.connecteast.com.au/marketdata.aspx, accessed on 5 December 2011).

(p): Horizon Roads acquired 100 percent of the issued securities in ConnectEast Group on 26 October 2011 (http://www.connecteast.com.au/marketdata.aspx, accessed on 5 December 2011).

Appendix C: Changes to the Toll Compared with the Original Project Concept – Cross City Tunnel

Toll Component	Original Project Concept	After the Change	Reason for Change
Toll Escalation Formula	CPI adjusted toll escalation	Opening – Dec 2011[(a)]: Greater of 4 perc ent and CPI Jan 2012 – Dec 2017[(a)]: Greater of 3 percent and CPI After Dec 2017[(a), (b)]: Greater of CPI and 0 percent	To avoid the RTA paying an extra $75 million costs following the Supplementary Environment Impact Statement and associated additional Conditions of Approval
Base Toll Level	Cars: $2.50 for main tunnel $1.10 for exit at SJYC Heavy vehicles: $5.00 for main tunnel $2.20 exit at SJYC	Cars: $2.65 for main tunnel $1.25 for exit at SJYC Heavy vehicles: $5.30 for main tunnel $2.50 for exit at SJYC	In return for CCM carrying out $35 million of additional work identified for the RTA

Source: NSWAGO (2006a); JSCCT (2006a)

(a): Quarterly adjusted. Effectively, the adjustment is greater than 4 per cent. If the CPI was treated as an annual figure then the toll charged at 31 December 2005 would have been $3.45 not $3.56.
(b): If CPI is negative during any quarter, the toll will remain at the same level until the CPI is positive.

SJYC: Sir John Young Crescent

Appendix D: Risk Attribute Matrix

Risk Attribute	Definition	Level	Public Sector	Private Sector
Traffic risk	This is the risk that traffic volume is lower than fore-cast which results in total revenue derived from the project over the concession term varying from initial expectations.	high	Private firm inflates traffic forecast in order to win the contract and raise finance; forced to bail out/subsidise the project when demand fails to meet projections.	Patronage is substantially lower than forecast during the ramp-up.
		medium	SPV does not invest in understanding the demographic composition being affected; forced to increase subsidy; unable to redeem concession notes or share upside gains.	Traffic forecast and demographic changes stated in the EIS are not robust, causing erroneous forecast in the traffic model; difficulty in predicting travel patterns of short trips vs long trips.
		low	Private operator has no recourse to government.	Government provides revenue assurance.
Network risk	This risk arises when the contracted services or meth-od of delivery of those serv-ices are linked to, rely on are otherwise affected by certain infrastructure and other services or methods	high	Private operator is only concerned with the profitability of each individual road; network disintegration.	Private road is in direct competition with neighbouring public roads that are free to use.
		medium	Concession inhibits the flexibility of future transport network development.	Future transport network development will adversely affect traffic volume of the private road.

Risk Attribute	Definition	Level	Public Sector	Private Sector
Network risk (cont.)	of delivering the contracted services. Road projects are particularly concerned with the access to the existing road network and the feasibility of connecting to future infrastructure.	low	Private operator is willing to contribute to the cost of creating the physical connection to an existing road network, and future network development that will improve the network efficiency as well as the profitability of the private tollroad.	Willingness of government to allow for renegotiation or financial compensation if future network development adversely affects the profitability of the private road.
Financial risk	This risk primarily refers to the variability in returns that the project is expected to earn. It is affected by a number of parameters, including market confidence, public perceptions, consumer attributes, etc.	high	As most PPP tollroads are developed using non-recourse financing, the organisations involved must be reputable to raise the funds needed for each development; this risk is high when the private consortium does not have a strong balance sheet to sustain the project in the long run.	Project does not generate sufficient cash flows; fails to achieve required hurdle rate of return; new road represents greater risk and higher cost of capital; low acceptance of user-pays by motorist.
		medium	Project mainly relies on debt financing, driving up the cost of risk premium.	Government's approach to evaluate the business case focuses only on capital costs without giving adequate consideration to life cycle cost savings.
		low	Project is non-recourse to government; the SPV exercises due diligence in assessing the risk, and it is able to package an innovative project finance to manage the risk.	Funding structure has a low debt to equity ratio; main party in the SPV has a strong balance sheet; market exhibits greater acceptability of user-pays.

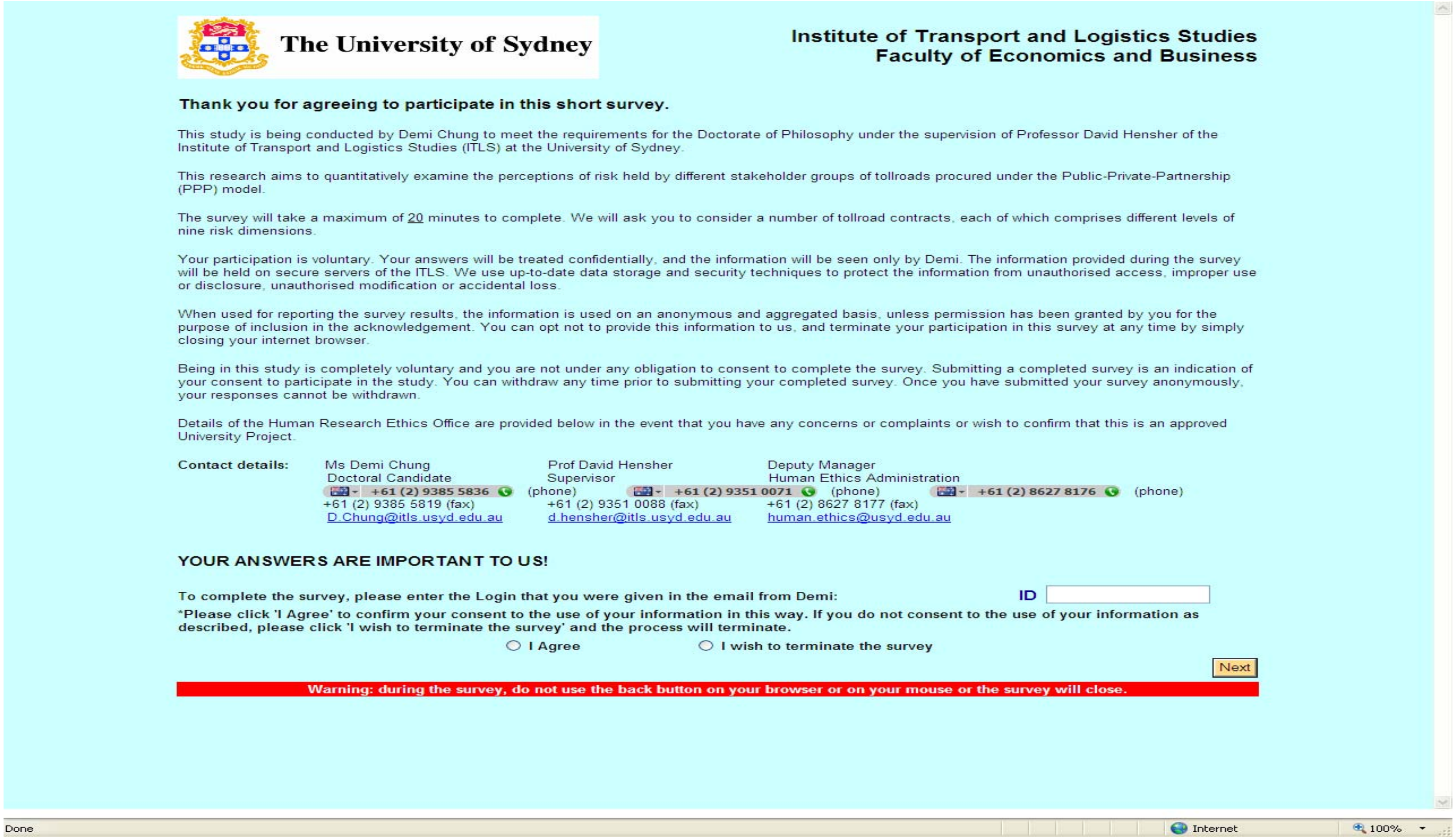
Risk Attribute	Definition	Level	Public Sector	Private Sector
Risks associated with ownership	This category includes design and construction risks (D&C) and operation and maintenance risks (O&M).	high	Design is unwelcome by the community; the SPV barely delivers the project and associated services to its specifics.	Time and cost overruns; facility cannot be operated within cost and within the constraints of the concession agreement.
		medium	Project is not delivered on time (cost overrun is passed on to the consortium); poor handling of O&M by private operator reduces the asset's residual value; private operator does minimum in order to save costs.	Public procurer is inflexible with the output specifications; implementation of new technology (with no prior field experience) may render post-construction performance inefficient.
		low	SPV possesses 'learning efficiency' and awareness of the broader community.	Government is flexible with the process of delivery; there exists legal enforcement for non-payment to be financially sanctioned.
force majeure	This refers to the risk that events may occur that will have a catastrophic effect on either party's ability to perform its obligations under the contract.	high	Occurrences of *force majeure* event will trigger financial compensation under the MAE clause.	MAE events are not adequately insured or are uninsurable.
		medium	SPV will renegotiate under the MAE clause to demand tariff increase and contract extension.	Mechanism of redress for the aggrieved parity is not transparent; MAE clause is too restrictive.
		low	SPV is willing to renegotiate in good faith in the event MAE occurs; MAE events are sufficiently insured by the SPV.	Government is willing to renegotiate in good faith in the event MAE occurs; MAE approach is transparent.

Risk Attribute	Definition	Level	Public Sector	Private Sector
Sovereign risk	Sovereign risk is the uncertainty in legislation and government policy that may adversely affect the project's profitability and the possibility of a new government abandoning or changing PPP schemes. It is particularly relevant to PPPs because of the long duration of contractual obligations.	high	Changes in policies at the federal government level, such as tax, that are outside the judiciary power of state/local government.	Government has records of exercising its power and immunities, including but not limited to the power to legislate and determine policy in a way that disadvantages the project's profitability; introduction of new government will make policy changes that will impair the project's profitability.
		medium	Unstable economic environment will increase the cost of private capital.	Policy fragmentation with respect to PPPs and tolls at different levels of government; changes in the taxation framework may impact on the financial assumptions of the project.
		low	There exists a consistent, uniform approach to PPPs.	The country is a democratic economy and has a uniform approach to PPPs.
Risk of unclear project objectives	Unclear and poorly defined project objectives will expose government to a series of new risks, include-ing weakening bargaining power and adverse equity impact. Offering an uncertain project to market tender opens unlimited scope for negotiation.	high	EIS procedures are not followed; project proposal is unsolicited; project concept comes from a uncompliant bid.	After committing to the project, project scope requires significant modification due to community rejection.

Risk Attribute	Definition	Level	Public Sector	Private Sector
Risk of unclear project objectives (cont.)	A properly managed EIS process can reduce this risk.	medium	Project development is not transparent, inadequate communication with the community.	Community expectations are not managed properly upfront during the EIS process.
		low	Project has community approval; clear communication maintained throughout the project development.	Project objectives and benefits are made clear to the market.
Political and reputational risks	These are social-dimension risks. Political risk relates to questions about the continuing commitment of key political parties to the project and is closely associated with reputational risk. These risks are common to virtually all PPPs in every area.	high	Public perceives the government offloading public accountability through the PPP vehicle and hence forms adverse perception about the PPP scheme.	Government does not realise that these risks should be retained and internalised within the public sector.
		medium	Changes in project scope are seen as providing windfall gains to the private operator.	Government is inexorable regarding the levels of toll.
		low	Government understands the social dimension embedded in the essential services PPP projects designated to provide.	Users are subsidised by government.

Risk Attribute	Definition	Level	Public Sector	Private Sector
Media risk	Media serves as the medium of community expectations and public perception management; its impact can be instant and extensive.	high	Media has an adverse opinion on PPPs	Bad press results in negative public perception; hence reduction in demand for the service.
		medium	Media's interest in PPPs exerts pressure on bureaucracy.	Government backs away from supporting the project.
		low	Media is generally supportive and private sector is willing to work with government to promote project benefits to the media.	Public agency has a public relations team dedicated to keeping media informed and managing the public relations; the agency is willing to work with the private firm to manage public relations.
Risk of public misperception	This risk arises when there is a lack of public support, which can be detrimental to the proposed PPP road.	high	Low public acceptance of private ownership of roads; public expects that tollroads deliver little public benefit.	Refusal of usage by users leads to low patronage; lack of public understanding about the benefits of tollroads.
		medium	Private sector's neglect of different market segments; ignorance of demography around the project locality and the impact of prospective changes on the project.	Community resentment not handled adequately during the EIS process.
		low	SPV is actively engaging in community activities and promoting project benefits.	Community concerns have been adequately handled during the EIS consultation phase.

Appendix E: Screen Shots of the Online Stated Choice Experiment Survey



The University of Sydney

Institute of Transport and Logistics Studies
Faculty of Economics and Business

Thank you for agreeing to participate in this short survey.

This study is being conducted by Demi Chung to meet the requirements for the Doctorate of Philosophy under the supervision of Professor David Hensher of the Institute of Transport and Logistics Studies (ITLS) at the University of Sydney.

This research aims to quantitatively examine the perceptions of risk held by different stakeholder groups of tollroads procured under the Public-Private-Partnership (PPP) model.

The survey will take a maximum of 20 minutes to complete. We will ask you to consider a number of tollroad contracts, each of which comprises different levels of nine risk dimensions.

Your participation is voluntary. Your answers will be treated confidentially, and the information will be seen only by Demi. The information provided during the survey will be held on secure servers of the ITLS. We use up-to-date data storage and security techniques to protect the information from unauthorised access, improper use or disclosure, unauthorised modification or accidental loss.

When used for reporting the survey results, the information is used on an anonymous and aggregated basis, unless permission has been granted by you for the purpose of inclusion in the acknowledgement. You can opt not to provide this information to us, and terminate your participation in this survey at any time by simply closing your internet browser.

Being in this study is completely voluntary and you are not under any obligation to consent to complete the survey. Submitting a completed survey is an indication of your consent to participate in the study. You can withdraw any time prior to submitting your completed survey. Once you have submitted your survey anonymously, your responses cannot be withdrawn.

Details of the Human Research Ethics Office are provided below in the event that you have any concerns or complaints or wish to confirm that this is an approved University Project.

Contact details:

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Doctoral Candidate	Supervisor	Human Ethics Administration
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YOUR ANSWERS ARE IMPORTANT TO US!

To complete the survey, please enter the Login that you were given in the email from Demi: ID

***Please click 'I Agree' to confirm your consent to the use of your information in this way. If you do not consent to the use of your information as described, please click 'I wish to terminate the survey' and the process will terminate.**

○ **I Agree** ○ **I wish to terminate the survey**

Next

Warning: during the survey, do not use the back button on your browser or on your mouse or the survey will close.

Done Internet 100%

About You and the Projects You Have Been Involved In

1) To begin, we would like you to tell us about your involvement in PPP tollroad projects.

Q1.1 Could you tell us the extent of your participation in any type of PPP project?

No. of **years**: No. of **projects**:

Q1.2 In particular, could you tell us the extent of your participation in PPP **tollroad** projects?

No. of **years**: No. of **projects**:

Q1.3 What is/was your primary role in PPP tollroad projects? (you can select multiple categories)

- ☐ Primary Decision Maker ☐ Regulator ☐ Tollroad Operator ☐ Insurer
- ☐ Traffic Modeller ☐ Debt Financier ☐ Auditor ☐ Underwriter
- ☐ Evaluator ☐ Consultant ☐ Constructor ☐ Equity Investor
- ☐ Quality Surveyor ☐ Other, please specify in the space provided:

Q1.4 Which organisation(s) were you working for at the time when you were involved with these PPP tollroads? (you can select multiple categories)

- ☐ Public Sector ☐ Road Authority ☐ Budget Cabinet Commmittee
- ☐ Treasury ☐ State Infrastructure Planning Authority ☐ State Audit Office
- ☐ Local Government Council ☐ Academia ☐ Private Sector ☐ Tollroad Company
- ☐ Investment Bank ☐ Construction Company ☐ Consultancy ☐ Insurance Company
- ☐ Other, please specify in the space provided:

Q1.5 Is the organisation you were working for at the time a part of the private consortium bidding for a tollroad concession? ○ Yes ○ No

2) More specifically, we would like you to think about the PPP tollroads that you have been most involved in.

Could you indicate the location, the type, the nature and the tolling scheme, of the 3 most recent projects that you have been involved in?

City or Region	Country	Type	Nature	Tolling Scheme
e.g. Sydney	e.g. Australia	e.g. bridge, motorway, tunnel, bypass, etc.	e.g. a new infrastructure, an extension of an existing infrastructure, a missing link of an existing transport network, etc.	e.g. fixed toll, time-based variable toll, distance-based variable toll, shadow toll, etc.

Next

Internet 100%

Background of the Games

In order to provide infrastructure-based road services, a public road authority is considering entering into a PPP tollroad concession with the private sector.

The concession will grant the private proponent the right to charge users a toll in exchange for the private proponent being given a concession to design, build, finance and operate the road infrastructure for an agreed period (e.g., 30 years).

Imagine that you are the representative of one of the contracting parties and facing two contracts each of which comprises a unique risk profile.

We would like you to play a series of games in which you choose one of the two contracts on offer based on their risk profiles.

The next screen will provide you with detailed instructions on how to play the games.

Back Next

Done Internet 100%

Instructions

The following screens will take you to a number of games that are designed to seek your views on the dimensions of risk that are particularly important to you in deciding to enter into a PPP tollroad concession.

Each of these games describes a different scenario that comprises two tollroad contracts. Each contract represents a unique risk profile. The risk profiles are distinguished by varying levels of 9 risk attributes that are commonly considered by contracting parties in negotiating PPP tollroad concessions.

For example:

	Contract A may have a greater probability that the actual traffic volume is lower than forecast, i.e. higher downside traffic risk (80%), while financial risk is relatively moderate, i.e. risk neutral is 70%.			**Contract B** may contain a greater probability that future transport network integration will increase patronage to the tollroad, i.e. higher upside gain (90%) from improved network integration, while subject to a more sensitive media scrutiny, i.e. greater downside media risk (60%).		
	Contract A			Contract B		
Risk Attributes	downside risk	risk neutral	upside gain	downside risk	risk neutral	upside gain
traffic risk	80%	15%	5%	80%	10%	10%
financial risk	10%	70%	20%	60%	20%	20%
network risk	70%	0%	30%	5%	5%	90%
force majeure	80%	10%	10%	90%	0%	10%
sovereign risk	90%	5%	5%	50%	10%	40%
risk of unclear project objectives	80%	0%	20%	80%	0%	20%
political and reputational risk	70%	20%	10%	70%	20%	10%
media risk	60%	20%	20%	60%	35%	5%
risk of public perception	50%	10%	40%	60%	10%	30%

You will be shown five independent scenarios, each of which invites you to choose between the two contracts on offer. You can make your choice by checking the boxes below:

	Contract A	Contract B
Which contract do you think a consortium bid team would prefer?	●	●
Which contract do you think the public agency would prefer?	●	●
Would you accept the contract you prefer if it actually existed?	○ Yes	○ No
To what extent (in percentage term) do you think the other party would accept the contract you prefer?		%

In order to help you to understand the game in more detail, we will take you through a practice game after the next screen that shows the definitions of the 9 risk attributes and their associated levels.

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Definitions of Different Levels of Each Risk Attribute

You will have access to these definitions anytime during the game by rolling your cursor over any risk level.

	downside risk of X% indicates that there is a X% probability that	risk neutral of Y% indicates that there is a Y% probability that	upside gain of Z% indicates that there is a Z% probability that
traffic risk	the actual traffic volume will be below forecast	the actual traffic volume will be meeting the forecast	the actual traffic volume will be above the forecast
financial risk	changes in economic conditions will adversely affect the financial returns the tollroad is expected to earn	changes in economic conditions will make no difference to the financial returns the tollroad is expected to earn	changes in economic conditions will increase the financial returns the tollroad is expected to earn
network risk	future transport network developments by government may reduce traffic flows to the tollroad	future transport network developments by government may have no major impact on traffic flows to the tollroad	future transport network developments by government may increase traffic flows to the tollroad
force majeure	the occurrences of uninsured events may worsen the tollroad's performance	in the event that uninsured events occur, the other party will agree to a transparent approach to redress the aggrieved party	all events are well insured, or if not both parties are willing to negotiate in good faith to redress the aggrieved party
sovereign risk	future changes in government policies may worsen policy fragmentation across different levels of government	future changes in government policies may not have an effect on the existing overall PPP policy framework	future changes in government policies may result in a more consistent and coherent PPP policy framework across all political jurisdictions
risk of unclear project objectives	project objectives are unspecified or are unclear to contracting parties and the community	project objectives are clearly specified and there are clear communications amongst contracting parties and the community	project objectives are made clear to the market and project deliveries will adhere to stated objectives throughout all project phases
political and reputational risk	contracting parties will not deliver the project in the public interest, the public sector is seen as offloading public accountability, thus causing public resentment to the PPP scheme and the project	political and reputational risk is not of significant concern	all parties understand this risk and are willing to internalise this risk within its own sector as well as to collaborate with the other party to resolve public resentment
media risk	the media is critical of the PPP scheme/project, thus exposing the tollroad to poor publicity	the media is neutral to the PPP scheme/project, thus resulting in low publicity for the tollroad	the media is supportive to the PPP scheme/project, it conveys to the community the public benefits of the tollroad, resulting in welcome publicity
risk of public perception	public acceptance of private ownership of tollroad, public expectations of benefits derived from the tollroad, and of both sectors' commitment to the community are poor	public perceptions of private ownership of tollroad, public expectations of benefits derived from the tollroad, and of both sectors' commitment to the community are of insignificant concern	the public welcomes private ownership of tollroad and public expectations of benefits derived from the tollroad, and of both sectors' commitment to the community are high

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Practice Game: Choosing the Contract

This screen and the next 2 screens will give you an opportunity to practise playing the game. Your answers will not be recorded.

Keeping in mind the risk-sharing arrangements in *the projects that you have been involved in*, and the background of the games we showed you, we would like you to make some choices. Choose the contract that you would prefer, and the contract that you think the other party might prefer.

The last two questions give you an opportunity to tell us if neither of the contracts would be acceptable to you or to the other party.

		Contract A			Contract B		
Risk Attributes	Brief Definitions of Each Risk Attribute	risk neutral	downside risk	upside gain	risk neutral	downside risk	upside gain
traffic risk	actual patronage below, met, above forecast	15%	80%	5%	10%	80%	10%
financial risk	actual returns below, met, above forecast	70%	10%	20%	20%	60%	20%
network risk	future traffic flows will be reduced, no change, increased by network developments	0%	70%	30%	5%	5%	90%
force majeure	uninsured events will worsen, no effect, improve the project's performance	10%	80%	10%	0%	90%	10%
sovereign risk	future changes in public policies will worsen, no impact on PPP policy fragmentations, or result in more coherent PPP policy framework	5%	90%	5%	10%	50%	40%
risk of unclear project objectives	project objectives are unspecified, clearly specified, clearly communicated and adhered to	0%	80%	20%	0%	80%	20%
political and reputational risk	the PPP project is seen to be not in, neutral to, in the public interest	20%	70%	10%	20%	70%	10%
media risk	the media is critical, neutral, supportive of the project	20%	60%	20%	35%	60%	5%
risk of public perception	the concept of PPP tollroad is unwelcome, seen to be neutral, welcome by the public	10%	50%	40%	10%	60%	30%

Questions:

Which contract do you think a consortium bid team would prefer?		
Which contract do you think the public agency would prefer?		
Would you accept the contract you prefer if it actually existed?	Yes	No
To what extent (in percentage term) do you think the other party would accept the contract you prefer?		%

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Practice Game: How did you decide (1)?

Were there any contract attributes that you ignored when making your decision?
Click on any attribute levels that you ignored (they will turn grey, click again if you change your mind; you can make multiple selections).

	Contract A			Contract B		
Risk Attributes	risk neutral	downside risk	upside gain	risk neutral	downside risk	upside gain
traffic risk	15%	80%	5%	10%	80%	10%
financial risk	70%	10%	20%	20%	60%	20%
network risk	0%	70%	30%	5%	5%	90%
force majeure	10%	80%	10%	0%	90%	10%
sovereign risk	5%	90%	5%	10%	50%	40%
risk of unclear project objectives	0%	80%	20%	0%	80%	20%
political and reputational risk	20%	70%	10%	20%	70%	10%
media risk	20%	60%	20%	35%	60%	5%
risk of public perception	10%	50%	40%	10%	60%	30%

Which attribute(s) do you think the other party would likely to ignore when making their decision?
Click on any attributes that you think the other party would likely to ignore (they will turn grey, click again if you change your mind; you can make multiple selections).

	Contract A			Contract B		
Risk Attributes	risk neutral	downside risk	upside gain	risk neutral	downside risk	upside gain
traffic risk	15%	80%	5%	10%	80%	10%
financial risk	70%	10%	20%	20%	60%	20%
network risk	0%	70%	30%	5%	5%	90%
force majeure	10%	80%	10%	0%	90%	10%
sovereign risk	5%	90%	5%	10%	50%	40%
risk of unclear project objectives	0%	80%	20%	0%	80%	20%
political and reputational risk	20%	70%	10%	20%	70%	10%
media risk	20%	60%	20%	35%	60%	5%
risk of public perception	10%	50%	40%	10%	60%	30%

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Practice Game: How did you decide (2)?

What level of risk did you tend to focus mainly on?

Please rank the three levels in ascending order (1 = least focus on; 3 = most focus on).

	Least focus on		Most focus on
risk neutral	○ 1	○ 2	○ 3
downside risk	○ 1	○ 2	○ 3
upside gain	○ 1	○ 2	○ 3

This is the end of the practice game. The next screen will start a real game. Please select your option in each game carefully - you cannot go back to change your answers.

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Game 1 / 5: Choosing the Contract

Warning: do not use the back button on your mouse or the back arrow on your browser to go back to previous screens or the survey will close.

Now the real game begins! Please choose either Contract A or Contract B on offer.
Also note that the order of 'downside risk', 'risk neutral' and 'upside gain' under each contract may be different from the practice game.

Keeping in mind the risk-sharing arrangements in *the projects that you have been involved in*, and the background of the games we showed you, we would like you to make some choices. Choose the contract that you would prefer, and the contract that you think the other party might prefer.

The last two questions give you an opportunity to tell us if neither of the contracts would be acceptable to you or to the other party.

		Contract A			Contract B		
Risk Attributes	Brief Definitions of Each Risk Attribute	risk neutral	downside risk	upside gain	risk neutral	downside risk	upside gain
traffic risk	actual patronage below, met, above forecast	10%	35%	55%	20%	45%	35%
financial risk	actual returns below, met, above forecast	40%	5%	55%	80%	15%	5%
network risk	future traffic flows will be reduced, no change, increased by network developments	10%	5%	85%	60%	15%	25%
force majeure	uninsured events will worsen, no effect, improve the project's performance	10%	65%	25%	30%	15%	55%
sovereign risk	future changes in public policies will worsen, no impact on PPP policy fragmentations, or result in more coherent PPP policy framework	10%	15%	75%	50%	45%	5%
risk of unclear project objectives	project objectives are unspecified, clearly specified, clearly communicated and adhered to	0%	75%	25%	0%	5%	95%
political and reputational risk	the PPP project is seen to be not in, neutral to, in the public interest	40%	45%	15%	30%	55%	15%
media risk	the media is critical, neutral, supportive of the project	0%	55%	45%	50%	15%	35%
risk of public perception	the concept of PPP tollroad is unwelcome, seen to be neutral, welcome by the public	70%	15%	15%	60%	25%	15%

Questions:

Which contract do you think a consortium bid team would prefer?	○	○
Which contract do you think the public agency would prefer?	○	○
Would you accept the contract you prefer if it actually existed?	○ Yes	○ No
To what extent (in percentage term) do you think the other party would accept the contract you prefer?		____ %

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Game 1 / 5: How did you decide (1)?

Warning: do not use the back button on your mouse or the back arrow on your browser to go back to previous screens or the survey will close.

Were there any contract attributes that you ignored when making your decision?
Click on any attribute levels that you ignored (they will turn grey, click again if you change your mind; you can make multiple selections).

	Contract A			Contract B		
Risk Attributes	risk neutral	downside risk	upside gain	risk neutral	downside risk	upside gain
traffic risk	10%	35%	55%	20%	45%	35%
financial risk	40%	5%	55%	80%	15%	5%
network risk	10%	5%	85%	60%	15%	25%
force majeure	10%	65%	25%	30%	15%	55%
sovereign risk	10%	15%	75%	50%	45%	5%
risk of unclear project objectives	0%	75%	25%	0%	5%	95%
political and reputational risk	40%	45%	15%	30%	55%	15%
media risk	0%	55%	45%	50%	15%	35%
risk of public perception	70%	15%	15%	60%	25%	15%

Which attribute(s) do you think the other party would likely to ignore when making their decision?
Click on any attributes that you think the other party would likely to ignore (they will turn grey, click again if you change your mind; you can make multiple selections).

	Contract A			Contract B		
Risk Attributes	risk neutral	downside risk	upside gain	risk neutral	downside risk	upside gain
traffic risk	10%	35%	55%	20%	45%	35%
financial risk	40%	5%	55%	80%	15%	5%
network risk	10%	5%	85%	60%	15%	25%
force majeure	10%	65%	25%	30%	15%	55%
sovereign risk	10%	15%	75%	50%	45%	5%
risk of unclear project objectives	0%	75%	25%	0%	5%	95%
political and reputational risk	40%	45%	15%	30%	55%	15%
media risk	0%	55%	45%	50%	15%	35%
risk of public perception	70%	15%	15%	60%	25%	15%

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Game 1 / 5: How did you decide (2)?

Warning: do not use the back button on your mouse or the back arrow on your browser to go back to previous screens or the survey will close.

What level of risk did you tend to focus mainly on?

Please rank the three levels in ascending order (1 = least focus on; 3 = most focus on).

	Least focus on		Most focus on
risk neutral	1	2	3
downside risk	1	2	3
upside gain	1	2	3

This is the end of the Game 1. The next screen will start an independent game. Do not compare options in different games. Please select your option carefully - you cannot go back to change your answers.

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Game 2 / 5: Choosing the Contract

Warning: do not use the back button on your mouse or the back arrow on your browser to go back to previous screens or the survey will close.

Now the levels of risk attributes have changed, so both contracts are different from those in Game 1. Please choose either Contract A or Contract B on offer.
Also note that the order of 'downside risk', 'risk neutral' and 'upside gain' under each contract may be different from the previous game.

Keeping in mind the risk-sharing arrangements in *the projects that you have been involved in*, and the background of the games we showed you, we would like you to make some choices. Choose the contract that you would prefer, and the contract that you think the other party might prefer.

The last two questions give you an opportunity to tell us if neither of the contracts would be acceptable to you or to the other party.

		Contract A			Contract B		
Risk Attributes	Brief Definitions of Each Risk Attribute	risk neutral	downside risk	upside gain	risk neutral	downside risk	upside gain
traffic risk	actual patronage below, met, above forecast	70%	15%	15%	30%	5%	65%
financial risk	actual returns below, met, above forecast	40%	15%	45%	0%	35%	65%
network risk	future traffic flows will be reduced, no change, increased by network developments	70%	15%	15%	50%	45%	5%
force majeure	uninsured events will worsen, no effect, improve the project's performance	40%	55%	5%	10%	35%	55%
sovereign risk	future changes in public policies will worsen, no impact on PPP policy fragmentations, or result in more coherent PPP policy framework	0%	45%	55%	20%	65%	15%
risk of unclear project objectives	project objectives are unspecified, clearly specified, clearly communicated and adhered to	50%	45%	5%	90%	5%	5%
political and reputational risk	the PPP project is seen to be not in, neutral to, in the public interest	30%	5%	65%	60%	35%	5%
media risk	the media is critical, neutral, supportive of the project	10%	5%	85%	40%	55%	5%
risk of public perception	the concept of PPP tollroad is unwelcome, seen to be neutral, welcome by the public	0%	95%	5%	50%	5%	45%

Questions:

Which contract do you think a consortium bid team would prefer?		
Which contract do you think the public agency would prefer?		
Would you accept the contract you prefer if it actually existed?	Yes	No
To what extent (in percentage term) do you think the other party would accept the contract you prefer?		%

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Game 2 / 5: How did you decide (1)?

Warning: do not use the back button on your mouse or the back arrow on your browser to go back to previous screens or the survey will close.

Were there any contract attributes that you ignored when making your decision?
Click on any attribute levels that you ignored (they will turn grey, click again if you change your mind; you can make multiple selections).

	Contract A			Contract B		
Risk Attributes	risk neutral	downside risk	upside gain	risk neutral	downside risk	upside gain
traffic risk	70%	15%	15%	30%	5%	65%
financial risk	40%	15%	45%	0%	35%	65%
network risk	70%	15%	15%	50%	45%	5%
force majeure	40%	55%	5%	10%	35%	55%
sovereign risk	0%	45%	55%	20%	65%	15%
risk of unclear project objectives	50%	45%	5%	90%	5%	5%
political and reputational risk	30%	5%	65%	60%	35%	5%
media risk	10%	5%	85%	40%	55%	5%
risk of public perception	0%	95%	5%	50%	5%	45%

Which attribute(s) do you think the other party would likely to ignore when making their decision?
Click on any attributes that you think the other party would likely to ignore (they will turn grey, click again if you change your mind; you can make multiple selections).

	Contract A			Contract B		
Risk Attributes	risk neutral	downside risk	upside gain	risk neutral	downside risk	upside gain
traffic risk	70%	15%	15%	30%	5%	65%
financial risk	40%	15%	45%	0%	35%	65%
network risk	70%	15%	15%	50%	45%	5%
force majeure	40%	55%	5%	10%	35%	55%
sovereign risk	0%	45%	55%	20%	65%	15%
risk of unclear project objectives	50%	45%	5%	90%	5%	5%
political and reputational risk	30%	5%	65%	60%	35%	5%
media risk	10%	5%	85%	40%	55%	5%
risk of public perception	0%	95%	5%	50%	5%	45%

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Done Internet 100%

Game 2 / 5: How did you decide (2)?

Warning: do not use the back button on your mouse or the back arrow on your browser to go back to previous screens or the survey will close.

What level of risk did you tend to focus mainly on?

Please rank the three levels in ascending order (1 = least focus on; 3 = most focus on).

	Least focus on		Most focus on
risk neutral	○ 1	○ 2	○ 3
downside risk	○ 1	○ 2	○ 3
upside gain	○ 1	○ 2	○ 3

This is the end of the Game 2. The next screen will start an independent game. Do not compare options in different games. Please select your option carefully - you cannot go back to change your answers.

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Done   Internet   100%

Game 3 / 5: Choosing the Contract

Warning: do not use the back button on your mouse or the back arrow on your browser to go back to previous screens or the survey will close.

Now the levels of risk attributes have changed, so both contracts are different from those in previous games. Please choose either Contract A or Contract B on offer.
Also note that the order of 'downside risk', 'risk neutral' and 'upside gain' under each contract may be different from previous games.

Keeping in mind the risk-sharing arrangements in *the projects that you have been involved in*, and the background of the games we showed you, we would like you to make some choices. Choose the contract that you would prefer, and the contract that you think the other party might prefer.

The last two questions give you an opportunity to tell us if neither of the contracts would be acceptable to you or to the other party.

		Contract A			Contract B		
Risk Attributes	Brief Definitions of Each Risk Attribute	risk neutral	downside risk	upside gain	risk neutral	downside risk	upside gain
traffic risk	actual patronage below, met, above forecast	10%	65%	25%	30%	35%	35%
financial risk	actual returns below, met, above forecast	40%	45%	15%	20%	65%	15%
network risk	future traffic flows will be reduced, no change, increased by network developments	30%	55%	15%	0%	65%	35%
force majeure	uninsured events will worsen, no effect, improve the project's performance	20%	15%	65%	60%	15%	25%
sovereign risk	future changes in public policies will worsen, no impact on PPP policy fragmentations, or result in more coherent PPP policy framework	10%	5%	85%	70%	15%	15%
risk of unclear project objectives	project objectives are unspecified, clearly specified, clearly communicated and adhered to	30%	45%	25%	40%	5%	55%
political and reputational risk	the PPP project is seen to be not in, neutral to, in the public interest	50%	45%	5%	40%	15%	45%
media risk	the media is critical, neutral, supportive of the project	40%	25%	35%	10%	5%	85%
risk of public perception	the concept of PPP tollroad is unwelcome, seen to be neutral, welcome by the public	20%	35%	45%	0%	45%	55%

Questions:

Which contract do you think a consortium bid team would prefer?	○	○
Which contract do you think the public agency would prefer?	○	○
Would you accept the contract you prefer if it actually existed?	○ Yes	○ No
To what extent (in percentage term) do you think the other party would accept the contract you prefer?		____ %

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Game 3 / 5: How did you decide (1)?

Warning: do not use the back button on your mouse or the back arrow on your browser to go back to previous screens or the survey will close.

Were there any contract attributes that <u>you</u> ignored when making your decision?
Click on any attribute levels that <u>you</u> ignored (they will turn grey, click again if you change your mind; you can make multiple selections).

	Contract A			Contract B		
Risk Attributes	risk neutral	downside risk	upside gain	risk neutral	downside risk	upside gain
traffic risk	10%	65%	25%	30%	35%	35%
financial risk	40%	45%	15%	20%	65%	15%
network risk	30%	55%	15%	0%	65%	35%
force majeure	20%	15%	65%	60%	15%	25%
sovereign risk	10%	5%	85%	70%	15%	15%
risk of unclear project objectives	30%	45%	25%	40%	5%	55%
political and reputational risk	50%	45%	5%	40%	15%	45%
media risk	40%	25%	35%	10%	5%	85%
risk of public perception	20%	35%	45%	0%	45%	55%

Which attribute(s) do you think the <u>other party</u> would likely to ignore when making their decision?
Click on any attributes that you think the <u>other party</u> would likely to ignore (they will turn grey, click again if you change your mind; you can make multiple selections).

	Contract A			Contract B		
Risk Attributes	risk neutral	downside risk	upside gain	risk neutral	downside risk	upside gain
traffic risk	10%	65%	25%	30%	35%	35%
financial risk	40%	45%	15%	20%	65%	15%
network risk	30%	55%	15%	0%	65%	35%
force majeure	20%	15%	65%	60%	15%	25%
sovereign risk	10%	5%	85%	70%	15%	15%
risk of unclear project objectives	30%	45%	25%	40%	5%	55%
political and reputational risk	50%	45%	5%	40%	15%	45%
media risk	40%	25%	35%	10%	5%	85%
risk of public perception	20%	35%	45%	0%	45%	55%

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Done Internet 100%

Game 3 / 5: How did you decide (2)?

Warning: do not use the back button on your mouse or the back arrow on your browser to go back to previous screens or the survey will close.

What level of risk did you tend to focus mainly on?

Please rank the three levels in ascending order (1 = least focus on; 3 = most focus on).

	Least focus on		Most focus on
risk neutral	○ 1	◉ 2	○ 3
downside risk	◉ 1	○ 2	○ 3
upside gain	○ 1	○ 2	○ 3

This is the end of the Game 3. The next screen will start an independent game. Do not compare options in different games. Please select your option carefully - you cannot go back to change your answers.

Next

Done Internet 100%

Game 4 / 5: Choosing the Contract

Warning: do not use the back button on your mouse or the back arrow on your browser to go back to previous screens or the survey will close.

Now the levels of risk attributes have changed, so both contracts are different from those in previous games. Please choose either Contract A or Contract B on offer.
Also note that the order of 'downside risk', 'risk neutral' and 'upside gain' under each contract may be different from previous games.

Keeping in mind the risk-sharing arrangements in *the projects that you have been involved in*, and the background of the games we showed you, we would like you to make some choices. Choose the contract that you would prefer, and the contract that you think the other party might prefer.

The last two questions give you an opportunity to tell us if neither of the contracts would be acceptable to you or to the other party.

		Contract A			Contract B		
Risk Attributes	Brief Definitions of Each Risk Attribute	risk neutral	downside risk	upside gain	risk neutral	downside risk	upside gain
traffic risk	actual patronage below, met, above forecast	40%	5%	55%	20%	65%	15%
financial risk	actual returns below, met, above forecast	40%	25%	35%	10%	45%	45%
network risk	future traffic flows will be reduced, no change, increased by network developments	20%	15%	65%	0%	45%	55%
force majeure	uninsured events will worsen, no effect, improve the project's performance	30%	15%	55%	10%	75%	15%
sovereign risk	future changes in public policies will worsen, no impact on PPP policy fragmentations, or result in more coherent PPP policy framework	50%	5%	45%	60%	5%	35%
risk of unclear project objectives	project objectives are unspecified, clearly specified, clearly communicated and adhered to	10%	65%	25%	50%	35%	15%
political and reputational risk	the PPP project is seen to be not in, neutral to, in the public interest	10%	45%	45%	40%	55%	5%
media risk	the media is critical, neutral, supportive of the project	0%	5%	95%	90%	5%	5%
risk of public perception	the concept of PPP tollroad is unwelcome, seen to be neutral, welcome by the public	20%	45%	35%	70%	25%	5%

Questions:

Which contract do you think a consortium bid team would prefer?	●	●
Which contract do you think the public agency would prefer?	●	●
Would you accept the contract you prefer if it actually existed?	○ Yes	○ No
To what extent (in percentage term) do you think the other party would accept the contract you prefer?		%

Next

Done   Internet   100%

Game 4 / 5: How did you decide (1)?

Warning: do not use the back button on your mouse or the back arrow on your browser to go back to previous screens or the survey will close.

Were there any contract attributes that you ignored when making your decision?
Click on any attribute levels that you ignored (they will turn grey, click again if you change your mind; you can make multiple selections).

	Contract A			Contract B		
Risk Attributes	risk neutral	downside risk	upside gain	risk neutral	downside risk	upside gain
traffic risk	40%	5%	55%	20%	65%	15%
financial risk	40%	25%	35%	10%	45%	45%
network risk	20%	15%	65%	0%	45%	55%
force majeure	30%	15%	55%	10%	75%	15%
sovereign risk	50%	5%	45%	60%	5%	35%
risk of unclear project objectives	10%	65%	25%	50%	35%	15%
political and reputational risk	10%	45%	45%	40%	55%	5%
media risk	0%	5%	95%	90%	5%	5%
risk of public perception	20%	45%	35%	70%	25%	5%

Which attribute(s) do you think the other party would likely to ignore when making their decision?
Click on any attributes that you think the other party would likely to ignore (they will turn grey, click again if you change your mind; you can make multiple selections).

	Contract A			Contract B		
Risk Attributes	risk neutral	downside risk	upside gain	risk neutral	downside risk	upside gain
traffic risk	40%	5%	55%	20%	65%	15%
financial risk	40%	25%	35%	10%	45%	45%
network risk	20%	15%	65%	0%	45%	55%
force majeure	30%	15%	55%	10%	75%	15%
sovereign risk	50%	5%	45%	60%	5%	35%
risk of unclear project objectives	10%	65%	25%	50%	35%	15%
political and reputational risk	10%	45%	45%	40%	55%	5%
media risk	0%	5%	95%	90%	5%	5%
risk of public perception	20%	45%	35%	70%	25%	5%

Next

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Game 4 / 5: How did you decide (2)?

Warning: do not use the back button on your mouse or the back arrow on your browser to go back to previous screens or the survey will close.

What level of risk did you tend to focus mainly on?

Please rank the three levels in ascending order (1 = least focus on; 3 = most focus on).

	Least focus on		Most focus on
risk neutral	○ 1	○ 2	○ 3
downside risk	○ 1	○ 2	○ 3
upside gain	○ 1	○ 2	○ 3

This is the end of the Game 4. The next screen will start an independent game. Do not compare options in different games. Please select your option carefully - you cannot go back to change your answers.

Next

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Game 5 / 5: Choosing the Contract

Warning: do not use the back button on your mouse or the back arrow on your browser to go back to previous screens or the survey will close.

Now the levels of risk attributes have changed, so both contracts are different from those in previous games. Please choose either Contract A or Contract B on offer.
Also note that the order of 'downside risk', 'risk neutral' and 'upside gain' under each contract may be different from previous games.

Keeping in mind the risk-sharing arrangements in *the projects that you have been involved in*, and the background of the games we showed you, we would like you to make some choices. Choose the contract that you would prefer, and the contract that you think the other party might prefer.

The last two questions give you an opportunity to tell us if neither of the contracts would be acceptable to you or to the other party.

		Contract A			Contract B		
Risk Attributes	Brief Definitions of Each Risk Attribute	risk neutral	downside risk	upside gain	risk neutral	downside risk	upside gain
traffic risk	actual patronage below, met, above forecast	50%	15%	35%	90%	5%	5%
financial risk	actual returns below, met, above forecast	70%	15%	15%	80%	5%	15%
network risk	future traffic flows will be reduced, no change, increased by network developments	60%	35%	5%	80%	5%	15%
force majeure	uninsured events will worsen, no effect, improve the project's performance	90%	5%	5%	0%	55%	45%
sovereign risk	future changes in public policies will worsen, no impact on PPP policy fragmentations, or result in more coherent PPP policy framework	50%	15%	35%	0%	75%	25%
risk of unclear project objectives	project objectives are unspecified, clearly specified, clearly communicated and adhered to	30%	65%	5%	60%	35%	5%
political and reputational risk	the PPP project is seen to be not in, neutral to, in the public interest	20%	55%	25%	10%	85%	5%
media risk	the media is critical, neutral, supportive of the project	20%	45%	35%	70%	25%	5%
risk of public perception	the concept of PPP tollroad is unwelcome, seen to be neutral, welcome by the public	10%	65%	25%	30%	25%	45%

Questions:

Which contract do you think a consortium bid team would prefer?	○	○
Which contract do you think the public agency would prefer?	○	○
Would you accept the contract you prefer if it actually existed?	○ Yes	○ No
To what extent (in percentage term) do you think the other party would accept the contract you prefer?		____ %

Next

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Game 5 / 5: How did you decide (1)?

Warning: do not use the back button on your mouse or the back arrow on your browser to go back to previous screens or the survey will close.

Were there any contract attributes that you ignored when making your decision?
Click on any attribute levels that you ignored (they will turn grey, click again if you change your mind; you can make multiple selections).

	Contract A			Contract B		
Risk Attributes	risk neutral	downside risk	upside gain	risk neutral	downside risk	upside gain
traffic risk	50%	15%	35%	90%	5%	5%
financial risk	70%	15%	15%	80%	5%	15%
network risk	60%	35%	5%	80%	5%	15%
force majeure	90%	5%	5%	0%	55%	45%
sovereign risk	50%	15%	35%	0%	75%	25%
risk of unclear project objectives	30%	65%	5%	60%	35%	5%
political and reputational risk	20%	55%	25%	10%	85%	5%
media risk	20%	45%	35%	70%	25%	5%
risk of public perception	10%	65%	25%	30%	25%	45%

Which attribute(s) do you think the other party would likely to ignore when making their decision?
Click on any attributes that you think the other party would likely to ignore (they will turn grey, click again if you change your mind; you can make multiple selections).

	Contract A			Contract B		
Risk Attributes	risk neutral	downside risk	upside gain	risk neutral	downside risk	upside gain
traffic risk	50%	15%	35%	90%	5%	5%
financial risk	70%	15%	15%	80%	5%	15%
network risk	60%	35%	5%	80%	5%	15%
force majeure	90%	5%	5%	0%	55%	45%
sovereign risk	50%	15%	35%	0%	75%	25%
risk of unclear project objectives	30%	65%	5%	60%	35%	5%
political and reputational risk	20%	55%	25%	10%	85%	5%
media risk	20%	45%	35%	70%	25%	5%
risk of public perception	10%	65%	25%	30%	25%	45%

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Game 5 / 5: How did you decide (2)?

Warning: do not use the back button on your mouse or the back arrow on your browser to go back to previous screens or the survey will close.

What level of risk did you tend to focus mainly on?

Please rank the three levels in ascending order (1 = least focus on; 3 = most focus on).

	Least focus on		Most focus on
risk neutral	○ 1	◉ 2	○ 3
downside risk	◉ 1	○ 2	○ 3
upside gain	○ 1	○ 2	○ 3

This is the end of all games. The next 4 screens will seek your personal views on the risk-sharing arrangements in PPP tollroads, and the extent to which the other factors are important to you in deciding to enter into a PPP tollroad concession.

Next

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Your Prior Experience

Warning: do not use the back button on your mouse or the back arrow on your browser to go back to previous screens or the survey will close.

Given your experience with PPPs, can you tell us what is the most representative risk-sharing arrangement present in the recent PPP tollroad projects that you were involved in?

For each risk attribute, please provide your answer in percentage terms for "downside risk" and "upside gain" , the value for "risk neutral" will be automatically calculated as the residual.

		Prior Contract		
Risk Attributes	Brief Definitions of Each Risk Attribute	downside risk	risk neutral	upside gain
traffic risk	actual patronage below, met, above forecast	%	100 %	%
financial risk	actual returns below, met, above forecast	%	100 %	%
network risk	future traffic flows will be reduced, no change, increased by network developments	%	100 %	%
force majeure	uninsured events will worsen, no effect, improve the project's performance	%	100 %	%
sovereign risk	future changes in public policies will worsen, no impact on PPP policy fragmentations, or result in more coherent PPP policy framework	%	100 %	%
risk of unclear project objectives	project objectives are unspecified, clearly specified, clearly communicated and adhered to	%	100 %	%
political and reputational risk	the PPP project is seen to be not in, neutral to, in the public interest	%	100 %	%
media risk	the media is critical, neutral, supportive of the project	%	100 %	%
risk of public perception	the concept of PPP tollroad is unwelcome, seen to be neutral, welcome by the public	%	100 %	%

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Attitudinal Questions (1)

Q1 We would like to understand your personal views on optimal risk-sharing arrangements in PPP tollroads.

Please rate on a 1 to 7 scale to indicate the extent to which that the following risks have been adequately dealt with in the PPP tollroad contracts that you have been involved in. (1= not well at all, 7 = very well)

Please briefly explain your choice in the space provided.

	not well at all 1	2	3	4	5	6	very well 7	Reason (optional)
a. traffic risk	○	○	○	○	○	○	○	
b. financial risk	○	○	○	○	○	○	○	
c. network risk	○	○	○	○	○	○	○	
d. force majeure	○	○	○	○	○	○	○	
e. sovereign risk	○	○	○	○	○	○	○	
f. risk of unclear project objectives	○	○	○	○	○	○	○	
g. political and reputational risk	○	○	○	○	○	○	○	
h. media risk	○	○	○	○	○	○	○	
i. risk of public perception	○	○	○	○	○	○	○	

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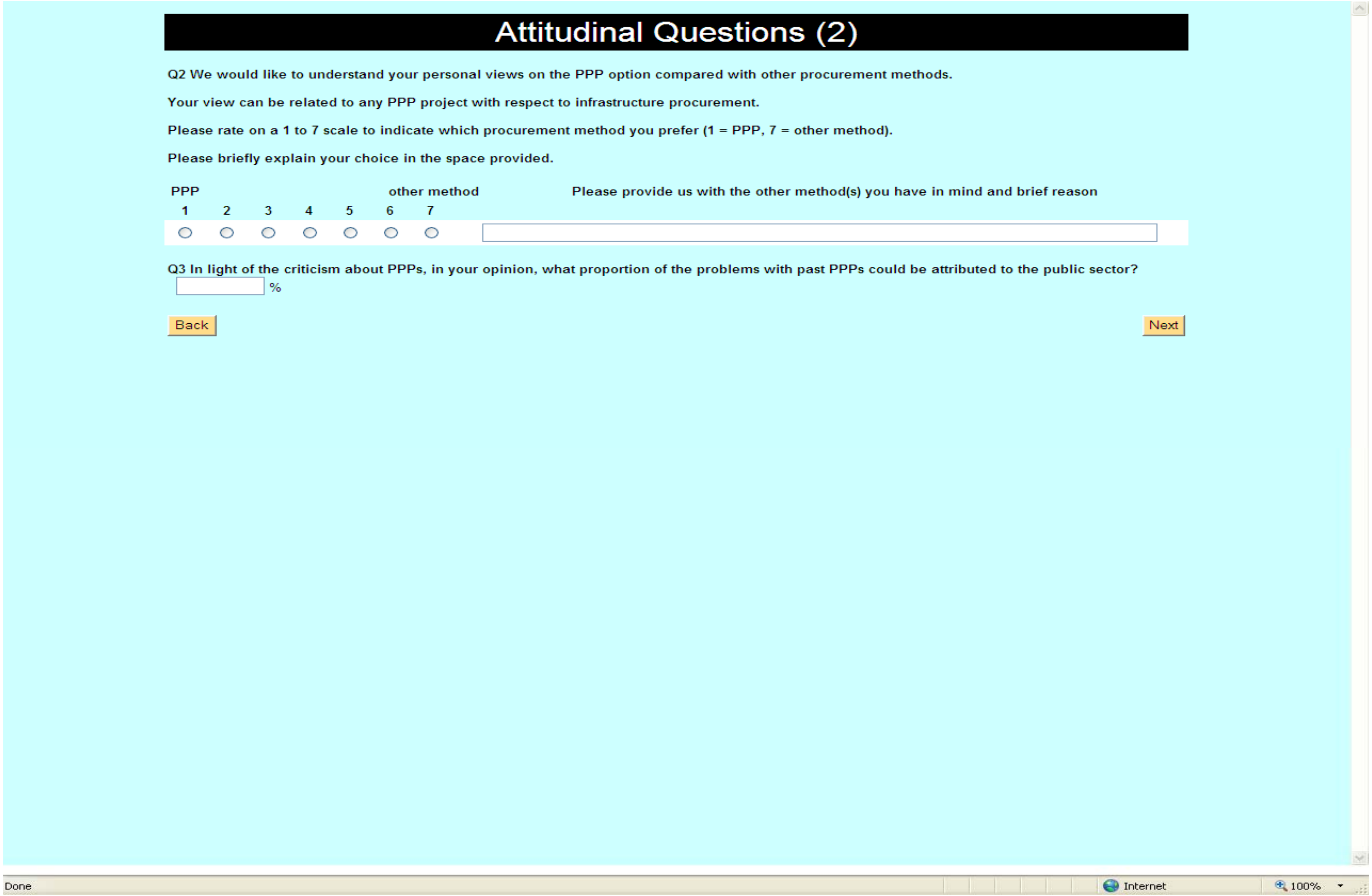
Attitudinal Questions (2)
Q2 We would like to understand your personal views on the PPP option compared with other procurement methods.
Your view can be related to any PPP project with respect to infrastructure procurement.
Please rate on a 1 to 7 scale to indicate which procurement method you prefer (1 = PPP, 7 = other method).
Please briefly explain your choice in the space provided.
PPP
other method
Please provide us with the other method(s) you have in mind and brief reason
1 2 3 4 5 6 7
Q3 In light of the criticism about PPPs, in your opinion, what proportion of the problems with past PPPs could be attributed to the public sector?
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Other Factors

How important are the following to you?

Please rate the following on a 1 to 7 scale (1= very unimportant; 7 = very important).

	very unimportant 1	2	3	4	5	6	very important 7
a. the impact of current global financial crises to tollroad financing	○	○	○	○	○	○	○
b. the future growth of private provision in transport infrastructure	○	○	○	○	○	○	○
c. the freedom of the private operator to set toll pricing	○	○	○	○	○	○	○
d. duration of the tollroad concession	○	○	○	○	○	○	○
e. performance standards embedded in the tollroad concession	○	○	○	○	○	○	○
f. financial penalties imposed on failing to meet performance standards	○	○	○	○	○	○	○
g. private ownership to help government keeping work force at arms length	○	○	○	○	○	○	○
h. private ownership as a way of making it easier to charging users a toll	○	○	○	○	○	○	○
i. proper toll pricing to manage traffic demand	○	○	○	○	○	○	○
j. the sharing of toll revenue with the other party	○	○	○	○	○	○	○
k. the availability model to incentivise efficient performance during the operational phase	○	○	○	○	○	○	○
l. land acquisition risk is borne by government	○	○	○	○	○	○	○

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And finally…

Are there some other aspects in your engagement in PPP tollroads that you think are important and you would like to share with us?

Comments or feedback:

If you are interested in receiving a summary of the main findings of this research, please provide your email address.

email:

Please click 'I Agree' if you wish to be included in the acknowledgement.

☐ I Agree

Name

Organisation (optional)

Back

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Thank you very much for completing this survey, we hope that you enjoyed taking part in this study!

Done

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Appendix F: List of Survey Participants

The table below lists, in alphabetical order, the people who generously offered me their valuable time in filling out the experiment survey and shared with me their invaluable expertise in the field of PPPs and tollroads. I wish to take this opportunity to acknowledge their generosity and kindness, as well as the people who wish to remain anonymous, without whom, this research would not have been possible.

Comments expressed in this thesis are entirely mine, they do not represent the views or opinions of any individual who participated in the survey.

LAST NAME	OTHER NAMES	ORGANISATION
Adam	Wendy	PB, AUSTRALIA
Akers	Gillian	Strategic design + Development
Allen	Bob	Sydney Harbour Tunnel Company Ltd
Alli	Nazir	South African National Roads Agency Ltd
Arndt	Raphael	Future Fund
Arriaga	Javier Lopez	Acciona, SPAIN
Ashley	David	SKM, AUSTRALIA
Aubert	Julian	Scott Wilson, UK
Balfe	Peter	Balfe & Assoc
Bleach	Murray	Intoll
Brock	Tom	GHD Pty Ltd, AUSTRALIA
Brown	Stephen	Access Capital Advisers
Burns	Brett	
Camarsh	Chris	CP2, USA
Canavan	Tony	Department of Treasury and Finance, VIC
Cantan	Linda	Plenary Group
Carew	Mark	Transfield Services
Carr	John	PwC, UK
Cavanagh	Gerard	Arup
Chilov	Robert	Macquarie Group
Clark	Sarah	Partnerships British Columbia, CANADA
Cleary	Flan	RiverCity Motorway
Cleary	Michael	ANZ
Coertjens	Ton	Rijkswaterstaat, NETHERLANDS
Daley	Ken	Transurban, USA
Dawson	Ken	Crosscity Motorway

de Vera	Fernando GutiÃ©rrez	
DEAU	Thierry	Meridiam Infrastructure
D'Elia	Mario	PwC, AUSTRALIA
Dent	Des	10,000 Friends of Greater Sydney
Devoil	Neal	John Laing, UK
Dobinson	Ken	Dobinson & Associates Pty Ltd
Dunn	Matthew	NSW Treasury
Easson	Michael	EG Funds Management
Foster	Paul	AMP Capital Investors
Gardiner	John	
Gavilanes	Gerardo	Ministry of Fomento, Spain
Godley	Robert	Halcrow, UK
Goldsmith	Paul	RTA, NSW
GonzÃ¡lez	J. Dionisio	CRTM (Madrid Region PTA), SPAIN
Gordon	Cameron	University of Canberra
Heavener	Norman	Westpac Banking Corporation
Hombergen	Leon	Rijkswaterstaat, NETHERLANDS
Humffray	Howard	John Holland Group, AUSTRALIA
Jellie	David	
Johnston	Neal	Ernst & Young, AUSTRALIA
Kessler	Peter	John Holland Group, AUSTRALIA
Lackey	Sam	RTA NSW
Larocca	David	Ernst & Young, AUSTRALIA
Laughton	Graeme	GRL Consulting Services
Lay	Max	Connect East
Lee	Joung	American Association of State Highway and Transportation Officials, USA
Locke	M. S.	PwC, AUSTRALIA
Lord	Thomas	Abigroup
Mathers	Ken	Linking Melbourne Authority, VIC
McKerral	John	
Milcz	Chris	CBA
Misko	Marko	Clayton Utz
Morris	Rob	
Mounsey	Graham	AECOM
Munro	Ian	Queensland Treasury, QLD
Murray	Peter	Ernst & Young, AUSTRALIA
Murray	Steve	Clayton Utz
O'Shea	Paul	Transurban (till 2008)
Papantoniou	Peter	City North Infrastructure Pty Ltd, QLD
Paradis	Charles	Bouygues Construction, FRANCE
Perez-Diaz	Marcos	Egis Projects, FRANCE
Plant	Tom	Macquarie Capital
Priddis	John	CBA

Read	Graham	Blake Dawson, AUSTRALIA
Reynolds	Ken	Baulderstone, AUSTRALIA
Rubio	Nicolas	Cintra, USA
Sandrejko	Ed	CrossCity Tunnel
Scarcella	Vincent	Department of Transport and Main Roads, QLD
Scott	William	QIC, AUSTRALIA
Smith	Alf	Department of Industry, Innovation and Regional Development, VIC
SoliÃ±o	Antonio SÃ¡nchez	Universidad PolitÃ©cnica de Madrid, SPAIN
Sonego	Massimo	Atlantia, ITALY
Stevens	Craig	Dept of Infrastructure & Planning, QLD
Theau	Ludovic	Hastings Funds Management, FRANCE
Tiong	Robert	NTU, SINGAPORE
Vann	Brad	Clayton Utz
Vassallo	Jose Manuel	Universidad PolitÃ©cnica de Madrid, SPAIN
Ware	Julian	TfL, UK
Warren	David	Corrs Chambers Westgarth, AUSTRALIA
Warwick	Richard	GHD Pty Ltd, AUSTRALIA
Webb	Matthew	RTA NSW
Wilson	Bruce	Bilfinger Berger Services, AUSTRALIA
Wilson	Chris	Halcrow, AUSTRALIA
Wilson	Ray	BrisConnections

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