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Linkage Projects: Project ID: LP160100259

“Innovative procurement theories to optimise educational outcomes per total cost of school facilities”

ARC Value in Operations

<https://research.qut.edu.au/arcvio/>

Research Activity #2 Real Options Study & Tool

*“An Empirical Study of an Integrated Theory of Transaction Costs and Real Options:
Advancing the Flexibility of Public-Private Partnerships”*

Research Team

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Research Activity #2 Real Options Study

- A **real option** itself, is the right—but not the obligation—to undertake certain business initiatives
- **Real options analysis**, as a discipline, extends from its application in **corporate finance**, to decision making under uncertainty in general, adapting the techniques developed for financial options to **“real-life” decisions**

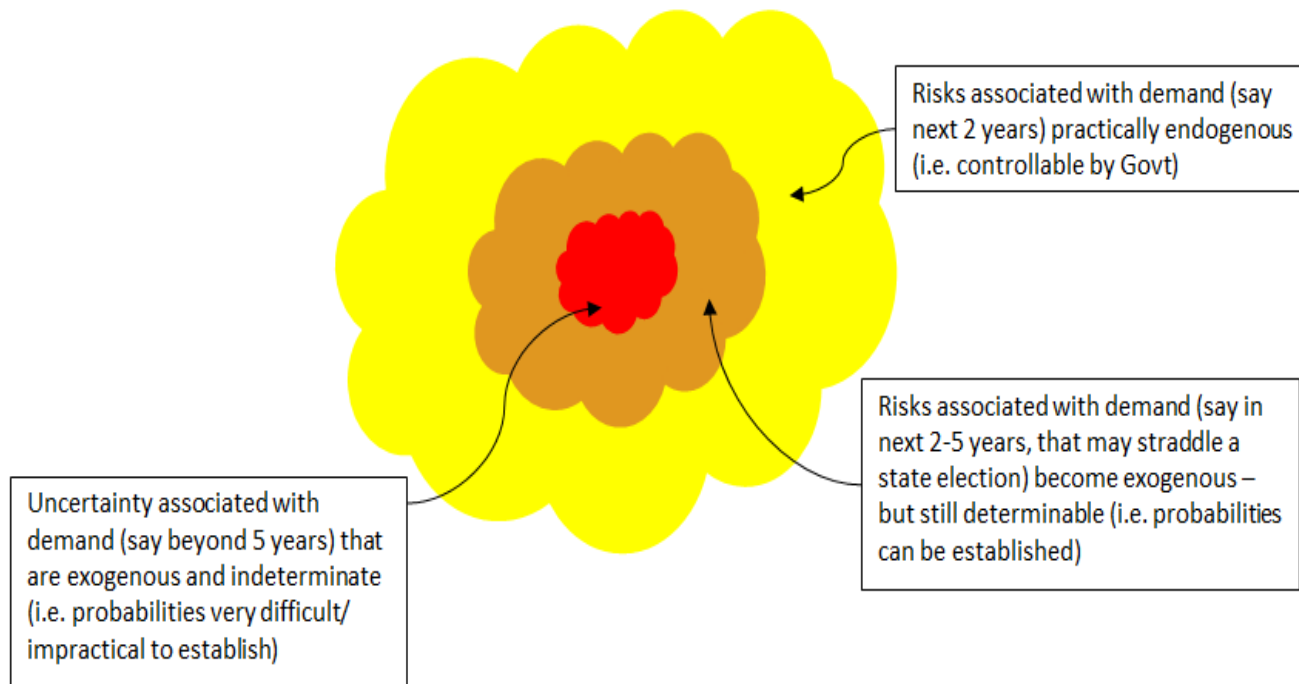
Research Activity #2 Real Options Study

- Examples of Real Options in an **availability-type PPP school setting**

Optionality	Example	Example in setting
Project Life and Timing	Accelerate	Bringing forward one or more schools in the contract
	Defer	Push back one or more schools in the contract
	Sequencing	Maintain overall staging of schools but switch the staging of one or more pairs of schools
Project Operation	Output Mix	Change mix of schools in contract e.g. alter proportion of primary, secondary, special schools
	Input Mix	Defer decision on possible change to technology after first major refurb (e.g. IT, M&E, vertical transport in vertical schools)
Project Size	Expand	Practically not applicable (in terms of real option) in this setting
	Contract/Abandon	Not applicable (in terms of real options) in this setting

Research Activity #2 Real Options Study

- Uncertainty in Real Options in an availability-type PPP school setting → *e.g. Staging*



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- Uncertainty in Real Options in an availability-type PPP school setting → **e.g. Staging**

Schools PPP Contract	Yr1	Yr2	Yr3	Yr4	Yr5
A	Stage 1		Stage 2		
B	Stage 1		Stage 2		
C		Stage 1		Stage 2	
D		Stage 1		Stage 2	
E			Stage 1		Stage 2
F			Stage 1		Stage 2

Traditional single point approach
(most likely opening date)

Option/s to accelerate and/or
defer (say 12 months or more in
one or more of the stages)

Research Activity #2 Real Options Study

- Uncertainty in Real Options in an availability-type PPP school setting → *e.g. Staging*
 - **Traditional** (single-point/"mostly likely"/single-point) **thinking**
 - Each stage based on most likely opening date
 - Govt retains risk of opening date (i.e. demand risk)
 - In contrast...**Real Options thinking**...

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– ...Real Options thinking

- Allows Govt to efficiently transfer (buy) this staging risk/this kind of demand risk
- At same time, PPP Co can achieve net-benefits from selling the option
- Promotes the **flexibility and viability** of PPPs vis-à-vis the PSC particularly at the current time as we move into more transparent accounting standards and increased **visibility of Value for Money** of PPP verses the PSC (traditionally financed procurement)
 - AASB16 from 1st July 2019 availability PPP contract move from off-balance to **on-balance sheet**

Research Activity #2 Real Options Study

- Literature (academic)

- ROA applied in a wide range of sectors but no empirical studies found in educational infrastructure...
- Furthermore, ROA applied in PPPs but no empirical studies found in availability-type PPPs
- Most fundamentally, across the entire ROA literature, there is no formal theoretical framework to assist managers to identify opportunities to create real options
 - Recall from Slide #2, mostly all we have is “Real options are most valuable when **uncertainty** is high”

Research Activity #2 Real Options Study

- Literature (*practice-based*)
 - Good practice guides...e.g.
 - **OECD recent report** on advancing private investment into infrastructure focuses on reducing endogenous uncertainty and avoiding high prices pre contract – in doing so practically **ignores exogenous uncertainty** that leads to costly hold-up post contract



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- Literature (practice-based)

- Meanwhile in **Australia**, Real Options thinking is not fully developed e.g. **VIC (2018) guidance on Real Options on PPPs** overlooks buyer/Govt exercising Real Options Availability-Type PPPs...



Appendix 7: Real options and procurement approaches

Procurement model	Ability of method to manage a real options approach	Pros	Cons
Contract with	Flexibility can be fully considered during the planning and design phase. Flexibility can be retained by entering into a contract with contract flexibility clauses. Contractors are incentivised to provide solutions to emerge and use it in the process.	May allow a higher level of contractor involvement in project delivery. Contractors may prefer to manage contract flexibility clauses. Contractors may not be incentivised to emerge and use it in the process.	May allow a higher level of contractor involvement in project delivery. Contractors may prefer to manage contract flexibility clauses. Contractors may not be incentivised to emerge and use it in the process.
Design and construct and operate	Flexibility can be fully considered during the planning phase. May allow for contractor solutions to emerge at the design stage.	May allow a higher level of contractor involvement in project delivery. Contractors may prefer to manage contract flexibility clauses. Contractors may not be incentivised to emerge and use it in the process.	May allow a higher level of contractor involvement in project delivery. Contractors may prefer to manage contract flexibility clauses. Contractors may not be incentivised to emerge and use it in the process.
Design and construct	Flexibility can be fully considered during the planning phase. May allow for contractor solutions to emerge at the design stage. Procurement flexibility for a real options approach may be facilitated through design and construct.	May allow a higher level of contractor involvement in project delivery. Contractors may prefer to manage contract flexibility clauses. Contractors may not be incentivised to emerge and use it in the process.	May allow a higher level of contractor involvement in project delivery. Contractors may prefer to manage contract flexibility clauses. Contractors may not be incentivised to emerge and use it in the process.
Early contractor involvement	Flexibility can be fully considered during the planning phase. May allow for contractor solutions to emerge at the design stage. Procurement flexibility for a real options approach may be facilitated through design and construct.	May allow a higher level of contractor involvement in project delivery. Contractors may prefer to manage contract flexibility clauses. Contractors may not be incentivised to emerge and use it in the process.	May allow a higher level of contractor involvement in project delivery. Contractors may prefer to manage contract flexibility clauses. Contractors may not be incentivised to emerge and use it in the process.
Partner	Flexibility can be fully considered during the planning phase. May allow for contractor solutions to emerge at the design stage. Procurement flexibility for a real options approach may be facilitated through design and construct.	May allow a higher level of contractor involvement in project delivery. Contractors may prefer to manage contract flexibility clauses. Contractors may not be incentivised to emerge and use it in the process.	May allow a higher level of contractor involvement in project delivery. Contractors may prefer to manage contract flexibility clauses. Contractors may not be incentivised to emerge and use it in the process.
Public Private Partnership	Flexibility can be fully considered during the planning phase. May allow for contractor solutions to emerge at the design stage. Procurement flexibility for a real options approach may be facilitated through design and construct.	May allow a higher level of contractor involvement in project delivery. Contractors may prefer to manage contract flexibility clauses. Contractors may not be incentivised to emerge and use it in the process.	May allow a higher level of contractor involvement in project delivery. Contractors may prefer to manage contract flexibility clauses. Contractors may not be incentivised to emerge and use it in the process.
Build Operate Transfer	Flexibility can be fully considered during the planning and design phase. May allow for contractor solutions to emerge at the design stage. Procurement flexibility for a real options approach may be facilitated through design and construct.	May allow a higher level of contractor involvement in project delivery. Contractors may prefer to manage contract flexibility clauses. Contractors may not be incentivised to emerge and use it in the process.	May allow a higher level of contractor involvement in project delivery. Contractors may prefer to manage contract flexibility clauses. Contractors may not be incentivised to emerge and use it in the process.

Note: In using real options, with different procurement methodologies

Public Private Partnership

Use of functional requirements specification rather than design specification could increase design flexibility opportunities

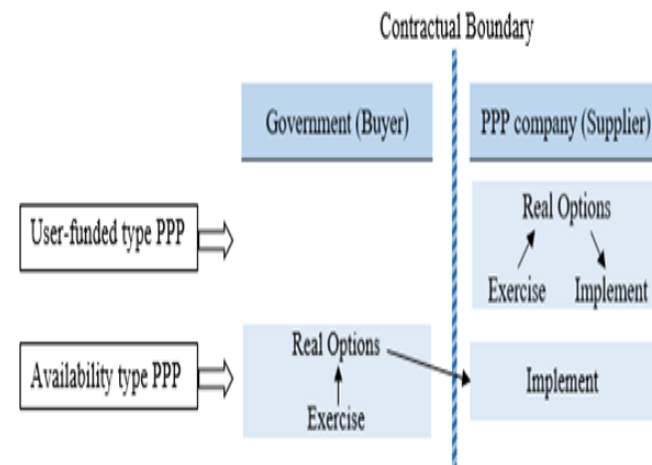
Contractor involvement in service delivery could provide an incentive to consider in-project options

Depending on contract, contractor may not have appropriate incentives to adopt a real options approach

Research Activity #2 Real Options Study

- Aim of study...

- Develop a **practical tool** on how ROA can be used in an availability-type PPP school project
- That is, we focus on the **uniqueness of Real Options in availability PPPs** i.e. exercising real options across a contractual boundary...



Research Activity #2 Real Options Study

- The option is found to be a **negative value** that equals the **upfront price government would pay** for the option
- And similar to an insurance policy **on average the PPP Company is better rewarded**

Real option to bring forward D&C

PPP INPUT:

The arrival of the decision to bring D&C forward is Stochastic (Binomial distribution):

n =	100
p =	0.5%

It is assumed that the chosen (forward) start time of D&C follows a uniform distribution (RANDBETWEEN).

Planned Start (Years from today)	10
Earliest Start (Years from today)	1
Base for Additional Cost (percentage of D&C)	10%

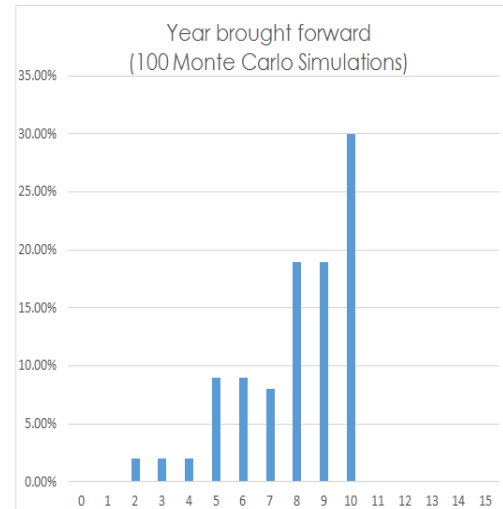
PV of D&C \$ 200.0

Time Value of Money (for NPV calculations) 4%

EXPECTED PV OF THE CONTRACT:

1. Expected PV D&C (AS ORIGINALLY AGREED)	\$ 200.00
2. Expected PV D&C (WITH OPTION TO BRING FORWARD)	\$ 227.44
3. Value of the Real Option (= 1-2)	-\$ 27.44

<https://www.vertex42.com/ExcelArticles/mc/GeneratingRandomInputs.html>
http://people.stern.nyu.edu/adamodar/New_Home_Page/Statfile/statdistns.h



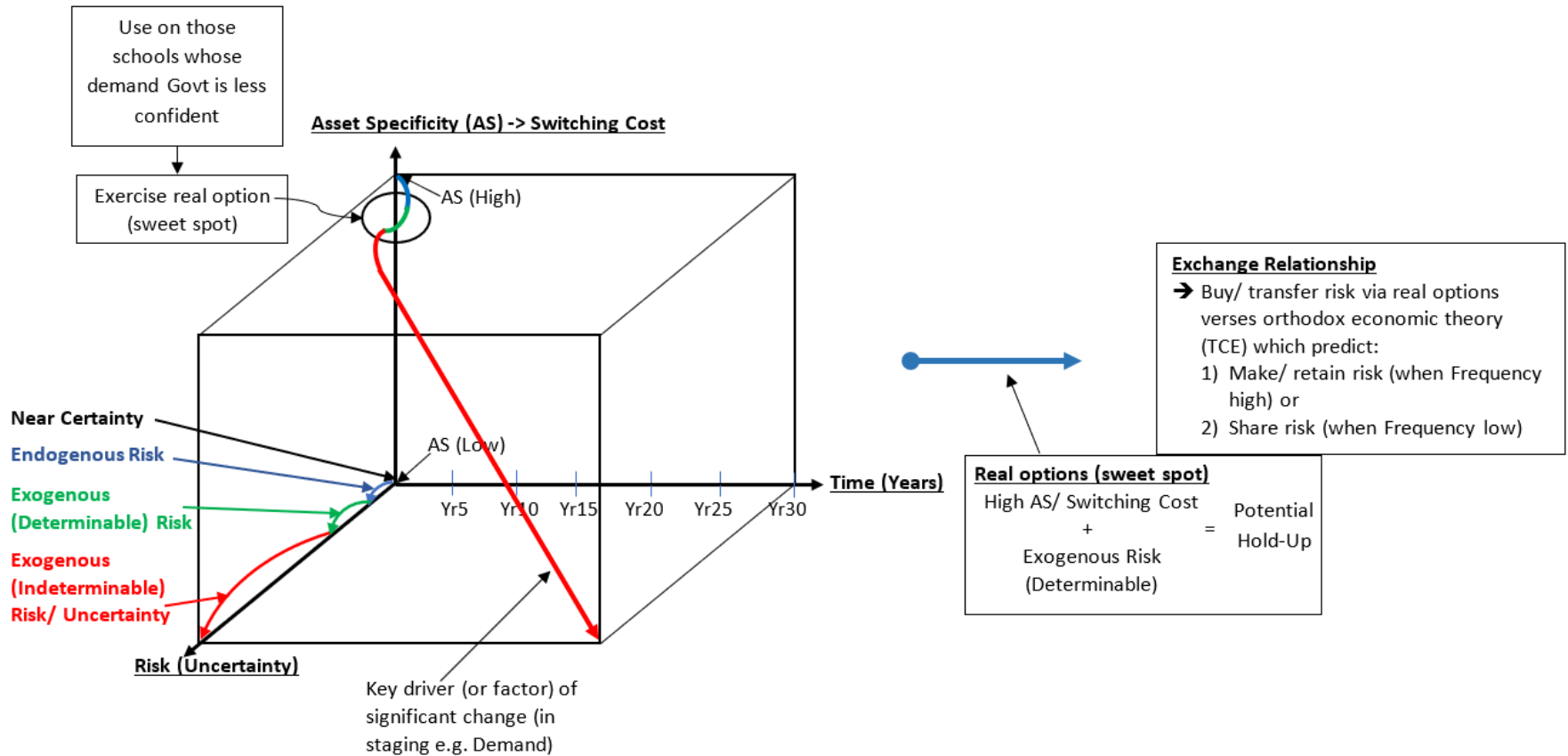
Research Activity #2 Real Options Study

- Aim of study...

- And in developing a practical tool, this study also aims to:
 - Develop a **new tool i.e. key filters (or variables in new theoretical framework)** to assist managers to identify where and when opportunities to create real options
 - Because managers can't stop and do a PhD study on each situation they face! Hence, a **predictive tool** (we're developing out of theory) is way to go 😊

Research Activity #2 Real Options Study

- New tool**, or **filters** to search for events that are likely yield **viable real options**... (= **basis of study's**



Hypothesis

Real options are more likely to be viable (providing net savings for the buyer and providing net gains, on average, for the supplier), where the buyer has made significant transaction specific investments and faces high switching cost and hold-up associated with exogenous (determinable) risks regardless of the Frequency of these transactions required by the buyer.

Research Activity #2 Real Options Study

Alternative A. Remain/Stay with PPP Company

- Negotiate/finalize the cost of the change to staging ex post/with an existing PPP Company

Alternative B. Leave/Switch from PPP Company to different contractor/s

- Omit the work in an existing PPP contract that is affected by the staging change
 - Negotiate the cost of this omission ex post with the existing PPP Company
 - Establish and agree/finalize the cost of this work with new contractor/s

Alternative C. Remain/Stay with PPP Company

- Exercise a real option to change to staging that was agreed and priced ex ante/as part of the contract sum with the existing PPP Company

A

B

C

