A survey of capital budgeting techniques used by Australian firms

Pratheepkanth Puwanenthiren
Department of Accounting, University of Jaffna Sri Lanka

Premkanth Puwanenthiren
Roehampton Business School, Roehampton University London

Abstract: Capital budgeting (CB) encompasses making investment decisions concerning the financing of investments by firms. This research examines the CB techniques employed by Australian firms to ascertain whether CB techniques vary significantly among the firms and whether these variances can be explained by differences attributed to different firms and its CFOs attributes. This study adopts a quantitative approach. There was a structured questionnaire survey to discover the CB techniques in the context of Australia, as an example of a developed market. The questionnaires were posted to 150 Australian firms, asking about the firm and the respondent's demographics along with various aspects of CB techniques, giving a response rate of 48.7 percent. The results revealed that Australian firms tend to use sophisticated techniques (i.e. NPV, IRR, WACC and CAPM) as their most frequently used CB techniques and the usage appears to be more common and important than what has been noted in many earlier studies. However, PBP is also prevalent (83 percent). This indicates that the sophistication of CB techniques appears to be significantly (if not mostly) influenced by attributes of the firm and the respondents. This finding supports the contingency theory—i.e. the CB techniques/investment approach of a firm should fit with the firm's attributes and those of its principles.

Key words: Capital budgeting, sophisticated techniques, investment approach

1.   INTRODUCTION

Comprehensive financial management and capital investment decision making are critical for the survival and long-term success of firms. The Global Financial Crisis (GFC) has confirmed this truth (Bennouna, Meredith, & Marchant, 2010). The significance of corporate investment decisions lies in their impact on the stakeholders' wealth (Beranek, 1975; Bosch-Badia, Montllor-Serrats, & Tarrazon-Rondon, 2014; Cooper & Petry, 1994). In this context, a firm's decision to capitalise

Correspondence: Pratheepkanth Puwanenthiren, University of Jaffna, Sri Lanka. Email: *ppratheep@univ.jfn.ac.lk*

a new investment should be made according to whether the investment increases the wealth of the firm's stakeholders (Jensen, 2001). Capital budgeting (CB) has been defined in various ways, by various researchers, at various times—i.e. Mullin (2007) suggests that CB practices tie together decisions about the long-term investment of a firm's capital and its operations; Major (1995) defines it as a situation where firms make current resource expenditure for benefits to be realised in the future. The selection of appropriate CB techniques, as a part of capital investment decision making, is an essential managerial activity (Roubi, Barth, & Faseruk, 2011; Wnuk-Pel, 2014). Investment decisions should rely on CB appraisal techniques to evaluate and sort out the quality of investment opportunities (Adler, 2006; Tappura, Sievanen, Heikkila, Jussila, & Nenonen, 2014). Measuring the extent to which firms employ selected CB techniques has been the general theme of several studies over the past decades. Most of these studies have concentrated on a narrowly defined set of CB techniques and have generally entailed an examination of the appraisal tools in use (Bennouna et al., 2010; Graham & Harvey, 2001; Maroyi & van der Poll, 2012; Truong, Partington, & Peat, 2008). Prior studies on CB techniques in many countries have revealed that firms are progressively employing more and more refined CB techniques for the decision making in investment (Graham & Harvey, 2001; Maroyi & van der Poll, 2012; Truong, Partington, & Peat, 2008). This study focuses on the CB techniques in Australia as a developed country. Many researchers have made extensive efforts to survey and identify the quantitative techniques used by firms around the world. However, the literature review suggests that CB studies (with some exceptions) have mostly focused on the United States and the United Kingdom (Arnold & Hatzopoulos, 2000; Alkaraan & Northcott, 2006; Graham & Harvey, 2001; Shao & Alan, 1996). There are only a few studies available for Australia (Freeman & Hobbes, 1991; Truong et al., 2008) which have yielded mixed results and that there is still significant scope for studies of the situation in Australia. Australia is a typical example of a developed economy and albeit in the world arena, it is often considered a small open economy, its business practices are well respected. Further reasons for considering Australia is to include its ability to weather the Global Financial Crisis (GFC); its ability to continuously improve its capital markets through regulations, whilst at the same time maintaining high corporate ethical standards. This study will examine the CB techniques of Australian firms in order to provide insights and evidences of the use of differing investment analysis, techniques and tools to help managers determine the most appropriate CB portfolio that will help maximise the firm's wealth. The paper is organised as follows. Section 2 discusses previous studies on CB and hypotheses development. This is followed by a discussion of the design approach and method in section 3. Section 4 then provides the results of the survey and a discussion of the empirical analysis of determinants of capital budgeting techniques. The paper ends with a summary and discussion of the results in section 5.

2. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

CB-technique focused studies have a long tradition in finance literature. Several articles have dealt with capital appraisal techniques around the world. Most of these studies have focused on developed countries such as the USA (Graham & Harvey, 2001; Shao & Alan, 1996), Canada (Baker, Dutta, & Saadi, 2011; Bennouna et al., 2010; Jog & Srivastava, 1995), the United Kingdom (Arnold & Hatzopoulos, 2000; Alkaraan & Northcott, 2006), and Australia (Freeman & Hobbes, 1991; Truong et al., 2008). On the basis of recent studies in the USA, Chief Financial Officers (CFOs) are not always in agreement as to the best choice of theoretical methods. CFOs have applied various methods and techniques to determine which investments are beneficial to the firm. The choice of evaluation method may therefore be determined by individual preferences of the manager and/or by the environment in which decisions have to be made (Hermes et al., 2007). Contingency theory suggests that for a firm to be effective, there must be a strong fit between its structure and context. Consequently, resource-distribution efficiency is not individually achieved via adopting only the sophisticated and theoretical best-investment techniques and procedures, but also entails the fit between the corporate context and the design and operation of the CB system (Pike, 1988). CB in the USA have been comprehensively surveyed concerning their firms' investment appraisal. Klammer (1973) found that whereas only 19 percent of a sample of large industrial firms used DCF techniques to evaluate proposed capital investments in 1959, this has increased to 38 percent in 1964 and 57 percent in 1970. Hendricks (1983) reported that the percentage increased to 76 percent by 1981. Bierman and Smidt (1993) reported that 99 percent of the respondents in their 1992 survey of the 100 largest Fortune 500 firms used IRR or NPV as either the primary or secondary evaluation measure. Graham and Harvey (2001) noted that approximately 75 percent of respondents selected NPV and IRR as their most frequently used CB techniques; and also that small firms employed the PBP almost as frequently as other DCF techniques. Block (2005) noted that 14 percent of the firms used RO in their CB practices. Trends in the UK over the past four decades are quite revealing. Pike's (1988) study noted that the use of DCF methods had increased from 58 percent in 1975 to 84 percent in 1986 with IRR being used by 42 percent of the firms compared with 23 percent for the NPV method. The PBP was the most widely used technique and was adopted by 92 percent of the respondents including 47 percent stating that they always use this method. Further studies in the 1990s noted the continuous use by UK firms of DCF techniques with Wilkes et al. (1996) suggesting by 1994 the use of such techniques had risen to around 85 percent (much more than what was found in most earlier studies). These results indicate that the theory-practice gap is narrowing. Whereas DCF was used by only 58 percent of large firms in 1975, most large firms

are now using either IRR or NPV with over 90 percent of small and medium firms also using these methods. Furthermore, one third of large firms in 1975 used one technique, with approximately one third using two techniques and the remaining one third using three or more techniques. Recent studies show 67 percent of firms now use three or more techniques for their appraisal (Alkaraan & Northcott, 2006). The general picture in the UK is that the PBP method is still an important method while the DCF methods seem to have also increased in importance. DCF has become the main appraisal techniques in Canada (Bennouna et al., 2010; Jog & Srivastava, 1995). In particular, the use of DCF appears to have increased from a low of around 35 percent in the early 1960s to approximately 90 percent or more in the early 1990s. NPV is now widely utilised among Candian firms but a sizeable percentage still uses IRR as their primary model in capital decision making. The theory-practice gap remains a regular theme in the CB Canada based literature, in particular with regard to NPV. Compared to previous Canadian studies, there has been a narrowing of the theory-practice gap. While the 2011 survey shows that 17 percent of responding firms used RO for their CB decisions (Baker et al., 2011), majority of Canadian firms use risk analysis tools with the main ones being sensitivity analysis, scenario analysis and risk-adjusted discount rates. Compared to previous researches, recent studies show a substantial increase in sensitivity analysis and the use of risk-adjusted discount rates. Comparing the results of studies by Lilleyman (1984) and McMahon (1981) and their study outcomes, Freeman and Hobbes (1991) found an increase in the use of DCF techniques from 52 percent of respondents in 1979 to 75 percent in 1989. Kalyebara (1998) also found that 75 percent of respondents in a 1996 survey used NPV followed by IRR and PBP. While the study found that the use of DCF techniques dominated, PBP was still employed in investment appraisals. A majority of extant studies specify that firms use more than one techniques. More recently, Truong et al. (2008) found that 94 percent of CFOs used NPV, followed by PBP and IRR. They also noted that RO analysis has gained more relevance in CB in Australia, albeit it was not yet a part of the main stream.

Table 1. Capital Budgeting Appraisal Techniques in Developed Countries*

Author	Year published	Country	Most favoured	DCF (%)		NDCF (%)	
				IRR	NPV	PBP	ARR
Freeman & Hobbes	1991	Australia	NPV	72.00	75.00	44.00	33.00
Kester, Chang, Echanis, Haikal, Mansor, Skully, Tsui, & Wang	1999	Australia	NPV/IRR	96.00	96.00	93.00	73.00
Truong, Partington, & Peat	2008	Australia	NPV	81.00	94.00	90.00	57.00
Jog & Srivastawa	1995	Canada	IRR	62.00	41.00	53.70	14.90
Bennouna, Meredith, & Marchant	2010	Canada	NPV	87.70	94.20		

Baker, Dutta, & Saadi	2011	Canada	NPV	68.40	74.60	67.20	39.70
Liljeblom & Vaihekoski	2004	Finland	IRR/PBP	22.90	18.80	22.90	6.30
Brounen, De Jong, & Koedijk	2004	France	PBP	44.07	35.09	50.88	16.07
Brounen, De Jong, & Koedijk	2004	Germany	PBP	42.15	47.58	50.00	32.17
Hanaeda & Serita	2014	Japan	PBP	26.51	23.35	56.02	43.87
Shinoda	2010	Japan	IRR	75.61	74.93	56.74	20.29
Brounen, De Jong, & Koedijk	2004	Netherland	NPV	56.00	70.00	64.71	25.00
Hermes, Smid, & Yao	2007	Netherland	NPV	74.00	89.00	84.00	2.00
Wnuk-Pel	2014	Poland	IRR	58.00	57.00	34.00	15.00
De Andrés, De Fuente, & San Martín	2015	Spain	IRR	74.10	71.10	39.30	
Holmen & Pramborg	2009	Sweden	PBP	34.00	49.00	57.00	38.00
Sandahal & Sjögren	2003	Sweden	PBP	22.70	52.30	78.10	21.10
Daunfeldt & Hartwig	2014	Sweden	NPV	30.05	61.14	54.40	23.83
Brounen, De Jong, & Koedijk	2004	UK	PBP	53.13	46.97	69.23	38.10
Drury & Tayles	1996	UK	PBP	57.00	43.00	63.00	41.00
Pike	1996	UK	PBP	81.00	74.00	94.00	50.00
Pike	1986	UK	PBP	75.00	68.00	92.00	56.00
Ballantine, Galliers, & Stray	1995	UK	PBP	7.00	3.00	16.00	11.00
Block	2005	UK	PBP	39.00	38.00	76.00	28.00
Arnold & Hatzopoulos	2000	UK	IRR	68.00	62.00	46.00	41.00
Alkaraan & Northcott	2006	UK	NPV	89.00	99.00	96.00	60.00
Wilkes, Samuels, & Greenfield	1996	UK	PBP	80.00	65.00	89.00	43.00
Sangster	1993	Scotland	PBP	58.00	48.00	78.00	31.00
Block	1997	US	PBP	16.40	11.20	42.70	22.40
Graham & Harvey	2001	US	IRR	75.61	74.93	56.74	20.29
Ryan & Ryan	2002	US	NPV	76.70	85.10	52.60	14.70
Chen	2008	US	NPV/IRR				
Trahan & Gitman	1995	US	NPV	79.80	81.00	66.70	59.50
Burns & Walker	1997	US	IRR	84.00	73.00	73.00	21.00
Hassan, Shao, & Shao	1997	US	IRR	39.60	15.35	26.23	15.35

*Note: Percent of using discounted and non-discounted techniques among the developed countries including Australia, Canada, US, UK, Netherland, Germany, France, Sweden, Singapore, Japan, Finland and Poland.

Early and recent researches in CB in the US (Graham & Harvey, 2001), UK (Arnold & Hatzopoulos, 2000), Sweden (Sandahal & Sjogren, 2003), UK, Netherlands, Germany and France (Brounen et al., 2004), Netherlands and China (Hermes et al., 2007) and Australia (Truong et al., 2008), have reported that, over

time, firms are increasingly adopting more refined CB practices. However, for most of the parts, these studies have focused on the application and enhancement of modelling techniques. The mixed outcomes of that research suggest that a significant gap exists in understanding the nature, intensity and direction of the CB techniques among the developed countries. Based on the literature, the following alternative hypotheses are proposed to be tested.

H_1: CB techniques are applied more extensively in Australia as a developed country

H_2: Firms and respondents' attributes have an effect on the choice of CB techniques employed

3.   RESEARCH APPROACH AND METHODS

The population of interest in this study is (initially) the 200 listed firms on the Australian Securities Exchange (ASX) from S&P/ASX200 as at February 2017. In selecting the population, this study excludes financial, investment and securities sector firms because their unique financial attributes, intensity of regulation, and/or intensive use of leverage are likely to confound the outcomes being studied. Also, the risk of missing data was minimised by excluding firms that were not listed throughout the review period. After the eliminations, 150 Australian listed firms remained in the population. Table 2 (below) classifies the participating firms via the Global Industry Classification Standards (GICS).

Table 2. Participating Firms

Global Industry Classification Standard (GICS)	Australia
Consumer Discretionary	20
Consumer staples	07
Energy	20
Health Care	10
Industrials	30
Information Technology	04
Materials	47
Telecommunication Services	04
Utilities	08
	150

Source: Australian Securities Exchange official website

After careful consideration, a quantitative method approach was adopted in this study. A structured questionnaire survey was used to explore the CB techniques of Australian firms as an example of a developed market. The questionnaire sought

information on the CB techniques of the responding firms and included two types of questions. The first set of questions sought to describe attributes of the firm and its respondents while the second set investigated attributes of the CB techniques. The survey gives a descriptive study of CB techniques in Australian listed firms and the comparison of those CB techniques identifies similarities and differences in the practices between firms and CFO attributes.

4. RESULTS AND DISCUSSION

4.1. Descriptive Analysis

As shown in Table 3, the NPV and IRR methods are now the most widely used techniques among the Australian firms participating in the survey. NPV and IRR are the two most popular techniques, with 98 percent of the firms reporting that they use these techniques, although, PBP is also prevalent (83 percent) in Australia. Interestingly, a large percentage of Australian firms still use PBP. In contrast to this, other CB techniques such as discounted payback period (DPP) and ARR are less frequently used in Australia. However, only 51 percent of Australian firms use ARR as the prevalent CB techniques. The mean values for NPV and IRR techniques are 4.62 followed by PBP technique (4.16) in Australia.

Table 3. CB Appraisal Techniques

Techniques	Australia						
	Mean	Std	Frequently	Mostly	Neutral	Rarely	Never
PBP	4.16	0.903	41	42	13	2	2
DPP	2.87	1.401	16	20	24	16	24
ARR	3.24	1.417	22	29	18	13	18
NPV	4.62	0.614	67	31	2	0	0
IRR	4.62	0.535	65	33	2	0	0

The results also illustrate that scenario approach and sensitivity analyses are the most extensively used techniques for assessing the capital investments risk in Australia. The results indicate that among Australian respondents, 76 percent of the respondents use scenario approach or sensitivity analysis, 31 percent use decision tree approach while 26 percent of respondents employ probabilistic (Monte Carlo) simulation. Twelve percent and 13 percent of the respondents would usually use the decision tree approach and probabilistic (Monte Carlo) simulation respectively while only 16 percent of Australian respondents considered using a risk adjusted discount rate. The results also present the mean values for the scenario approach and sensitivity analyses as 4.04 and 3.94 followed by the decision tree approach with 3.04 in Australia.

Table 4. CB Risk Analysis Techniques

Techniques	Australia						
	Mean	Std	Frequently	Mostly	Neutral	Rarely	Never
Scenario	4.04	0.737	29	47	24	0	0
Sensitivity	3.94	0.720	20	56	22	2	0
Decision tree	3.04	1.065	7	24	49	7	13
Monte Carlo	2.87	1.307	13	13	45	5	24
Risk adjusted	2.56	0.990	0	16	44	20	20

In estimating the cost of capital, 85 percent of Australian firms rely to some extent on the WACC; 75 percent use the CAPM most frequently, 49 percent mention using interest payable on debt capital, 33 percent use the earnings yield on shares, 24 percent note that they use the dividend yield on shares method most often. Australian firms appear to use the WACC and CAPM more often. Thus, the WACC has clearly established its position as the most popular method and dividend yield on shares method and CAPM method are used; 24 and 31 percent of the Australian firms report that they use these methods frequently. The results also show the mean values for WACC and CAPM are 4.24 and 4.04 followed by the interest payable on debt capital with 3.38 in Australia.

Table 5. Cost of Capital Techniques

Techniques	Australia						
	Mean	Std	Frequently	Mostly	Neutral	Rarely	Never
WACC	4.24	0.957	49	36	9	4	2
CAPM	4.04	0.796	31	44	22	3	0
Interest payable	3.38	1.093	13	36	35	7	9
Dividend yield	2.82	1.007	2	22	44	18	14
Earnings yield	3	0.977	2	31	40	18	9

Table 4 presents the results of the survey on the techniques used by Australian firms to guide long-term investment decisions. As shown in the table, most of the firms in Australia adhere to the RO analysis over the other techniques. The RO analysis is highly ranked as the frequently/most practiced in CB with 73 percent in Australia. Forty two percent of firms in Australia stated that they use game theory most often. Twenty percent and 13 percent of Australian firms reported that they use balanced scorecard and value chain analysis, respectively. The results also show the mean values for the RO and game theory as 3.58 and 3.09 followed by the balanced scorecard with 2.69 in Australia.

Table 6. Information to Guide Long-term Investment Decision

Techniques	Australia						
	Mean	Std	Frequently	Mostly	Neutral	Rarely	Never
Real option	3.58	1.076	9	64	13	2	11
Game theory	3.09	1.083	4	38	31	16	11
Balanced score	2.93	0.809	0	20	32	9	9
Value chain	2.69	0.925	2	11	53	20	13

Respondents are asked to rate on Likert scale of 1 (never) to 5 (frequently). Researchers report the overall mean, standard deviation (Std) as well as the % of respondents that answered 1 (never) to 5 (frequently).

4.2. Cross-Classification of the Survey Results

CB Appraisal Techniques

The results in Table 7 illustrate that DCF and NDCF techniques are employed by respondents with bachelor's degrees in Australia, whereas, respondents with a master's degree are more likely to use DPP in Australia. As shown in the results, respondents aged between 25-55 are significantly more likely to use PBP, NPV and IRR in Australia. The NPV and IRR methods are significantly employed by more experienced (>16) respondents in Australia. Whereas less experienced Australian respondents (1-5) are more likely to use DCF and NDCF techniques. The DCF and NDCF techniques are extensively utilised among consumer staples, materials and consumer discretionary sectors in Australia. The result reveals that Australian large firms (more than 500 employees) use NPV and IRR techniques significantly more than other clusters. Table 7 shows that, among the highest domestic earned firms, 80 percent are more likely to use NPV and IRR in Australia. Accordingly, Table 7 shows that high-risk firms in Australia are significantly stating that they use NPV, IRR and DPP. These results note that there seems to be quite some differences with respect to the use of CB techniques between low-risk and high-risk firms.

Table 7. CB Appraisal Techniques

Techniques	Australia						
	Frequently/ Mostly	Mean	Education Background				
			Diploma	Bachelor	Honours	Master	PhD
PBP	83	4.16	0.00	4.00**	4.08**	4.40	4.00
DPP	36	2.87	0.00	3.25**	3.08	2.67**	3.00
ARR	51	3.24	0.00	3.63**	3.34	2.93	2.00
NPV	98	4.62	0.00	4.75**	4.42**	4.80**	3.50
IRR	98	4.62	0.00	4.88**	4.42**	4.47	5.00

Techniques	Australia					
	Frequently/ Mostly	Mean	Age group			
			<25	25-35	35-55	>55
PBP	83	4.16	3.00	4.13**	4.30**	4.00
DPP	36	2.87	3.00	3.00	2.70	3.00
ARR	51	3.24	3.00	3.34**	3.20	3.22
NPV	98	4.62	5.00	4.74**	4.60**	4.44
IRR	98	4.62	5.00	4.74**	4.55**	4.56

Techniques	Australia					
	Frequently/ Mostly	Mean	Age group			
			<25	25-35	35-55	>55
PBP	83	4.16	3.00	4.13**	4.30**	4.00
DPP	36	2.87	3.00	3.00	2.70	3.00
ARR	51	3.24	3.00	3.34**	3.20	3.22
NPV	98	4.62	5.00	4.74**	4.60**	4.44
IRR	98	4.62	5.00	4.74**	4.55**	4.56

Techniques	Australia					
	Frequently/ Mostly	Mean	Management Experience			
			1-5	6-10	11-15	>16
PBP	83	4.16	4.27**	3.93**	4.00	4.56
DPP	36	2.87	3.27**	2.86	2.36	3.00
ARR	51	3.24	3.18**	3.43**	3.00	3.34
NPV	98	4.62	4.91**	4.36**	4.45**	4.89**
IRR	98	4.62	4.82**	4.50**	4.55**	4.67**

Techniques	Frequently/ Mostly	Mean	Australia: Industry Sectors			
			Utilities	Information	Energy	Telecom
PBP	83	4.16	3.20	4.50	5.00	3.67
DPP	36	2.87	2.60	1.00	2.75	2.00
ARR	51	3.24	2.80	3.50	3.00	2.34
NPV	98	4.62	4.80**	4.00	4.25	4.34
IRR	98	4.62	4.80**	5.00	4.75	4.34
			Industrials	Consumer staples	Materials	Health Care	Consumer Discretionary
			4.34	4.30**	4.17**	4.67	3.83**
			4.17	3.00**	2.00**	4.34	2.83**
			4.34	3.80**	1.83**	4.34	3.00**
			5.00	4.60**	4.83**	4.67	4.50**
			4.84	4.60**	4.50**	4.34	4.50**

Techniques	Australia					
	Frequently/ Mostly	Mean	Number of Employees			
			<100	100-250	250-500	>500
PBP	83	4.16	5.00	4.00	5.00	4.08
DPP	36	2.87	1.00	2.00	5.00	2.88**
ARR	51	3.24	1.00	2.00	4.50	3.34**
NPV	98	4.62	5.00	4.00	5.00	4.60**
IRR	98	4.62	4.50	5.00	4.50	4.63**

Techniques	Australia					
	Frequently/ Mostly	Mean	Domestic Income			
			<20	20-40	40-80	>80
PBP	83	4.16	4.00	4.25	4.10**	4.18
DPP	36	2.87	2.00	3.75	2.10	3.11**
ARR	51	3.24	1.67	3.75	2.70	3.54
NPV	98	4.62	4.67	4.75**	4.60**	4.61**
IRR	98	4.62	4.34	5.00	4.50**	4.64**

Techniques	Australia		
	Frequently/ Mostly	Mean	Ownership	
			Domestic	Foreign
PBP	83	4.16	4.10**	5.00
DPP	36	2.87	2.92**	2.00
ARR	51	3.24	3.30**	3.00
NPV	98	4.62	4.60**	5.00
IRR	98	4.62	4.65**	4.00

Techniques	Australia						
	Frequently/ Mostly	Mean	Overall Risk Situation				
			Very High	High	Moderate	Low	Very Low
PBP	83	4.16	4.75	3.95	4.32**	3.67	0
DPP	36	2.87	2.00**	2.79**	2.95	4.00	0
ARR	51	3.24	2.50	3.42	3.16	3.67	0
NPV	98	4.62	4.25	4.63**	4.68**	4.67	0
IRR	98	4.62	5.00	4.63**	4.53**	4.67	0

CB Risk Analysis Techniques

The results in Table 8 provides evidence that the sensitivity analyses and decision tree approach and both scenario and decision tree approaches are significantly

preferred by respondents with bachelor's degree in Australia. Whereas, respondents with a master's degree are most likely to use probabilistic (Monte Carlo) simulation and risk adjusted discount rate. Table 8 also reports that the use of a scenario approach and sensitivity analyses are significantly more popular among the 25-35 and 35-55 age groups. The results also noted that the use of a scenario approach, sensitivity analysis, decision tree approach, probabilistic (Monte Carlo) simulation and risk adjusted discount rate are quite significant among less experienced (1-5) Australian respondents. The table also shows that all of these five risk assessment tools are significantly employed by the consumables, materials and consumer discretionary sectors in Australia while the risk adjusted discount rate is significantly used by the health care sector in Australia. Although the scenario approach, sensitivity analysis and risk adjusted discount rate are the most prevalent tools among utilities and industrial sectors in Australia. The large firms (more than 500 employees) are more inclined to use a decision tree approach, probabilistic (Monte Carlo) simulation and risk adjusted discount rate. The highest domestic earned firms (80 percent) are more likely to use decision tree approach, probabilistic (Monte Carlo) simulation and risk adjusted discount rate. The domestic owned firms in Australia are much more likely to use all of these risk assessment tools. As shown in Table 8, high-risk firms in Australia are significantly stating that they use risk adjusted discount rate.

Table 8. CB Risk Analysis Techniques

Techniques	Australia						
	Frequently/ Mostly	Mean	Education Background				
			Diploma	Bachelor	Honours	Master	PhD
Scenario	76	4.04	3.81	4.25**	4.00**	5.00	4.04
Sensitivity	76	3.94	3.94	3.75**	4.00	4.50	2.94
Decision	31	3.04	3.19	3.00**	2.80	4.00	3.04
Monte Carlo	13	2.87	2.69	3.17	2.67	4.00**	2.87
Risk adju	16	2.56	2.56	2.67	2.40	3.00**	2.56

Techniques	Australia					
	Frequently/ Mostly	Mean	Age group			
			<25	25-35	35-55	>55
Scenario	76	4.04	3.00	4.27**	4.05**	3.78
Sensitivity	76	3.94	5.00	4.00**	4.10**	3.34
Decision tree	31	3.04	1.00	3.13**	2.95	3.34
Monte Carlo	13	2.87	1.00	2.93	2.75	3.23
Risk adjusted	16	2.56	3.00	2.40	2.45	3.00

Techniques	Australia					
	Frequently/ Mostly	Mean	Management Experience			
			1-5	6-10	11-15	>16
Scenario	76	4.04	4.18**	4.14**	3.82**	4.00
Sensitivity	76	3.94	4.09**	3.79**	4.09**	3.78
Decision tree	31	3.04	2.73**	3.36**	2.82	3.23
Monte Carlo	13	2.87	2.64**	3.00	3.09	2.67
Risk adjusted	16	2.56	2.73**	2.89	2.90	2.34**

Techniques	Frequently/ Mostly	Mean	Australia: Industry Sectors			
			Utilities	Information	Energy	Telecom
Scenario	76	4.04	3.60**	4.50	4.75	4.00
Sensitivity	76	3.94	4.00**	4.00	4.00	3.67
Decision tree	31	3.04	2.60	3.50	3.50	3.67
Monte Carlo	13	2.87	2.60	1.00	2.50	3.34
Risk adjusted	16	2.56	3.20**	1.00	2.75	2.34
			Industrials	Consumer staples	Materials	Health Care	Consumer Discretionary
			3.67**	4.20**	3.67**	4.00	4.34**
			3.83**	4.10**	4.00**	3.34	4.00**
			3.67	2.70**	2.17**	3.34	3.34**
			3.00	2.80**	2.50**	4.34	3.34**
			2.67**	2.40**	2.83**	2.67**	2.34**

Techniques	Australia					
	Frequently/ Mostly	Mean	Domestic Income			
			<20	20-40	40-80	>80
Scenario	76	4.04	4.67**	3.50	4.00**	4.07
Sensitivity	76	3.94	4.34	4.50**	3.90**	3.82
Decision tree	31	3.04	2.67	2.50	2.80	3.25**
Monte Carlo	13	2.87	2.34	1.50	3.30	2.96**
Risk adjusted	16	2.56	1.34	2.50	2.70	2.64**

Techniques	Australia			
	Frequently/ Mostly	Mean	Ownership	
			Domestic	Foreign
Scenario	76	4.04	4.08**	4.50
Sensitivity	76	3.94	3.90**	4.50
Decision tree	31	3.04	3.18**	1.50
Monte Carlo	13	2.87	3.03**	1.50
Risk adjusted	16	2.56	2.58**	2.50

Techniques		Australia					
	Frequently/ Mostly	Mean	Overall Risk Situation				
			Very High	High	Moderate	Low	Very Low
Scenario	76	4.04	4.50	4.05	3.95**	4.00	0.00
Sensitivity	76	3.94	4.25	4.11	3.68**	4.00	0.00
Decision tree	31	3.04	2.50	3.42	2.79	3.00	0.00
Monte Carlo	13	2.87	2.25	3.26	2.58	3.00	0.00
Risk adjusted	16	2.56	3.00	2.47**	2.47	3.00	0.00

Cost of Capital Techniques

As seen in Table 9, in Australia, the WACC, CAPM, interest payable on debt capital and earnings yield on shares are significantly preferred by respondents with a bachelor's degree while the dividend yield on shares method is more likely to be used by respondents with a master's degree. The results show that young-adult respondents (25-35) prefer to use the WACC, CAPM, and interest payable on debt capital to estimate the cost of equity capital in Australia. In addition, older respondents (>55) use the earnings yield on shares more often than other age groups. The less experienced Australian respondents (1-5) seem to use all these tools quite often to estimate the cost of equity. Very experienced respondents (>16), seem to prefer to use the dividend yield on shares and earnings yield on shares. The WACC and CAPM are consistently more popular among firms in the consumables, materials and consumer discretionary markets in Australia — respondents in the health care market are more likely to use the earnings yield on shares. The results show that the interest payable on debt capital, dividend yield on shares and earnings yield on share methods are preferred by Australian large firms (> 500 employees). The highly domestic focused firms prefer the interest payable on debt capital,

dividend yield on shares and earnings yield on share methods. The WACC and interest payable on debt capital methods are used predominantly by Australian companies with a 20-40 percent focus on domestic markets. The domestic owed companies are more likely to use all these methods than the foreign-owned companies. As can be seen in Table 9, high-risk firms are more likely to use the dividend yield on shares and earnings yield on share methods.

Table 9. CB Risk Analysis Techniques

Techniques	Australia						
	Frequently/ Mostly	Mean	Education Background				
			Diploma	Bachelor	Honours	Master	PhD
WACC	85	4.24	0.00	4.25**	4.08**	4.27	5.00
CAPM	75	4.04	0.00	3.94**	3.84**	4.27	4.50
Interest payable	49	3.38	0.00	3.38**	3.17	3.47	4.00
Dividend yield	24	2.82	0.00	2.81	2.84	2.73**	3.50
Earnings yield	33	3.00	0.00	3.13**	2.58	3.20	3.00

Techniques	Australia					
	Frequently/ Mostly	Mean	Age group			
			<25	25-35	35-55	>55
WACC	85	4.24	4.00	4.34**	4.05**	4.56
CAPM	75	4.04	4.00	4.13**	3.95**	4.11
Interest payable	49	3.38	3.00	3.27**	3.35	3.67
Dividend yield	24	2.82	3.00	2.87	2.75	2.87
Earnings yield	33	3.00	3.00	3.14**	3.05	2.67**

Techniques	Australia					
	Frequently/ Mostly	Mean	Management Experience			
			1-5	6-10	11-15	>16
WACC	85	4.24	4.64**	3.79**	4.18**	4.56
CAPM	75	4.04	4.27**	3.64**	4.36**	4.00
Interest payable	49	3.38	3.64**	3.07**	3.45	3.45
Dividend yield	24	2.82	3.18**	2.71	2.91	2.45**
Earnings yield	33	3.00	3.09**	3.00**	2.91	3.00**

Techniques	Frequently/ Mostly	Mean	Australia: Industry Sectors			
			Utilities	Information	Energy	Telecom
WACC	85	4.24	4.80**	3.50	5.00	3.67
CAPM	75	4.04	4.60**	4.50	4.00	4.00
Interest payable	49	3.38	3.60**	1.50	4.00	3.34
Dividend yield	24	2.82	3.40**	2.00	2.75	3.34
Earnings yield	33	3.00	3.00	2.00	2.50	4.00
			Industrials	Consumer staples	Materials	Health Care	Consumer Discretionary
			4.34	4.10**	4.67**	4.00	3.67**
			3.67**	4.10**	4.50**	3.67	3.50**
			3.50**	3.40**	4.00**	2.67	3.00**
			3.00	2.70**	2.67**	2.67	2.67**
			3.34**	3.00**	3.17**	3.34**	2.50**

Techniques	Frequently/ Mostly	Mean	Australia			
			Number of Employees			
			<100	100-250	250-500	>500
WACC	85	4.24	4.00	4.00	5.00	4.23
CAPM	75	4.04	5.00	5.00	2.50	4.05
Interest payable	49	3.38	2.50	4.00	4.00	3.38**
Dividend yield	24	2.82	2.50	3.00	1.50	2.90**
Earnings yield	33	3.00	2.50	2.00	2.50	3.08**

Techniques	Frequently/ Mostly	Mean	Australia			
			Domestic Income			
			<20	20-40	40-80	>80
WACC	85	4.24	3.34	4.50**	4.10	4.36
CAPM	75	4.04	4.34	3.75	4.50**	3.89
Interest payable	49	3.38	2.34	3.75**	3.90	3.25**
Dividend yield	24	2.82	2.34	2.25	3.40	2.75**
Earnings yield	33	3.00	2.34	3.00	3.30	2.96**

Techniques	Australia			
	Frequently/ Mostly	Mean	Ownership	
			Domestic	Foreign
WACC	85	4.24	4.33**	3.00
CAPM	75	4.04	4.03**	4.50
Interest payable	49	3.38	3.40**	3.00
Dividend yield	24	2.82	2.90**	2.00
Earnings yield	33	3.00	3.03**	2.00

Techniques	Australia						
	Frequently/ Mostly	Mean	Overall Risk Situation				
			Very High	High	Moderate	Low	Very Low
WACC	85	4.24	4.75	3.95	4.42**	4.34	0.00
CAPM	75	4.04	4.50	4.11	3.89**	4.00	0.00
Interest payable	49	3.38	3.75	3.16**	3.53	3.34	0.00
Dividend yield	24	2.82	3.25**	2.68**	2.79	3.34	0.00
Earnings yield	33	3.00	3.25**	2.89**	3.00	3.34	0.00

5. CONCLUSIONS

The results suggest that Australian firms tend to use DCF as their most frequently used CB technique and its usage appears to be more common and important than what is noted in many earlier studies. Scenario approach and sensitivity analysis are the most widely used techniques for assessing capital-investments risk in Australia. Australian respondents prefer RO analysis over other capital investment techniques. These findings are consistent with studies conducted by Hermes et al. (2007) and Truong et al. (2008). Taken together, these results suggest that Australian respondents on average use more sophisticated CB techniques. These results support the H_1 assertion that: *CB techniques are applied more extensively in Australia as a developed country.* This research claims that larger firms in Australia tend to use more sophisticated CB techniques than smaller firms—implying that larger firms tend to have more processes to support their long-term capital investment decisions, whereas, small firms tend to use more rules-of-thumb. For e.g., the highest-domestic-focused Australian firms are more likely to use NPV, IRR and DPP; when the underlying respondents attributes are considered, well-grounded respondents frequently use more sophisticated methods in Australia —e.g., DCF and NDCF

tend to be favoured by respondents with a bachelor's degree; ARR and Australian respondents with a master's degree tend to favour DPP. This indicates that the sophistication of CB practices appears to be significantly (if not mostly) influenced by attributes of the firm and the respondent. The results are similar to those of Brounen et al. (2004), Brijlal (2009) and De Andrés et al. (2015). On balance, these results affirm the H$_2$ assertion that: *Firms and respondents' attributes have an effect on the choice of CB techniques employed.* Also, of great interest is that Australian firms are more likely to use multiple modes of CB appraisal techniques—perhaps because their appetite for risky investments appears to be significantly greater than that of their counterparts. In complex real-world situations, reconciling the outputs of a multifaceted approach to CB methods is more likely to give the depth and width of input needed to achieve an optimal capital investment plan. Also, the study adds to the general knowledge on CB by showing that the nature of the firm appears to swamp the nurture of the environment in which it is embedded. Therefore, this study contributes to understanding the role CB plays in business decision making by demonstrating the need for more sophistication in firms' analysis of long-term investment decision making and underinvestment can be minimised. Future research should consider including many countries across the emerging to developed continuum, so as to support more generalised conclusions. Instead of relying mainly on questionnaire mail survey, an alternative/supplement method of interviewing may provide more insights about CB. In addition to this, a longitudinal study might be able to validate findings more. Also, future research should expand consideration of the influence of firm size and sophistication on the CB.

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Dr Pratheepkanth Puwanenthiren holds a PhD from Federation University Australia and a Bachelor of Commerce (Honours) from University of Jaffna Sri Lanka. Pratheepkanth Puwanenthiren's teaching and research are in the fields of financial accounting and corporate reporting. His current research is broadly concerned with accounting standard settings, investment analysis and business ethics and corporate governance from both emerging and developed nation perspectives.

Dr Premkanth Puwanenthiren is a Lecturer in Accounting at the Roehampton Business School, University of Roehampton, London. He obtained a first class Bachelor of Business Administration Honours degree from the University of Jaffna, Sri Lanka and a Master of Business Administration at the Kelaniya University, Sri Lanka. He also gained his PhD from La Trobe University Australia.