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### Contents

1	Exec	utive summary	1
	1.1	Key elements remain broadly the same in our 2018 method	2
	1.2	Other elements will change incrementally	3
	1.3	Our process for this review	8
	1.4	Structure of this report	8
	1.5	List of final decisions	9
2	Cont	ext and principles for this review	13
	2.1	Who our final decisions affect	13
	2.2	Scope of this review	13
	2.3	Our principles for this review	14
3	Meas	suring WACC inputs	18
	3.1	Overview of our final decisions on measuring WACC inputs	18
	3.2	Our definition of the efficient benchmark entity	19
	3.3	Synchronise sampling dates and align sampling periods	21
	3.4	Continue to notify regulated businesses of sampling dates	23
4	Dete	rmining the cost of debt	24
	4.1	Overview of final decisions on cost of debt	24
	4.2	Maintain our midpoint method	25
	4.3	Adopt a 10-year trailing average approach to calculate the historic cost of debi	t 26
	4.4	Adopt a short-term trailing average approach to estimate the current cost of debt	29
	4.5	Adopt consistent observation windows in calculating historic and current costs	36
	4.6	Decide how to pass-through annual changes	38
	4.7	Where we use a true-up we will discount changes by the WACC	39
	4.8	Annualise bond yield data	40
	4.9	Maintain a 10-year term-to-maturity	41
	4.10	Continue to use 10-year coupon paying bond yields	44
	4.11	Continue to use the BBB debt margin published by the RBA	45
5	Dete	rmining the cost of equity	47
	5.1	Overview of final decisions on cost of equity	47
	5.2	Continue to use the Sharpe-Lintner CAPM	48
	5.3	Continue to determine cost of equity as midpoint between current and historic estimates	50
	5.5	Modify our approach for measuring the current MRP	52
	5.6	Modify our approach for selecting single value for current MRP	56
	5.7	Re-estimate the equity beta at each price review	59
	5.8	Use a broad selection of proxy companies to estimate the equity beta	61
	5.9	Modify our approach for adjusting equity betas to mitigate estimation bias	64
6	Com	bining measurements to derive the WACC	66
	6.1	Overview of final decisions on deriving the WACC	66

	6.2	Maintain our 2013 method of constructing the uncertainty index	67 68
	6.4	Maintain our discretion to consult on out-of-range situations	68
	6.5	Re-estimate the gearing ratio at each price review	73
7	Meas	suring inflation and gamma	75
	7.1	Overview of final decisions on inflation and gamma	75
	7.2	Setting a real post-tax WACC	76
	7.3	Adjust for expected inflation over the regulatory period	76
	7.4	Use a geometric average method to calculate expected inflation	77
Ар	pendi	ces	85
	А	Comparison of other regulators' approaches to WACC	86
	В	How we will update the cost of debt measurements	92
	С	Our analysis on the appropriate CAPM model	95
	D	IPART's uncertainty index model	99
	Е	Our analysis on using breakeven inflation (BEI)	103

### 1 Executive summary

Since mid-2017, the Independent Pricing and Regulatory Tribunal of NSW (IPART) has been reviewing our standard method for determining the weighted average cost of capital (WACC), with the aim of improving its accuracy and predictability.

The WACC is a key input for calculating the revenue requirements and setting prices for the businesses we regulate, and our decisions on this cost need to be as accurate as possible. If we set the WACC too high, customers would pay too much and the regulated business could be encouraged to over-invest. If we set it too low, the business' financial viability could suffer, and it may under-invest. Neither outcome is in the long-term interest of customers.

We have now completed the review and made final decisions on the method we will use in future determinations (the 2018 method).<sup>1</sup> A small number of these decisions differ from our draft decisions, and are generally more consistent with stakeholder views.

This report outlines our final decisions, explains how and why we made those decisions, and highlights where they differ from our draft decisions (see Box 1.1 for a summary of key differences). Our 2018 method will apply to pricing decisions that take effect **on or after 1 July 2018**.<sup>2</sup>

We would like to thank all the stakeholders who participated in this review and helped to make our final decisions an improvement on our existing WACC method. We consider that our 2018 method can be replicated by stakeholders and will increase the accuracy and stability of the regulatory regime for the businesses we regulate.

<sup>&</sup>lt;sup>1</sup> We will consult on applying our 2018 method in the course of future price reviews, approaching each review based on its unique circumstances.

<sup>&</sup>lt;sup>2</sup> Our 2018 method **will not apply** to any determination currently in effect, including our fare determinations for private ferries and rural and regional buses, both of which apply from 1 January 2018.

#### Box 1.1 Summary of key differences between draft and final decisions

#### We will use a 'trailing average' approach to calculate both historic and current cost of debt

In response to stakeholder feedback, we made draft decisions to adjust the current cost of debt over the regulatory period. However, stakeholders expressed concerns that this would not sufficiently mitigate refinancing risk and maintained that the most efficient cost of debt for a benchmark firm with long-lived assets is one based on a 10-year trailing average.<sup>a</sup>

After further consultation through a series of targeted stakeholder workshops and further analysis, we decided we will estimate the historic cost of debt as a 10-year trailing average, and the current cost of debt as a short-term trailing average with the length of this term matching the regulatory period (usually 4 to 5 years).

### We will update the cost of debt annually within a regulatory period and decide how annual changes are passed through on a case-by-case basis, as part of our price review process.

Our draft decision was to cumulate annual changes in the cost of debt and pass the cumulative change through to prices using a true-up at the beginning of the next regulatory period. Sydney Desalination Plan (SDP) and WaterNSW submitted a strong preference for annual price adjustments, as the delay associated with a true-up could potentially cause a firm to breach its debt covenants.<sup>b</sup> Given the approaches should be equivalent in present value terms, we decided that we will decide whether to apply annual price adjustments or a true-up on a case-by-case basis (as part of the price review process). If we decide to use a true-up, we will use the WACC as the discount rate in calculating the true-up amount.

### We will provide more consultation and transparency in our equity beta and gearing processes

Based on stakeholder feedback, we have also made some small adjustments to our processes for re-estimating equity beta and gearing to make them more transparent, replicable and consultative.

a Sydney Water submission to IPART Draft Report, December 2017, p 3; NSW Treasury submission to IPART Draft Report, December 2017, p 1; SDP submission to IPART Draft Report, December 2017, p 12; Hunter Water submission to IPART Draft Report, December 2017, p 4; WaterNSW submission to IPART Draft Report, December 2017, p 4.
b SDP submission to IPART Draft Report, December 2017, p 12; WaterNSW submission to IPART Draft Report, December 2017, p 9.

#### 1.1 Key elements remain broadly the same in our 2018 method

The feedback we received from stakeholders throughout this review confirmed our view that, overall, the 2013 WACC method works well.<sup>3</sup> For example, in response to our Issues Paper, the ARTC submitted that this method has provided significant value in "stability, logical consistency and transparency".<sup>4</sup>

Hunter Water put the view that compared to our previous method, the 2013 method is "a far better approach to the setting of financing costs" and that it welcomed the "setting of

<sup>&</sup>lt;sup>3</sup> WaterNSW submission to IPART Issues Paper, August 2017, p 4; ARTC submission to IPART Issues Paper, August 2017, p 3; Hunter Water submission to IPART Issues Paper, August 2017, p I; Sydney Water submission to IPART Issues Paper, August 2017, p 2; SDP submission to IPART Issues Paper, August 2017, p 1.

decision rules in the WACC formula, the use of externally available information sources for each parameter, the inclusion of the uncertainty index and the publication of biannual WACC updates". It also noted that the current method "satisfies the test of replicability, stability and transparency".<sup>5</sup>

In response to our Draft Report, stakeholders reiterated their general satisfaction with the 2013 method. For instance, Sydney Water commented:

IPART's existing WACC methodology works well, incentivising improved financial efficiency and stability. These sentiments have been echoed by our external rating agency, which have maintained our generally stable credit rating.<sup>6</sup>

PIAC considered that:

...the stability and consistency of the WACC are generally positive outcomes for consumers, [and stressed] the importance of keeping the WACC no higher than necessary, particularly to support affordability and allow households to effectively budget for the essential service of water.<sup>7</sup>

Therefore, in line with our draft decisions, we will maintain key elements of the 2013 method, including the existing approaches for:

- defining our benchmark firm
- constructing our uncertainty index and applying our WACC decision rule
- determining industry-specific parameters of gearing and equity beta, and
- using a real post-tax framework and accounting for imputation credits.

We consider maintaining the stability, certainty, replicability and predictability of our WACC method is important, as well as ensuring it produces reasonably accurate estimates. The stability and transparency of having a standard WACC method has been an important factor in supporting a strong credit rating for some of our regulated water businesses.

#### 1.2 Other elements will change incrementally

We have identified, analysed and consulted on opportunities to make incremental changes to some elements of our WACC method to improve its overall accuracy, transparency or predictability. In line with our review objectives, we aimed to limit these changes to areas where there were convincing reasons for change to increase accuracy, or enhance stability and certainty. However, where we were satisfied a change would, on balance, result in a more accurate WACC without causing a significant adjustment for stakeholders (that is, no windfall gains or losses, and the change could be implemented simply), we decided to change our method.

Where we found the case for change was not strong – that is, where it was not clear that a potential change would produce a more accurate WACC estimate with only minor adjustment impacts – we opted to maintain our 2013 method.

<sup>&</sup>lt;sup>5</sup> Hunter Water submission to IPART Issues Paper, August 2017, p i.

<sup>&</sup>lt;sup>6</sup> Sydney Water submission to IPART Draft Report, December 2017, p 1.

<sup>&</sup>lt;sup>7</sup> PIAC submission to IPART Draft Report, December 2017, p 1.

As already noted, some of our final decisions differ from our draft decisions (see Box 1.1). Specifically, we decided:

- In measuring WACC inputs, to synchronise sampling dates and periods for measuring selected current parameters.
- In determining the cost of debt, to estimate both the historic and current cost using a trailing average approach; decide how annual changes in this cost during the regulatory period will be passed through to prices on a case-by-case basis as part of our review process; and annualise bond yield data derived from semi-annual rates of return.
- In determining the cost of equity, to adjust our method for measuring the current market risk premium (MRP) to reduce bias; to modify our process and method for reestimating equity beta at each price review to improve its transparency, reliability and accuracy.
- In measuring inflation, to use the expected rate of inflation over the regulatory period; and to calculate this rate using an approach consistent with the AER's approach.

#### 1.2.1 Synchronise sampling dates and periods for selected current parameters

Because market observations tend to be volatile, the timing of the observations we use to measure the market-based parameters is important, particularly for current parameters. Under our 2013 method, we used the most recent available data for each parameter, which means the sampling dates differed across parameters.

We made draft decisions to synchronise the sampling dates for five parameters – the riskfree rate, debt margin, current MRP, inflation and uncertainty index - and to adopt aligned sampling periods of 40 working days each calendar year for the risk-free rate, and two months for the debt margin. Given stakeholder support<sup>8</sup>, we have decided to make these changes. In our view, they will improve the accuracy in our resulting WACC calculations by recognising the interrelationships between parameters.

#### 1.2.2 Estimate both the historic and current cost of debt using a trailing average approach

Our 2013 method set a cost of debt as the midpoint between our estimates of the historic and current cost unless there is significant economic uncertainty, and did not update this cost during the regulatory period. In response to stakeholder feedback that this approach creates a refinancing risk for regulated businesses,<sup>9</sup> we have made final decisions to estimate both the historic and current cost of debt using a trailing average approach, which will update the cost of debt annually over the regulatory period.

We will estimate the historic cost of debt as a 10-year trailing average by splitting the historic cost of debt into 10 equal tranches, with the commencement and maturity dates for

<sup>8</sup> SDP submission to IPART Draft Report, December 2017, p 12; Hunter Water submission to IPART Draft Report, December 2017, p 8; WaterNSW submission to IPART Draft Report, December 2017, p 5.

<sup>9</sup> NSW Treasury submission to IPART Issues Paper, August 2017, p 1; WaterNSW submission to IPART Issues Paper, August 2017, p 9; Sydney Water submission to IPART Issues Paper, August 2017, pp 11-12; Hunter Water submission to IPART Issues Paper, August 2017, p 5.

each tranche staggered by one year. At the beginning of each year of the regulatory period, the oldest tranche of debt will mature, and a new tranche will replace it.

We will estimate the current cost of debt as a short-term trailing average in a similar way. We will split the current cost of debt into a number of equal tranches equal to the number of years in the regulatory period, with the commencement and maturity dates staggered by one year. At the beginning of each year, the oldest tranche of debt will mature, and a new tranche will replace it.

For both estimates, we will estimate the interest rate for each annual tranche of debt using a 40 working day observation window that we choose. We will give firms confidential, advance notice of this window.

As the change to our approach for estimating the historic cost of debt is not likely to have a major impact on firms or customers, we will implement it without a transition period. However, we will transition to a short-term trailing average for the current cost of debt over one regulatory period.

We consider that these changes:

- will increase the accuracy of our cost of debt estimates as an incremental improvement to our 2013 method
- will increase replicability of our estimates by reducing refinancing risk for firms
- will not create any windfall gains or losses to firms or customers, and
- can be implemented simply.

## 1.2.3 Decide how to pass annual changes in the cost of debt through to prices on a case-by-case basis, as part of our review process

As noted above, adopting a trailing average approach will update the cost of debt annually over the regulatory period. We considered whether we should update prices to reflect the updated cost of debt annually, or use a regulatory true-up in the notional revenue requirement for the next period, which we would pass through to prices at the beginning of the next period. We have decided to determine the most appropriate option on a case-bycase basis, as part of our price review process. Where we decide to use a true-up, we will use the WACC as the discount rate for calculating the true-up.

As noted above, our 2018 method will apply only to determinations made on or after 1 July 2018. Determinations already in effect will be subject to our 2013 method. This means at the next regulatory review, there will be no true-up of the cost of debt in current determinations. Rather, the true-up will be calculated throughout the next regulatory period and prices adjusted at the subsequent period.

#### 1.2.4 Annualise bond yield data

We have decided to modify our approach for estimating the cost of debt by converting published bond yield data into annualised yields. We will continue to use RBA-published

data on the spread between the yield of BBB rated bonds issued by Australian non-financial corporations to the 10-year Australian Government Bond yield.

#### 1.2.5 Adjust our method for measuring the current MRP

Under our 2013 method, we estimated the current MRP using six different methods, five of which are variations of a dividend discount model (DDM) method, and one of which is a market indicators method. We determined a point estimate by selecting the midpoint of the highest and lowest of these estimates in each month.

We considered several alternative methods, including selecting the median of all six estimates, and using a weighted average of the market indicators MRP estimate and the median of the DDM MRP estimates. We decided to:

- combine the DDM MRP estimates into one estimate using a median approach that does not exclude outliers, and
- set the point estimate as the weighted average of the market indicators MRP and the median DDM MRP, with a one-third weight to the former and two-thirds weight to the latter.

These changes are in line with our draft decisions. Most stakeholders supported these draft decisions,<sup>10</sup> but SDP argued we should maintain our existing approach of using the midpoint, and weighting all estimates equally.<sup>11</sup> After considering SDP's submission, we maintain our view that giving all six estimates equal weight could place too much emphasis on the DDM results. We considered SDP's reasoning that the median is not appropriate, if there are no consistent outliers.<sup>12</sup> However, we consider that during and after the GFC, the Bloomberg MRP estimate was consistently the high estimate, sitting significantly higher than the others in the group. As such, we consider that it was a genuine outlier at that time and the mean approach would have given it too much weight.

We have also decided to replace two of the indicators in our market indicator method (the dividend yield and the risk-free rate) with a single new indicator (earnings yield less the risk-free rate).

# 1.2.6 Modify our process and method for re-estimating the equity beta at each price review

In our 2013 method, we assessed the equity beta each time we determined the WACC for a regulated business to check that it remained appropriate, in light of updated market data, and having regard to other regulators' recent WACC decisions. We only changed the value we used in our WACC calculations where we considered there was sufficient evidence to support this.

<sup>&</sup>lt;sup>10</sup> WaterNSW submission to IPART Draft Report, December 2017, p 15; Hunter Water submission to IPART Draft Report, December 2017, p 11; Sydney Water submission to IPART Draft Report, December 2017, p 5.

<sup>&</sup>lt;sup>11</sup> SDP submission to IPART Draft Report, December 2017, p 13.

<sup>&</sup>lt;sup>12</sup> Frontier Economics, *IPART review of the WACC method – Response to Draft Report: Report prepared for Sydney Desalination Plant*, December 2017.

While we decided to maintain this approach, we have made some changes to the timing and transparency of our consultation process on the equity beta. We also decided to broaden the sample of proxy firms we use in estimating the equity beta, and discontinue considering the Blume-adjusted equity beta.

#### Broaden the sample of proxy firms

One of the main weaknesses of our current approach for estimating the equity beta is that the selected proxy companies may not represent a benchmark firm well, leading to an inaccurate estimate. To address this weakness, we have decided to use the broadest possible selection, but exclude thinly traded stocks in line with feedback from Frontier Economics (on behalf of SDP).<sup>13</sup> We agree that a broad sample method is more objective, more likely to yield statistically reliable estimates, and more resistant to problems caused by companies dropping out of the sample over time (for example, because they become de-listed).

#### Discontinue consideration of the Blume-adjusted equity beta

Several studies have found equity betas obtained from ordinary least squares (OLS) regression analysis are likely to be subject to a high degree of estimation bias due to sampling error. Regulators commonly adjust for this bias using the Vasicek and/or Blume methods.

Our 2013 method was to make a judgement on the appropriate equity beta by considering each of the OLS equity betas with no adjustments, the Blume-adjusted equity beta and Vasicek-adjusted equity beta. We have decided to discontinue considering the Blumeadjusted equity beta because it is an automatic, formulaic and arbitrary adjustment. We consider that the Vasicek adjustment is preferable because it relies on firm-specific information to adjust the empirical results.

### 1.2.7 Use the expected rate of inflation over the regulatory period

Under our 2013 method we deflated our nominal WACC inputs by applying a single, forward-looking rate that is the expected rate of inflation over the next 10 years, regardless of the length of the regulatory period. We calculated expected inflation as the geometric average of the inflation rate.

In response to our Issues Paper, Sydney Water submitted that we should use a best estimate of expected inflation over the regulatory period rather than 10 years. It also noted our existing method might be problematic when long-term inflation expectations differ substantially from forecast inflation over the regulatory period.<sup>14</sup> We agree with Sydney Water's view, and have decided to use the expected rate of inflation over the regulatory period. We note that this could mean we use a slightly different inflation rate in two concurrent reviews, if we decide to set different regulatory periods for the businesses concerned.

<sup>&</sup>lt;sup>13</sup> Frontier Economics, Review of WACC method: response to IPART Issues Paper: A Report Prepared for Sydney Desalination Plant, August 2017, p 39.

<sup>&</sup>lt;sup>14</sup> Sydney Water submission to IPART Issues Paper, August 2017, p 18.

#### 1.2.8 Calculate the rate of inflation using an approach consistent with the AER's

We have decided to calculate the expected rate of inflation by first calculating the geometric average of the forecast change in the level of prices over the regulatory period, and then converting this average into an annual inflation rate separately. Most stakeholders supported this approach, which is consistent with the AER's approach.

To improve clarity, we have also decided to define the forecast we use in estimating inflation, as the inflation forecast in the RBA's most recently issued Statement of Monetary Policy (SMP) that is closest to 12 months from the start the regulatory period.

In response to our Issues Paper, some stakeholders suggested that we should use a 'breakeven inflation' (BEI) method, which is estimated by comparing yields on nominal bonds to those on inflation-linked bonds.<sup>15</sup> On balance, we consider that while the BEI method has merit in theory, there may be some problems with implementing it currently, and our 2013 method promotes greater stability and predictability for stakeholders. However, we will consider whether we should move to a break-even inflation method at our next WACC review. Most stakeholders supported this approach.<sup>16</sup>

#### 1.3 Our process for this review

In conducting this review, we undertook public consultation and extensive analysis. The key steps in our process were:

- Releasing an Issues Paper in July 2017, which set out our approach, proposed principles for the review and key issues on which we sought feedback. We received seven submissions.
- Holding a public hearing in August 2017 to provide stakeholders with an opportunity to discuss our Issues Paper, propose changes and raise further issues.
- Considering all submissions to the Issues Paper, feedback from the public hearing and conducting our own analysis and research to inform our draft decisions.
- Releasing a Draft Report in October 2017, which set out the analysis and reasoning for our draft decisions, on which we sought feedback. We received six submissions.
- Holding two informal workshops with stakeholders to discuss our draft decisions, particularly on the cost of debt, and work through implementation issues.
- Considering all submissions to the Draft Report and feedback from workshops, and conducting further analysis to form our final decisions.

#### 1.4 Structure of this report

The rest of this report discusses the review in more detail and sets out our analysis and final decisions:

<sup>15</sup> WaterNSW submission to IPART Issues Paper, August 2017, p 13; Hunter Water submission to IPART Issues Paper, August 2017, p 10; NSW submission to IPART Issues Paper, August 2017, p 6.

<sup>16</sup> Sydney Water submission to IPART Draft Report, December 2017, p 6; WaterNSW submission to IPART Draft Report, December 2017, p 15; Hunter Water submission to IPART Draft Report, December 2017, p 12, SDP submission to IPART Draft Report, December 2017, p 14; PIAC submission to IPART Draft Report, December 2017, p 3

- Chapter 2 provides contextual information about our WACC method and our principles for this review.
- Chapter 3 focuses on our approaches for measuring WACC inputs, including our definition of the benchmark firm and the timing of market observations.
- Chapters 4 and 5 discuss our approaches for determining the costs of debt and equity respectively.
- Chapter 6 discusses how we combine debt and equity measurements to derive a point estimate of the WACC, including how we implement the WACC decision rule.
- Chapter 7 focuses on our approaches for measuring inflation and gamma.

#### 1.5 List of final decisions

For convenience, a complete list of our final decisions is provided below.

#### **Measuring WACC inputs**

1	Maintain our definition of the efficient benchmark firm as 'a firm operating in a competitive market and facing similar risks to the regulated business.	21	
2	Synchronise the sampling dates for the risk-free rate, debt margin, current MRP, inflation and the uncertainty index.	23	
3	Adopt a sampling period of 40 working days from the sampling date for the risk-free rate and 2 months for the debt margin, aligning the start and end of the sampling periods as closely as possible.	23	
4	Continue to provide regulated businesses with confidential, advance notice of the sampling dates.	23	
Dete	Determining the cost of debt		
5	Continue to estimate the cost of debt as the midpoint of our estimates of the current and historic cost of debt when our uncertainty index is at, or within one, standard deviation of its long-term average.	26	
6	Estimate the historic cost of debt using a trailing average approach that involves:	29	
	- splitting the historic debt into 10 equal tranches, each with a 10-year term to maturity	29	
	- staggering the commencement and maturity dates for each tranche by one year, and	29	
	<ul> <li>refinancing one tranche at the beginning of each year.</li> </ul>	29	
7	Estimate the current cost of debt using a short-term trailing average approach that involves:	36	
	<ul> <li>splitting the current debt into tranches equalling the number of years in the regulatory period, each with a 10-year term to maturity, and</li> </ul>	36	
	<ul> <li>staggering the commencement and maturity dates for each tranche so that at the beginning of each year of the regulatory period, the interest rate on the oldest</li> </ul>		

	tranche of debt will reprice at the prevailing interest rate on the new tranche of debt.	36		
8	For the current cost of debt, maintain a 40-working day observation window for the risk- free rate and an equivalent two-month observation window for the debt risk premium and:	37		
	choose the exact timing of the observation window	37		
	<ul> <li>inform the regulated firm in advance on a confidential basis</li> </ul>	37		
		51		
9	For the historic cost of debt, adopt a 40-working day observation window for the risk- free rate and an equivalent two-month observation window for the debt risk premium for each new point in the trailing average calculation and:	38		
	<ul> <li>choose the exact timing of the observation window</li> </ul>	38		
	<ul> <li>inform the regulated firm in advance on a confidential basis.</li> </ul>	38		
10	Update the regulatory cost of debt annually, and decide whether to pass through changes via annual price adjustments or a true-up in the subsequent period:	39		
	<ul> <li>as part of the price determination, and</li> </ul>	39		
	<ul> <li>on a firm-by-firm basis.</li> </ul>	39		
11	Where a true-up is used to pass through changes in the cost of debt, the discount rate used to calculate the true-up amount will be the firm's regulatory WACC.	40		
12	Convert published bond yield data into annualised yields.	41		
13	Continue to use a 10-year term to maturity to estimate the cost of debt.	44		
14	Continue to use the 10-year coupon-paying bond yield data to estimate the cost of debt.	45		
15	Continue to use the 10-year BBB corporate bond spreads published by the RBA to measure the debt margin across all industries.	46		
Dete	Determining the cost of equity			
16	Continue to use the Sharpe-Lintner CAPM to estimate the cost of equity, and monitor the impact that the Fama-French model would have if we adopted it at a future review.	50		
17	Continue to estimate the cost of equity as the midpoint between our estimates of the current and historic cost of equity when the uncertainty index is at, or within one standard deviation of its long-term average.	51		
18	Maintain our 2013 method of keeping the cost of equity fixed during the regulatory period.	51		
19	Continue to use a range with a midpoint of 6% as the estimate of historic MRP.	52		
20	Continue to use our existing six methods to measure the current MRP.	55		

21	Continue to use the ASX 200 share price index and consensus earnings per share forecasts to measure the current MRP using the Damodaran and Bloomberg methods and the two Bank of England methods.	55
22	Modify the indicators we use to measure the current MRP using the market indicator method by replacing two of our existing indicators – the dividend yield and the risk-free rate – with one new indicator – the earnings yield less the risk-free rate.	56
23	In combining different DDM MRP estimates, move from the midpoint to a median approach, but do not exclude outliers.	59
24	Determine the point estimate of current MRP as the weighted average of the market indicators MRP and the median DDM MRP, with a one-third weight to the market indicators MRP and two-thirds weight to the median DDM MRP.	59
25	Continue to re-estimate equity betas at each price review to inform our assessment of whether the existing estimates remain appropriate.	61
26	Use the broadest possible selection of proxy companies to estimate equity beta, but exclude thinly traded stocks.	64
27	Adopt a proxy selection process that includes:	64
	<ul> <li>publishing our criteria for proxy selection, and our list of comparator companies that meet our criteria at the start of the relevant review, and</li> </ul>	64
	<ul> <li>giving stakeholders the opportunity to propose additional comparable industries that meet our criteria.</li> </ul>	64
28	Determine the appropriate equity beta having regard to equity betas calculated using the OLS method with the Vasicek adjustment.	65
Com	bining measurements to derive the WACC	
29	Maintain our 2013 method of constructing the uncertainty index.	67
30	Maintain our 2013 method decision rule.	68
31	Continue to use our discretion to determine the appropriate weighting of current and historic average market data when the market is in an abnormal state, and to consult with stakeholders before we make our decisions.	70
32	Continue to re-estimate the gearing of the benchmark entity at each price review to inform our assessment of whether the existing estimates remain appropriate.	74
Meas	suring inflation and gamma	
33	In converting our nominal WACC inputs into real terms, adjust them by the expected rate of inflation over the regulatory period.	77
34	Calculate the average expected inflation rate as the geometric average of:	80

	<ul> <li>the RBA's 1-year ahead inflation forecast in its most recently issued Statement of Monetary Policy for the first year of the regulatory period, and</li> </ul>	80
	<ul> <li>the midpoint of the RBA's target inflation band (2.5%), for the remaining years in the regulatory period.</li> </ul>	80
35	Reconsider whether we should move to a break-even inflation method to calculate the average expected inflation rate at the next review of our WACC method.	80
36	Calculate expected inflation as the geometric average of the change in the level of prices.	81
37	Define the 1-year ahead RBA forecast we use to estimate inflation, as the inflation forecast:	81
	<ul> <li>in the RBA's most recently issued Statement of Monetary Policy, and</li> </ul>	81
	<ul> <li>that is closest to 12 months ahead of the start of the regulatory period.</li> </ul>	81
38	Continue to use 0.25 as the value for gamma.	83

### 2 Context and principles for this review

Our consultations during this review confirmed that our existing 2013 method is generally working well and has resulted in reasonably accurate decisions in the past. Stakeholders can replicate our calculations, and the method has increased the stability of the regulatory regime for our regulated businesses.

Our objective for this review was to identify whether there are opportunities to make incremental improvements to the method so our WACC decisions better reflect efficient financing costs. We developed an approach for meeting this objective, including a set of principles to guide our decision making.

#### 2.1 Who our final decisions affect

Our WACC decisions have a major impact on the returns on assets for our regulated businesses and others affected by our building block calculations. These regulated businesses include:

- water utilities such as Sydney Water Corporation, WaterNSW, Hunter Water Corporation and the Sydney Desalination Plant (SDP), and
- public transport businesses such as Transport for NSW and private ferries.

Other affected businesses include those we review under section 9 of the *Independent Pricing and Regulatory Tribunal Act 1992* (IPART Act), such as the Port Authority of NSW, for which we recently recommended maximum fees and charges for cruise ships.

Our WACC decisions also have a major impact on the customers of our regulated businesses. The allowance for a return on assets within the revenue requirement significantly affects the prices these businesses can charge.

#### 2.2 Scope of this review

The review focussed on how we measure and estimate the parameters we use to calculate the WACC. Its scope included:

- our basis for measurement, including our definition of the benchmark firm and approach to sampling
- how we estimate the parameters for the cost of debt and the cost of equity
- how we bring these parameters together to select a single point estimate of the WACC, and
- how we measure inflation and gamma.

We did not consider broader policy issues related to how we apply the WACC. For example, the type of WACC we apply (ie, whether it is pre- or post-tax, real or nominal) and

matters associated with our building block method (such as financeability) were outside the scope.

We are satisfied that applying a post-tax WACC more closely estimates tax paid by a benchmark firm than applying a pre-tax WACC using the statutory tax rate. We also consider that it is appropriate to maintain our approach of setting a real WACC and indexing the asset base for inflation. Moreover, moving away from a real post-tax WACC would add considerably to uncertainty and have the potential for large price changes.

### 2.3 Our principles for this review

In making our decisions for this review, we aimed to balance the following four principles:

- 1. Our WACC method should produce estimates of the cost of capital that are as reasonably accurate as possible. This will ensure that customers do not pay more than necessary and that the regulated firms will be financially viable and have the incentive to invest in the efficient level of productive assets.
- 2. Our WACC method should be relatively stable over time to give stakeholders certainty.
- 3. Our WACC method should be predictable and replicable by stakeholders to provide transparency and reduce resources required in each review.
- 4. We should make incremental improvements where there is sufficient evidence that they increase the accuracy of the cost of capital faced by a benchmark firm.

We consider these principles take account of the impact of our WACC method on regulated business and their customers, and take account of the matters we are required to consider in making our determinations and recommendations under section 15 of the IPART Act (see Box 2.1).

We added the first principle listed above following PIAC's submission to our Issues Paper, which suggested that we should:

...emphasise the impact on consumers from any changes to the WACC method in this review. This should help to frame the debate to ensure that the WACC methodology is, indeed, working in the best interest of consumers.<sup>17</sup>

PIAC welcomed the inclusion, stating:

Keeping this principle central to the review should help minimise risk that stakeholders lose sight of the overarching role of the WACC in regulatory price and revenue determinations and instead become caught up in an academic or technical debate over which method or model is inherently 'better'.<sup>18</sup>

Each principle, and our rationale for including it, is discussed in more detail below.

<sup>&</sup>lt;sup>17</sup> PIAC submission to IPART Issues Paper, August 2017, pp 1-2.

<sup>&</sup>lt;sup>18</sup> PIAC submission to IPART Draft Report, December 2017, p 1.

#### Box 2.1 Matters we are required to consider under section 15 of the IPART Act

There are several matters we are required to consider in making our determinations and recommendations. Under section 15 of the *Independent Pricing and Regulatory Tribunal Act 1992* (IPART Act) we must have regard to a range of factors, including, but not limited to:

- 1. cost of providing the services concerned
- 2. protection of consumers from abuses of monopoly power
- 3. appropriate return on public sector assets and associated dividends to the Government for the benefit of the people of New South Wales
- 4. need for greater efficiency in the supply of services so as to reduce the costs for the benefit of consumers and taxpayers, and
- 5. impact on borrowing, capital and dividend requirements of the government agency concerned and, in particular, the impact of any need to renew, or increase relevant assets.

The cost of capital is a component of the costs of providing the services. Setting the WACC too high is arguably inconsistent with (2) and (4), while setting it too low may conflict with (3) and (5). The requirement to consider efficiency influences our definition of the benchmark entity and how we measure the WACC parameters.

Source: Independent Pricing and Regulatory Tribunal Act 1992, section 15.

# 2.3.1 Our WACC method should produce as reasonably accurate as possible estimates

Our overarching objective in setting the WACC is to produce a reasonably accurate estimate. This is important because, if we set a WACC that is too high, then customers would pay too much for the services and we risk encouraging too much investment in that business. If we set the WACC too low, then we risk the financial viability of the firm and encouraging too little investment. Neither of these outcomes is in the long term interest of consumers.

# 2.3.2 Our WACC method should be stable over time to provide stakeholder certainty

Having a stable WACC method within and between regulatory periods provides certainty to regulated businesses and their customers. Increased certainty translates to reduced risk, stable revenues for businesses and stable prices for customers.

For example, regulatory stability is an important influence on the credit ratings of Australian water utilities. Moody's rating agency's 'Regulated Water Utilities' methodology assigns a 15% weight to 'stability and predictability of regulatory environment'.<sup>19</sup>

Following the implementation of our 2013 WACC method, in March 2015, Moody's upgraded Sydney Water Corporation's (Sydney Water) issuer rating from A1 to Aa3. It attributed this upgrade to Sydney Water's "expectation of improved transparency in the regulatory framework". Moody's commented that:

IPART has been demonstrating increased predictability and transparency in its regulatory decisions. Although it does not have the track record of the Australian Energy Regulator which

<sup>&</sup>lt;sup>19</sup> Moody's Investor Service, *Rating Methodology – Regulated Water Utilities*, December 2015, p 6.

regulates transmission and distribution electricity and gas networks in the eastern and southern states, it has shown a philosophy that has become increasingly transparent, and supportive of the credit profiles of regulated entities, including Sydney Water.<sup>20</sup>

Similarly, Moody's March 2015 rating report for Hunter Water Corporation (Hunter Water) stated that IPART has "a stable and mature regulatory framework..."<sup>21</sup> and "we believe that IPART will continue to exhibit consistency in its decision translating into increased stability in revenue outcomes for Hunter Water."<sup>22</sup>

In October 2016, Moody's changed its outlook for Sydney Water to stable, stating:

The change in outlook to stable reflects Moody's belief that Sydney Water's shareholder, the New South Wales state government (New South Wales Treasury Corporation (TCorp), Aaa stable), will implement countermeasures to maintain the company's metrics within its rating tolerance level.

...the rating recognizes that the transparent regulatory framework which governs Sydney Water's regulated tariffs provides visibility into likely future revenue reductions and space to implement the required countermeasures to protect its credit profile.<sup>23</sup>

Sydney Water agreed, stating that "IPART's existing WACC methodology works well, incentivising improved financial efficiency and stability. These sentiments have been echoed by our external rating agency, which have maintained our generally stable credit rating".<sup>24</sup>

We have not made broad changes to our WACC method to ensure its ongoing stability.

## 2.3.3 The WACC should be predictable and replicable by stakeholders for increased transparency

In our 2013 WACC review, we decided to publish financial market updates biannually in February and August.<sup>25</sup> We publish these updates to allow our stakeholders to better replicate and anticipate our WACC decisions. In conjunction with the updates, we also release a WACC spreadsheet with a working copy of our WACC model.

This enables stakeholders to understand how our WACC decisions are made. It reduces the resources and effort required by stakeholders in each regulatory review. This has been beneficial for both IPART and the regulated businesses. As discussed above, it has also had a positive impact on the ratings outlook for water utilities, with Moody's specifically referencing IPART's improvement of "the transparency and predictability of its revenue decisions" in its reasoning for changing the Sydney Water rating outlook from stable to positive.<sup>26</sup> It stated that:

<sup>&</sup>lt;sup>20</sup> Moody's Investor Service, *Rating Action: Moody's upgrades Sydney Water's rating to Aa3; outlook stable*, March 2015, p 1.

<sup>&</sup>lt;sup>21</sup> Moody's Investor Service, Rating Action: Moody's assigns first-time A1 issuer rating to Hunter Water Corporation; Outlook Stable, March 2015, p 1.

<sup>22</sup> Ibid.

<sup>&</sup>lt;sup>23</sup> Moody's Investor Service, Rating Action: Moody's changes outlook for Sydney Water Corp's Aa3 rating to Stable, October 2016, p 1.

<sup>&</sup>lt;sup>24</sup> Sydney Water submission to Draft Report, December 2017, p 1.

<sup>&</sup>lt;sup>25</sup> IPART, Review of WACC Methodology – Final Report, December 2013, p 29.

<sup>&</sup>lt;sup>26</sup> Moody's Investor Service, Moody's revises Sydney Water's rating outlook to positive from stable, December 2014, p 1.

The improvement in IPART's transparency is reflected in a number of measures that the regulator has taken in the last 1-2 years, including the bi-annual publication of its financial market updates, following a review of its weighted average cost of capital ("WACC") methodology. As a result, the improvement in the transparency of the regulatory framework is enhancing Sydney Water's credit profile, which also factors in our expectation for continued stability in its financial metrics.<sup>27</sup>

In making our decisions for this review, we sought to maintain or improve our current transparency, predictability and replicability.

## 2.3.4 We should make incremental improvements where there are convincing reasons

While our WACC method has generally performed well over time, we noted in our Issues Paper and Draft Report that there was scope to improve it incrementally. We have made improvements only where we have found that there are convincing reasons for change to increase accuracy, or enhance stability and certainty.

There are many differences between the approaches individual regulators take to calculating the WACC. This makes it difficult to be consistent with other regulators when making our WACC decisions. However, as part of this review we considered recent changes that other Australian and New Zealand regulators have made to their WACC approach, and the evidence and reasons for these changes (See Appendix A).

While stakeholders considered that a consistent approach across regulators would be beneficial, we consider that we should pursue it only where it leads to an improvement. In response to our Issues Paper, Sydney Water stated its view that:

...generally harmonising positions across regulators is beneficial, in so far as harmonisation brings about improvements to IPART's WACC method. That is, change towards regulatory best practice.<sup>28</sup>

Hunter Water stated:

Regulators should continually review and benchmark their methodologies against peers to encourage robust outcomes in their respective jurisdictions. A common position across regulators when it occurs should indicate a best practice position, however should not be promoted for the sake of consistency.<sup>29</sup>

Water NSW stated:

We think that there should be a race to best-in-class, and that it is better to have a regulatory environment that is 'better-and-different', than the 'same-and-worse'.<sup>30</sup>

We agree with these views and have proposed changes only where they would improve the accuracy of our WACC estimate.

<sup>27</sup> Ibid.

<sup>&</sup>lt;sup>28</sup> Sydney Water submission to IPART Issues Paper, August 2017, p 8

<sup>&</sup>lt;sup>29</sup> Hunter Water submission to IPART Issues Paper, August 2017, p A.2

<sup>&</sup>lt;sup>30</sup> WaterNSW submission to IPART Issues Paper, August 2017, p 5

### 3 Measuring WACC inputs

We use two types of inputs for our WACC calculation: industry-specific parameters, and market-based parameters. The industry-specific parameters include the gearing ratio and the equity beta. We measure these parameters by studying a benchmark entity, rather than the actual regulated firm. The market-based parameters include the risk-free rate, debt margin, market risk premium (MRP) and inflation forecast. We base these parameters on a sample of market observations or forecasts.

As part of this review, we have considered:

- our definition of the benchmark entity, particularly whether we should assume that it operates in a competitive or regulated market, and
- our approach to sampling the market observations, including whether the sampling dates for all parameters should be synchronised, and whether these dates should be disclosed to regulated businesses in advance.

The sections below provide an overview of decisions on these issues, and then discuss them in detail.

### 3.1 Overview of our final decisions on measuring WACC inputs

We have decided to maintain our definition of the benchmark entity. We consider this definition is consistent with our price setting objective, and stakeholders expressed strong support for maintaining it.

However, we have also decided to make two changes to our approach to sampling market observations. These are to:

- synchronise the sampling dates for the risk-free rate, debt margin, current MRP, inflation and the uncertainty index, and
- adopt a consistent sampling period of 40 working days and 2 months from the sampling date for the risk-free rate and debt margin, respectively, so that the sampling periods closely align.<sup>31</sup>

We consider these modifications would improve the accuracy of our WACC decisions by recognising the co-relationships between parameters.

In addition, we will continue to provide regulated businesses with advance notice of the sampling dates we will use, but not make this information public until we release our determinations. We consider this would allow businesses to manage their debt portfolios without exposing them to undue financing risk.

<sup>&</sup>lt;sup>31</sup> We measure some parameters daily and others monthly, depending on the data source.

These final decisions are a slight modification from our draft decisions, taking into account our final decisions on how we calculate our cost of debt.

### 3.2 Our definition of the efficient benchmark entity

Our 2013 method estimates the WACC with reference to an efficient benchmark entity, which we define as 'a firm operating in a competitive market and facing similar risks to the regulated business'. The cost of capital for this firm may be different to the regulated business' actual cost. This is consistent with our price setting objective, which is to attempt to replicate the disciplines of a competitive market. A competitive market would limit prices to the level of efficient and prudent costs. This could differ from the costs incurred by the actual business.

Because the benchmark entity is a hypothetical firm, its cost of capital cannot be observed directly. Therefore, we rely on information on a sample of proxy firms to determine the industry-specific WACC parameters. How we define the benchmark efficient entity is important, as it guides our selection of these proxy firms.

### 3.2.1 Other regulators use a different definition

Our definition of the benchmark firm differs from those used in some other Australian jurisdictions. For example, the AER adopts 'a conceptual definition of the benchmark efficient entity that is a pure play, regulated energy network business operating within Australia'.<sup>32</sup>

The AER's reasoning is that demand risk is mitigated by the regulatory regime through revenue or price setting mechanisms under a revenue cap. Energy network businesses can use higher fixed charges to offset demand volatility under a price cap and have the ability to propose the form of control they employ (eg, revenue cap or price cap). By virtue of being regulated, these businesses effectively face a very limited increase in risk due to competition.<sup>33</sup>

The Queensland Competition Authority (QCA) uses similar guidance in choosing proxy firms for benchmarking, being 'pure play', 'regulated' and 'standalone' firms.<sup>34</sup>

The Essential Services Commission of South Australia (ESCOSA) applies a set of operational principles for setting a rate of return, which include that 'The rate of return should reflect the prudent and efficient financing strategy of an incumbent large water utility which minimises expected costs in the long-term, on a risk-adjusted basis'.<sup>35</sup> Further, ESCOSA's operational principles state that 'The assumed prudent financing strategy should not depend on the ownership of the regulated business (ie, the approach is indifferent to whether the entity is in Government or private ownership).'<sup>36</sup>

<sup>&</sup>lt;sup>32</sup> AER, Better Regulation, Explanatory Statement - Rate of Return Guideline, December 2013, p 32.

<sup>&</sup>lt;sup>33</sup> Ibid, p 33.

<sup>&</sup>lt;sup>34</sup> Queensland Competition Authority, *Final decision, Trailing average cost of debt*, April 2015, p 6.

<sup>&</sup>lt;sup>35</sup> Essential Services Commission of South Australia, *SA Water Regulatory Rate of Return 2016 – 2020, Final Report to the Treasurer*, March 2015, p 21.

<sup>&</sup>lt;sup>36</sup> Ibid, p 22.

#### 3.2.2 Stakeholders supported our existing definition

Stakeholders generally supported our current definition.<sup>37</sup> For example, Sydney Water stated:

We believe, complying with IPART's definition will promote efficient financing practices for Sydney Water and deliver long term benefits to our customers. Further we agree with IPART's rationale that it is not necessary to be fully consistent with other regulators.<sup>38</sup>

Hunter Water stated:

Hunter Water's submission to IPART's issues paper also noted the importance of ensuring that the benchmark entity takes into consideration the risks of investing in and operating infrastructure assets. This will recognise the risks of substantial up-front costs and capital investment, long lives of assets and long and detailed planning process which drives investment decision making in a regulated business such as Hunter Water.<sup>39</sup>

PIAC considered that our preliminary view was 'not inappropriate'.40

#### 3.2.3 Our final decision is to maintain our existing definition

We maintain our view that our current definition is appropriate. The underlying rationale for this definition is that, if the regulated utility was subject to competition instead of regulation, then it would be able to pass only efficient capital costs through to customers.

We note that IPART operates under different legislation to that of the AER, QCA and ESCOSA in regulating energy utilities and we regulate a broader cross-section of businesses. In setting prices, we can aim to replicate the outcomes of a competitive market and choose proxy companies that reflect similar risks to those established under our regulatory framework.

We prefer our definition for two reasons:

- 1. It is consistent with our price setting objective, which is to replicate the outcomes of a competitive market. Our definition aims to ensure that a regulated firm faces similar investment incentives to a competitive firm facing similar risks. This approach replicates the outcomes of a competitive market and avoids creating possible distortions between the regulated and competitive sectors of the economy. This encourages an efficient allocation of capital across the economy.
- 2. There are more listed businesses in the competitive sector than in the regulated sector. This means that analysis of firms in the competitive sector benefits from a larger set of observations of the cost of capital and financing strategies.

We consider that it is appropriate to include non-regulated firms (those operating in a competitive market) and relevant regulated firms in the set of proxy firms. This is because:

<sup>&</sup>lt;sup>37</sup> WaterNSW submission to IPART Issues Paper, August 2017, p 7; SDP submission to IPART Issues Paper, August 2017, p 13; PIAC submission to IPART Issues Paper. August 2017, p 2; Sydney Water, submission to IPART Issues Paper, August 2017, p 9; Hunter Water submission to IPART Issues Paper, August 2017, p A.2.

<sup>&</sup>lt;sup>38</sup> Sydney Water submission to IPART Draft Report, December 2017, p 3.

<sup>&</sup>lt;sup>39</sup> Hunter Water submission to IPART Draft Report, December 2017, p 8.

<sup>&</sup>lt;sup>40</sup> PIAC submission to IPART Issues Paper, August 2017, p 2.

- Our price setting objective aims to replicate the outcomes of a competitive market and therefore firms should be compensated for that level of risk.
- Some other regulators, such as ESCOSA, aim to replicate the outcomes of a competitive market, potentially making those regulated firms appropriate proxies. Businesses that are not regulated under this objective would be less suitable proxies.
- For some industries, there are few proxy firms. Therefore, we include some regulated firms as a practical necessity.

#### **Final Decision**

1 Maintain our definition of the efficient benchmark firm as 'a firm operating in a competitive market and facing similar risks to the regulated business.

#### 3.3 Synchronise sampling dates and align sampling periods

Because market observations tend to be volatile, the timing of the observations we use to measure the market-based parameters is important, particularly for the current parameters. Sampling at different times would yield different WACC values.

Data on some current parameters is generally published on the last workday of each month. The exceptions are the risk-free rate, which is published daily, and inflation, which is a forecast. This means we have two main options. We can either sample data:

- on the closest possible day to the date we make our WACC decision for each parameter (the latest available data method), or
- on a common day for all parameters (the synchronised method).

Under our 2013 method, we use the latest available data method.<sup>41</sup> In practice, this means we use the latest month's data for most parameters, and the latest day's data for the risk-free rate (published the day we make our WACC decision). In addition, we use end-of-month values for the MRP and debt margin calculations, but use a 40 working day average of daily values to calculate the risk-free rate estimate.

While our 2013 method ensures we use the most recent information available for all parameters, it also means we use information sampled on different dates. This could result in errors when parameters co-vary over time, such as the risk-free rate and the MRP. To address this issue, we made draft decisions to synchronise our sampling dates and consider adopting a similar sampling period across all market parameters.

#### 3.3.1 Most stakeholders supported our draft decisions

Most stakeholders agreed that synchronising sampling dates across parameters would be an incremental improvement to our current approach. For example, in response to our Issues Paper, Sydney Water submitted that:

<sup>&</sup>lt;sup>41</sup> In the instance where we have more than one determination or decision starting from the same (or very near) date, we use the same sample dates for all determinations/decisions.

...synchronising and aligning sampling dates would be beneficial by removing measurement error and/or biases, with little to no additional administrative costs.<sup>42</sup>

Hunter Water stated that:

...synchronised sampling of parameters represents an incremental improvement that will improve accuracy in the cost of capital.<sup>43</sup>

However, Sydney Water did not support our draft decision to adopt a sampling period of two months for the risk-free rate and debt margin stating:

A sampling period of two months for the current cost of debt results in significant refinancing risk. Sydney Water considers that the reference period for the current cost of debt be extended to 4 years.<sup>44</sup>

#### 3.3.2 We will synchronise sampling dates and use an aligned sampling period

We have decided to synchronise sampling dates, so that we use the latest month's data for debt margin, current MRP, inflation and the uncertainty index, and the risk-free rate published on the same day as that monthly data. This method would minimise any errors that may arise from sampling variables on different dates. However, it would also mean that the risk-free rate sample would normally not be the most recent available, unless the WACC decision is made very close to the beginning of a month.

The synchronised method improves the accuracy of our WACC decisions because it recognises co-relationships. Combining WACC inputs that were sampled on different dates does not necessarily cause a problem if those inputs are uncorrelated. But when two inputs are correlated, they should be sampled on the same date. Otherwise, the date inconsistency could lead to systematic bias in the WACC estimate, as illustrated by the three examples presented in our Issues Paper.<sup>45</sup>

While moving to the synchronised method would reduce any potential bias in the estimates that may result from a mismatch in our sampling periods, it may not completely eliminate it unless we adopt a similar length sampling period.

As discussed in Chapter 4, we have made final decisions to calculate the historic and current cost of debt using a trailing average with a sampling period of 40 working days (40-day period) for the risk-free rate. In light of this, we have made a slight modification to our sampling periods. We have decided to use a 40-day period for the risk-free rate and a two month period for the debt margin, aligning the start and end of the sampling periods as closely as possible.

We consider that Sydney Water's proposal to adopt a 4-year sampling period for current data<sup>46</sup> would substantially reduce the influence of current financial conditions on the WACC. These conditions reflect the marginal cost of capacity expansion. We consider that setting prices (in part) to reflect this marginal cost is important.

<sup>&</sup>lt;sup>42</sup> Sydney Water submission to IPART Issues Paper, August 2017, p 10.

<sup>&</sup>lt;sup>43</sup> Hunter Water submission to IPART Issues Paper, August 2017, p A.3.

<sup>&</sup>lt;sup>44</sup> Sydney Water submission to IPART Draft Report, December 2017, p 3.

<sup>&</sup>lt;sup>45</sup> IPART, *Review of our WACC method – Issues Paper*, July 2017, pp 16-17.

<sup>&</sup>lt;sup>46</sup> Sydney Water submission to IPART Draft Report, December 2017, p 3.

- 1. For the firm, because the current cost of borrowing is the efficient cost of financing new investment. Ideally, the current estimate would reflect the expected cost of debt at any point within the regulatory period when debt is required to finance expansion.
- 2. For customers, because their decision to consume an extra unit of water, or electricity, should be influenced by the cost this imposes, which will often reflect the cost of expansion.

If we diluted the impact of the current cost of debt by using a 4-year average sampling period, it would be harder to take account of the current cost of equity, which reflects market conditions in a way that historic cost of equity doesn't.

#### **Final Decision**

- 2 Synchronise the sampling dates for the risk-free rate, debt margin, current MRP, inflation and the uncertainty index.
- 3 Adopt a sampling period of 40 working days from the sampling date for the risk-free rate and 2 months for the debt margin, aligning the start and end of the sampling periods as closely as possible.

#### 3.4 Continue to notify regulated businesses of sampling dates

We currently provide regulated businesses with advance notice of the sampling period we will use to measure the current market-based parameters. However, we do not publish this information until we release our price determination.

Advance notice of the sampling period allows the business to manage some of the regulatory risk associated with our WACC decision (ie, the risk that movements in interest rates and borrowing costs over the regulatory period result in a significant divergence between our decision on the cost of debt and the actual cost of debt over the period). In particular, it allows it to hedge its debt portfolios in line with our decision on the cost of debt.

Keeping the sampling period confidential until our determination is finalised ensures there is no impact on the businesses' financing risk. For example, if financial market participants knew the sampling dates we proposed to use in advance, they would know when businesses were likely to raise debt or execute hedges and could raise their borrowing or hedging costs accordingly.

For these reasons, our draft decision was to continue this current approach. As stakeholders generally supported our draft decision, we have maintained this decision.

#### **Final Decision**

4 Continue to provide regulated businesses with confidential, advance notice of the sampling dates.

### 4 Determining the cost of debt

Under our 2013 method, we determine the regulatory cost of debt as the midpoint between our estimates of the historic cost of debt and the current cost of debt.<sup>47</sup> This approach places equal weight on each of these costs. We set this value at the start of the regulatory period, and do not adjust it during the period.

We estimate the historic and the current cost by adding the **risk-free rate** of return (calculated using data on 10-year Australian Government Bond (AGS) yields) and the **debt margin** (calculated using data published by the RBA on the spread between 10-year BBB-rated corporate bond yields and the 10-year AGS yields).<sup>48</sup> For the historic cost of debt, we use averaged data for the previous 10 years. For the current cost, we use averaged data for a recent 40 working day period (a 40-day observation window).

In this review, we considered a range of potential improvements to this approach and the data we use. The sections below outline our final decisions (using **bold** to highlight those that differ from our draft decisions), and then discuss each decision in detail.

### 4.1 Overview of final decisions on cost of debt

Our final decision is to maintain our 2013 method of determining the cost of debt as the midpoint between the historic and the current costs of debt, unless there is significant economic uncertainty. On balance, we consider a midpoint approach creates the right balance of incentives for efficient investment and for prudent debt management.

However, we have decided to make incremental changes to the way we calculate the historic and the current costs, and to update these costs during the regulatory period. These changes serve the long-term interests of customers, as they should increase the accuracy of our approach and reduce the refinancing risks that regulated businesses face. They are also consistent with stakeholder feedback. They are to:

- Adopt a 10-year trailing average approach to calculate the historic cost of debt. This should increase the accuracy and replicability of this calculation, and is only a relatively minor change from our 2013 method.
- Adopt a short-term trailing average approach to calculate the current cost of debt, where the period of the trailing average equals the length of the regulatory period. This should allow firms to better manage their refinancing risk, while maintaining their incentives for efficient investment.

<sup>&</sup>lt;sup>47</sup> We select the midpoint when the uncertainty index is at, or within, one standard deviation of the long-term average.

<sup>&</sup>lt;sup>48</sup> There is also small allowance (12.5 basis points) for debt raising costs added to both the current and historic estimates.

- Adopt consistent observation windows in calculating the historic and current costs of debt. Under the trailing average approach, we need to sample the cost of debt annually for both the historic and current cost estimates. To do this, we will use a subset of financial market data over a 40-day observation window each year, and give the specific business advance notice of this window. This approach is most consistent with how an efficient benchmark entity would raise and manage debt in a competitive market.
- Update our cost of debt decision during the regulatory period, and decide how changes will flow through to prices on a case-by-case basis, as part of the review process. We will use a trailing average approach to update the cost of debt at the start of each year within the period. Before the start of the period, we will decide on a caseby-case basis whether the annual changes in the cost of debt will flow through to prices in the subsequent year, or whether they will be cumulated and passed through via a true-up in the subsequent regulatory period.
- Where we decide to use a true-up, we will discount changes in the cost of debt by the WACC to account for the time value of money.
- **Annualise bond yield data** derived from semi-annual rates of return, which should increase the accuracy of our method.

Other elements of our 2013 method will remain unchanged. In particular, we have decided continue using a 10-year term-to-maturity in calculating both the historic and current cost of debt. We will also continue to use RBA data on the spread between corporate and government bond yields to measure the debt margin, and data on coupon-paying AGS yields to measure the risk-free rate.

Appendix B provides more technical detail on how we will estimate the historic and current cost of debt under our 2018 method.

### 4.2 Maintain our midpoint method

In line with our draft decision, we have decided to continue determining the cost of debt as the midpoint between our estimates of the historic and the current cost of debt, and only consider moving away from this midpoint rule when our uncertainty index indicates market conditions are highly volatile.

### 4.2.1 Stakeholders preferred historic trailing average for all debt

Most stakeholders advocated that we should determine the cost of debt by only estimating a 10-year trailing average.<sup>49</sup> Effectively, this would mean placing 100% weight on the historic cost and no weight on the current cost.

<sup>&</sup>lt;sup>49</sup> Hunter Water submission to IPART Draft Report, December 2017, p 8; Sydney Water submission to IPART Draft Report, December 2017, p 3; NSW Treasury submission to IPART Draft Report, December 2017, p 2; WaterNSW submission to IPART Draft Report, December 2017, p 4.

#### 4.2.2 We think a midpoint approach creates right balance of incentives

Prices for regulated goods and services should send signals to the regulated business that encourage efficient behaviour. To do this, the cost of debt applied to new investments should represent the marginal cost of borrowing at the time that the business is considering new capital expenditure. Prices should also send signals to consumers about efficient consumption. If the cost of debt does not reflect the marginal cost of providing additional supply capacity, it could encourage inefficient consumption decisions.

When the allowance for the cost of debt in the WACC is significantly higher than the marginal cost of borrowing, firms have an incentive to borrow and invest more than the efficient level. This behaviour could lead to prices that are above the efficient level. Conversely, when the allowance is significantly lower than the marginal cost of borrowing, firms would have an incentive to borrow less and underinvest relative to efficient levels. This behaviour could adversely affect the quality of service.

Given the above, IPART's view is that:

- the current cost of debt must form part of the calculation for the cost of debt allowance included in the WACC so that the WACC provides efficient investment signals, and
- a 50% weight on the current cost of debt is appropriate as it sufficient to provide these signal while also recognising that, in practice, regulated businesses engage in longterm debt strategies.

#### **Final Decision**

5 Continue to estimate the cost of debt as the midpoint of our estimates of the current and historic cost of debt when our uncertainty index is at, or within one, standard deviation of its long-term average.

# 4.3 Adopt a 10-year trailing average approach to calculate the historic cost of debt

Under our 2013 method, at the beginning of each regulatory period we estimate the historic cost of debt by:

- calculating a 10-year average of daily observations for the 10-year tenor risk-free rate, and
- adding a 10-year average of monthly observations for the 10-year tenor BBB corporate bond debt margin.

We do not update this estimate during the regulatory period.

In our Draft Report, we did not propose changes to this approach. However, after considering stakeholder feedback we have decided to move to a trailing average approach in our 2018 method.

#### 4.3.1 Stakeholders preferred a 10-year trailing average approach

In submissions and other consultations, stakeholders advocated that we adopt a 10-year trailing average to estimate the historic cost of debt.<sup>50</sup> In particular, SDP argued that our 2013 method cannot be replicated:

In order to match the long-term cost of debt allowance at the beginning of the regulatory period, a firm would have to issue 10-year fixed rate debt consistently over the prior 10 years. During the regulatory period, some of that debt would mature and have to be refinanced at prevailing rates, whereas the regulatory allowance under IPART's proposed approach would remain fixed. If prevailing rates have departed from the fixed regulatory allowance (which is very likely), then this would result in a mismatch between the firm's actual cost of debt and the allowed cost of debt.<sup>51</sup>

SDP commented further that:

There is no efficient or feasible way for SDP or any other regulated business to use interest rate swaps or other derivatives to eliminate such mismatches...Shareholders ultimately bear these cash flow mismatches and any attendant financeability risks...the existing regulatory approach also unnecessarily exposes consumers to the risk of over-paying for the regulated services they receive.<sup>52</sup>

### 4.3.2 We will adopt a 10-year trailing average approach for the historic cost of debt in our 2018 method

We have considered stakeholders' analysis and decided to change our approach. Because our 2013 method does not update the historic cost of debt within a regulatory period, it implicitly assumes that debt maturing within the period is refinanced at historic costs rather than prevailing interest rates. In general, this means firms are not able to match the cost of debt maturing within a regulatory period with the cost of new debt issuance. As a result, our 2013 method can create refinancing risks for firms on the portion of their debt that is maturing during the regulatory period.

We also accept that because a trailing average approach updates the historic cost of debt annually within a regulatory period, it assumes that maturing debt is refinanced at prevailing interest rates. This increases accuracy and reduces refinancing risks for firms.

At the same time, we maintain our view that our 2013 method and a trailing average approach are likely to produce a similar cost of debt over time, on average. They will produce the same cost at the beginning of the regulatory period. The annual changes in this cost during the period under a 10-year trailing average approach are likely to be small because the cost of debt is recalculated for only 5% of the benchmark firm's total debt each year.<sup>53</sup> Over time, we would expect annual changes in the cost of debt would tend to net out over the course of a business cycle.

<sup>&</sup>lt;sup>50</sup> Hunter Water submission to IPART Draft Report, December 2017, p14, SDP submission to IPART Draft Report, December 2017, p 12.

<sup>&</sup>lt;sup>51</sup> SDP submission to IPART Draft Report, December 2017, p 4.

<sup>&</sup>lt;sup>52</sup> Ibid, p 4.

<sup>&</sup>lt;sup>53</sup> Each year, the change in the historic estimate will be added to the change in the current estimate. Depending on the length of the regulatory period, in total, about 15-20% of the firm's debt would reprice each year under our 2018 method.

Nevertheless, consistent with stakeholder feedback, our final decision is that we will estimate the historic cost of debt using a 10-year trailing average. We believe this change is an incremental improvement that will increase the accuracy of our 2018 method and reduce risks for regulated firms with no significant drawbacks.

# 4.3.3 We will estimate the 10-year trailing average by splitting the historic cost into 10 equal parts

Under our 2018 method, we will estimate the historic cost of debt at the beginning of each regulatory period, and update this cost annually during the period.

To estimate the 10-year trailing average, we will split the historic cost of debt into 10 equal parts, or tranches, with the commencement and maturity dates for each tranche staggered by one year. At the beginning of each year of the regulatory period, the oldest tranche of debt will mature and a new tranche at the new prevailing interest rate will replace it.

To update the historic cost of debt, we will calculate the change in the historic cost of debt each year during the regulatory period by:

- measuring the interest rate of the new tranche of debt, and subtracting the interest rate of the maturing tranche of debt, and
- dividing this number by the total of tranches (ie, 10).

The change in the cost of debt calculated at the beginning of year *i* of regulatory period ( $\Delta R_i$ ) is also shown in equation 1 below:

(1) 
$$\Delta R_i = \frac{(R_i - R_{i-10})}{10}$$

where  $R_i$  is the interest rate in year *i*.

We will estimate the interest rate for each annual tranche of debt using a 40-day observation window that we would choose. We will also give firms advanced notice of this window. See section 4.5 for further explanation.

### 4.3.4 We will implement this new approach at the start of the next regulatory period

We do not think it is necessary to transition to our new approach for estimating the historic cost of debt. Therefore, we will implement the 10-year trailing average approach at the start of the next regulatory period, when our 2018 method applies. Under this approach we will:

- initially set the historic cost of debt as a 10-year average, with the interest rate for each annual tranche estimated over a consistent 40-day period
- update the historic cost of debt from the beginning of the second year of the regulatory period, by averaging the interest rates of each annual tranche of debt
- calculate the change in the historic cost of debt in line with equation (1) above, and
- pass through this change in the 10-year trailing average to prices through either an annual update or a regulatory true-up in the following period (discussed in section 4.6 below).

To illustrate the difference between our 2013 method for calculating the historic cost of debt and our new 10-year trailing average approach, Figure 4.1 compares the interest rate data we would use to calculate this cost for a hypothetical firm under each method.



## Figure 4.1 Calculating the historic cost of debt under our 2013 method compared to our 2018 method

**Note:** R(y) is the interest rate on a bond issued in Year *y*. For example, R(0), is the interest rate for a 10-year bond issued in Year 0.

#### **Final Decision**

- 6 Estimate the historic cost of debt using a trailing average approach that involves:
  - splitting the historic debt into 10 equal tranches, each with a 10-year term to maturity
  - staggering the commencement and maturity dates for each tranche by one year, and
  - refinancing one tranche at the beginning of each year.

## 4.4 Adopt a short-term trailing average approach to estimate the current cost of debt

Under our 2013 method, at the beginning of each regulatory period we estimated the current cost of debt by calculating a 40 working day average of recent daily observations for the 10-year tenor risk-free rate, and adding a 2-month average of monthly observations for the 10-year tenor BBB corporate bond debt margin. We did not update this value during the regulatory period.

Our draft decision was to adopt a new approach that involved:

- calculating the current cost of debt in line with our 2013 method at the beginning of each regulatory period
- adjusting this estimate at a monthly basis during the regulatory period to reflect changes in the actual cost of debt during the regulatory period, and
- making this adjustment at the beginning of the following regulatory period using a true-up mechanism.

We considered that this would be an incremental improvement to the extent that it addressed stakeholders' concerns that the current approach creates refinancing risk, and enhanced investment incentives because it would reflect the marginal cost of raising debt **at all points during** the regulatory period.

#### 4.4.1 Stakeholders did not support our draft decision

Stakeholders were generally receptive of an approach that updates the cost of debt during the regulatory period, particularly on an annual basis. For example, Hunter Water suggested that a "well-designed method of updating the current cost of debt should allow the utility to match or closely approximate the actual cost of new debt raised throughout the regulatory period".<sup>54</sup>

However, stakeholders did not support the specific approach we set out in our Draft Report. They identified two particular drawbacks. The first was that it would not reduce refinancing risk. Because our draft decision resets the current cost of debt estimate at the beginning of each regulatory period, to match it a firm would still need to refinance at least half its debt portfolio for a 10-year period just prior to the start of a regulatory period. NSW Treasury stated:

In order to effectively hedge the current cost of debt allowance, the utility would have to issue all the debt related to the current cost of debt allowance (50% of total debt portfolio) during the 40 day averaging period prior to each determination. A pro-rata portion of this debt would mature at each month-end of the determination period. This maturing debt would then need to be refinanced into debt that matured at the end of the determination period. The process would then repeat with all the debt related to the current cost of debt (50% of total debt portfolio) being refinanced. The new proposal increases the refinancing burden instead of reducing this burden as IPART suggest in their draft report.<sup>55</sup>

The second was that updating the current cost of debt on a monthly basis would be uneconomic. For example, SDP argued that the costs associated with refinancing, or hedging, a small share of debt each month would be inefficiently high.<sup>56</sup> Sydney Water submitted it "would be unlikely for an efficient benchmark entity to refinance approximately 1 percent of its total debt monthly".<sup>57</sup> However, Sydney Water also thought the use of monthly data would "provide a fair estimate of efficient debt costs over longer periods relative to say a yearly reference period".<sup>58</sup>

<sup>&</sup>lt;sup>54</sup> Hunter Water submission to IPART Draft Report, December 2017, pp 3-4.

<sup>&</sup>lt;sup>55</sup> NSW Treasury submission to IPART Draft Report, December 2017, p 2.

<sup>&</sup>lt;sup>56</sup> SDP submission to IPART Draft Report, December 2017, pp 27-28.

<sup>&</sup>lt;sup>57</sup> Sydney Water submission to IPART Draft Report, December 2017, p 8.

<sup>&</sup>lt;sup>58</sup> Ibid, p 8.

Several stakeholders proposed that, if we maintain the midpoint rule, we could instead update the current cost of debt by adopting a short-term trailing average approach, on the basis that this would be an incremental improvement over our 2013 method.<sup>59</sup> In contrast, SDP proposed we update the current cost of debt by re-estimating the current cost of debt on an annual basis, by:

[resetting] the current cost of debt allowance each year in a defined 40 day window of time just prior to the commencement of the year in which prices are changed (rather than each month, as proposed by IPART in the Draft Report). This would ensure that an efficient business can match reasonably closely the cost of debt associated with its short-term debt pool, whilst exposing businesses to the prevailing cost of debt and efficient investment signals.<sup>60</sup>

Figure 4.2 illustrates how SDP's approach would work for a firm with a 4-year regulatory period.



Figure 4.2 How SDP's proposed approach to estimating the current cost of debt would work

**Note:** R(y, T) is the interest rate on a bond issued in Year y for a term of length T. For example, R(0,10), is the interest rate for a 10-year bond issued in Year 0.

## 4.4.2 We will adopt a short-term trailing average approach for the current cost of debt

We agree with stakeholders on the two drawbacks they identified with our draft decision, and with the suggestion that updating the current cost of debt by adopting a short-term trailing average approach would be an incremental improvement over our 2013 method.

We are concerned that SDP's proposed approach would result in excessive price volatility. Figure 4.3 plots the absolute annual changes in the risk-free rate and the debt margin, since 2006. It shows that SDP's proposed approach could lead to significant annual movements in interest rates.

Accordingly, our final decision is that we will estimate the current cost of debt as a short-term trailing average.

<sup>&</sup>lt;sup>59</sup> WaterNSW submission to IPART Draft Report, December 2017. pp 13-14, Sydney Water submission to IPART Draft Report, December 2017, p 8, Hunter Water submission to IPART Draft Report, pp 3-4 and NSW Treasury submission to IPART Draft Report, December 2017, p 3.

<sup>&</sup>lt;sup>60</sup> SDP submission to IPART Draft Report, December 2017, p 5.

Figure 4.3 Absolute annual changes in the risk-free rate and debt margin



**Note:** Each point calculates the annual change in the risk-free rate and debt margin, with the risk-free rate and debt margin measured over a 40-day, or 2-month period, in the two years. **Data source:** Bloomberg; RBA

### 4.4.3 We will estimate the short-term trailing average by splitting the current cost into tranches

Under the 2018 method, we will estimate the short-term trailing average in a similar way to the 10-year trailing average. We will split the current cost of debt into a number of equal tranches. This number will be equal to the years in the regulatory period, and the commencement and maturity dates for each tranche will be staggered by one year.<sup>61</sup> At the start of each year of the regulatory period, the oldest tranche of debt will mature and a new tranche at the new prevailing interest rate will replace it.

Once the short-term trailing average is fully implemented, it will measure the average cost over a period equal in length to the regulatory period. For example, over a 4-year regulatory period, it will measure the average cost of debt over the previous four years.

To update the current cost of debt, we will calculate the change in the current cost of debt each year during the regulatory period by:

- measuring the interest rate of the new tranche of debt, and subtracting the interest rate of the maturing tranche of debt, and
- dividing this number by the total number of tranches (eg, four).

We will account for any changes to the length of the regulatory period as they arise, usually as part of the review process.

We will adopt the same approach to measure the interest rate for each annual tranche of debt for both current and historic estimates (ie, adopting a consistent 40-day period that we will choose). See section 4.5 for further explanation.

<sup>&</sup>lt;sup>61</sup> This differs from the approach to estimating the current cost of debt we proposed in our Draft Report. The method in our Draft Report staggered the commencement dates, but did not stagger the maturity dates, for each tranche of debt.
We will also adopt a 10-year term-to-maturity (TTM) for the current estimate of the cost of debt. See section 4.8 for further explanation.

### 4.4.4 We will transition to the short-term trailing average over one regulatory period

Unlike the historic cost of debt, our 2013 and 2018 methods for estimating the current cost of debt are distinctly different. Our 2013 method measures the cost of debt at a discrete 40 working day window each regulatory period, whereas the short-term trailing average measures the average cost of debt over a period equal in length to the regulatory period. Given this difference, we have decided to transition to the new method, to promote stability and to allow stakeholders sufficient time to transition to our new method.

At the beginning of the next regulatory period when our new WACC method applies, we will initially set the current cost of debt as a 40-day average, in line with our 2013 method. At the beginning of the second year, we will begin updating the current cost of debt, by taking the average across the interest rates in each tranche of debt, as shown in **Figure 4.1**. We will calculate the change in the cost of debt at the beginning of Years 2 to 4 of the period  $(\Delta R_i)$ , as:

(2) 
$$\Delta R_i = \frac{(R_i - R_1)}{4}$$

where  $R_i$  is the interest rate in year *i*=2,3,4.

We will pass through this change in the 10-year trailing average to prices with an annual update, or via a regulatory true-up in the following period.

To illustrate the difference between our 2013 method for calculating the current cost of debt and our new short-term trailing average approach, Figure 4.4 compares the interest rate data we would use to calculate this cost for a hypothetical firm under each method.



Figure 4.4 Calculating the current cost of debt under our 2013 method and 2018 method

**Note:** R(y) is the interest rate on a bond issued in Year y. For example, R(0), is the interest rate for a 10-year bond issued in Year 0.

# 4.4.5 Our 2018 method for estimating the current cost of debt is an incremental improvement

We are satisfied that adopting a short-term trailing average for the current cost of debt is an incremental improvement over our 2013 method. Compared to the 2013 method, our new method increases accuracy, reduces refinancing risk for firms and maintains efficient investment incentives. These benefits more than offset the slight increase in complexity.

### Increases accuracy

Our new method measures the cost of debt in each year of the regulatory period, whereas the 2013 method measures the cost of debt in a 40-day period before the beginning of each regulatory period. Therefore, our 2018 method will more accurately account for changes in the cost of debt over time.

# **Reduces refinancing risk**

Under our 2013 method, a firm that issues long-term debt gradually (eg, on a staggered maturity basis) can face significant refinancing risk. The firm can contract interest rate swaps over the 40 working day period prior to the beginning of the regulatory period to

match the risk-free rate. However, there can be a large mismatch between the debt margin, measured over a 2-month period prior to the beginning of the regulatory period, and their actual debt margin, which is an average across their outstanding debt issuance.

Our 2018 method significantly reduces this risk. This is because the mismatch between the debt margin is smaller, because our 2018 method samples the debt margin over a regulatory period (typically 3-5 years). The firm can still contract interest rate swaps, each year on a rolling basis, to hedge changes in the risk-free rate.

That said, under the short-term trailing average, the firm would not typically match the average debt margin across their outstanding debt issuance in a given regulatory period. However, over the course of multiple regulatory periods, the short-term trailing average should approximate the firms' actual debt margin. This is because the short-term trailing average is a short-term moving average, whereas the firm's actual debt margin would be a long-term moving average. In some regulatory periods, the short-term average will be higher than the long-term average, but in other periods it will be lower.

In contrast, under our 2013 method, a firm issuing long-term debt would not be able to match the current estimate of the debt margin, even across many regulatory periods. This is because we estimated our current debt margin at discrete points in time, rather than as a short-term average.

#### Maintains efficient investment incentives

To provide efficient investment signals, our estimate of the current cost of debt should reflect the marginal, or current, cost of borrowing. Our 2013 method, and the short-term trailing average, equally reflect the marginal cost of financing new investment. To see why, consider a firm with a 4-year regulatory period:

- Under our 2013 method, at the beginning of the period the current cost of debt is the marginal cost of borrowing. By the end of the period, the estimate is four years out of date. Over the course of the regulatory period, the cost of debt estimate is two years out of date on average.
- Once implemented, our 2018 method measures the average cost of debt over the past four years at all points during the regulatory period. In effect, the average of this window is a cost of debt estimate that is two years out of date.

#### Slightly increases complexity

Our new approach does increase the complexity of our 2018 method, because we have to pass through changes in the cost of debt, either through an annual update or using a regulatory true-up in the following period. For the current cost of debt, we will transition to our new method over one regulatory period.

However, we consider that this increase in complexity is modest. We have clearly outlined how we pass through changes in the cost of debt under the two options, and the transition to the short-term trailing average is straightforward and occurs within a single regulatory period.

Overall, we consider that the reduction in refinancing risks under our proposed approach is material, and sufficient to warrant the increased complexity of a short-term trailing average.

#### **Final Decision**

- 7 Estimate the current cost of debt using a short-term trailing average approach that involves:
  - splitting the current debt into tranches equalling the number of years in the regulatory period, each with a 10-year term to maturity, and
  - staggering the commencement and maturity dates for each tranche so that at the beginning of each year of the regulatory period, the interest rate on the oldest tranche of debt will reprice at the prevailing interest rate on the new tranche of debt.

# 4.5 Adopt consistent observation windows in calculating historic and current costs

We estimate both the historic and current cost of debt by observing market interest rates and debt risk premia. Under our 2013 method, we observe:

- The current cost of debt over a window of 40 working days close to the start of the regulatory period. We take the average of 40 daily observations to sample the risk-free rate, and the average debt risk premium over a similar window.
- The historic cost of debt over a window of 10 years. We take the average of all daily observations over approximately 2,500 working days for the risk-free rate, and the debt risk premium over a matching window, taking the average over 120 monthly observations.

We have decided to maintain the 40-day observation window for current debt. This window will apply each year when we update the trailing average for the current cost of debt. We will inform only the regulated firm of the exact timing of this observation window **in advance** so it can make efficient hedging arrangements without signalling to the market a large debt issuance, which might potentially distort the price. This position on the observation window is consistent with our Draft Report.

We have also decided to change the observation window for historic debt so it is consistent with that for current debt. Instead of a 10-year daily average, we will average 10 annual observations. Each annual observation will be the average across a 40-day observation window. We will inform the regulated firm of the exact timing of the observation window for the current year on a confidential basis in advance. Observation periods for past years will remain fixed. This is a change since our Draft Report.

The observation windows for current and historic debt will be consistent for each annual tranche.

### 4.5.1 Stakeholders were divided on observation window

In further consultations with stakeholders, stakeholders were divided on their preferred observation window. On one hand, SDP preferred a continuation of the 40-day observation window that we use now for current debt, because it is more efficient for a debt issuer of its size to go to market infrequently with debt tranches of a certain minimum size.<sup>62</sup> An

<sup>&</sup>lt;sup>62</sup> Consultation between IPART and stakeholders, January 2018.

observation window longer than 40 working days would lead to an average cost of debt that it would be unable to replicate in the market, given its current issuing practices.

On the other hand, TCorp suggested that we move to an observation window similar to that used by the AER.<sup>63</sup> Under the AER's approach, each regulated firm would nominate its own preferred dates and length of observation window in advance. The window may be as short as 10 working days or as long as one year, at the firm's discretion.<sup>64</sup> Treasury and TCorp's reasons for moving to such an approach appeared to be that:

- As they borrowed for all of the NSW Government's requirements it was a practical necessity to tap bond markets frequently during the year.
- If TCorp and the state-owned utilities were to align the fund-raising activity to the 40day observation window, TCorp could saturate the market with debt raising. This saturation would increase the Government's cost of borrowing.<sup>65</sup>

# 4.5.2 We will use a 40-day sampling period in our 2018 method

In our view, we should not employ different observation windows for different regulated firms, as this would potentially lead to different WACC results for otherwise similar organisations. That means the length of the observation window must be the same for all the firms we regulate. It also means that when we set prices for two firms at the same time, the observation windows should be the same.

We agree with SDP's reasoning in support of continuing to use a 40-day period. We have considered the arguments TCorp put to us, but have decided not to allow firms to choose the timing or the length of the observation window.

While TCorp needs to issue debt on a continuous basis, part of the reason for this is that it needs to issue debt to service a whole-of-government portfolio. Firms in a competitive market do not tend to issue debt continuously; they would only do so at various points in time.

In addition, under our 2018 method the short-term trailing average cost of current debt consists of annual tranches of debt with a 10-year term-to-maturity. Most stakeholders indicated to us that they would not actually refinance each of these tranches each year. Instead they would hold tranches of long-term debt (eg, 10-year tenor) that are refinanced less frequently, and use swap contracts to match the regulatory debt allowance. If stakeholders refinance swap contracts each year, TCorp's concerns should be addressed if we do not publicly disclose the observation window ahead of time.

### **Final Decisions**

- 8 For the current cost of debt, maintain a 40-working day observation window for the riskfree rate and an equivalent two-month observation window for the debt risk premium and:
  - choose the exact timing of the observation window
  - inform the regulated firm in advance on a confidential basis.

<sup>63</sup> Ibid.

<sup>&</sup>lt;sup>64</sup> Australian Energy Regulator, *Better Regulation, Rate of Return Guideline*, December 2013, p 4.

<sup>&</sup>lt;sup>65</sup> Consultation between IPART and stakeholders, January 2018.

- 9 For the historic cost of debt, adopt a 40-working day observation window for the risk-free rate and an equivalent two-month observation window for the debt risk premium for each new point in the trailing average calculation and:
  - choose the exact timing of the observation window
  - inform the regulated firm in advance on a confidential basis.

### 4.6 Decide how to pass-through annual changes

Under our new trailing average approaches for estimating the historic and current costs of debt, we need to update our decision on the cost of debt each year. We considered whether:

- prices should update each year to reflect the updated cost of debt, or
- the regulated business should store the price changes until the start of the next regulatory period, when we would implement them through an NPV-neutral true-up to the regulatory revenue requirement.

In our view, each option should be equivalent in present value terms, so the decision to take one approach or the other should have no impact on the value of a regulated firm. Likewise, the effect on the firm's customers should also be equivalent in present value terms.

Therefore we will decide whether to apply annual price adjustments or a true-up on a caseby-case basis, as part of our review process. In making this decision, we will have regard to any evidence the regulated firm or its customers put forward to support one approach or the other. Neither option would be a default.

This final decision differs from our draft decision, which was to use an end-of-period trueup for all firms.

### 4.6.1 Stakeholders expressed mixed views on the options

SDP and WaterNSW submitted their strong preferences for annual price adjustments to reflect changes to interest costs.<sup>66</sup> For example, SDP noted that while a firm was waiting to receive a true-up in its favour in several years' time, it could potentially breach its debt covenants, which often specify financial ratios that must be met in each year.<sup>67</sup> While the eventual receipt of the true-up would theoretically overcome the problem, it might not be timely from the lenders' point of view.

On the other hand, Sydney Water submitted its strong preference for using a true-up to adjust prices. It stated that "the benefits to our customers of simple, transparent and stable bills for the entire regulatory period far outweighs any perceived small cumulative benefits of unidirectional changes in bills over the regulatory period".<sup>68</sup>

<sup>&</sup>lt;sup>66</sup> SDP submission to IPART Draft Report, December 2017, pp 8-10; WaterNSW submission to IPART Draft Report, December 2017, p 9.

<sup>&</sup>lt;sup>67</sup> SDP submission to IPART Draft Report, December 2017, p 9.

<sup>&</sup>lt;sup>68</sup> Sydney Water submission to IPART Draft Report, December 2017, p 2.

# 4.6.2 We will decide between annual price changes or true-up as part of our determination

We can see merit in both points of view. The different perspectives reflect the different circumstances of each organisation. For this reason, we have decided not to impose a uniform rule on all regulated firms. Instead, we will decide whether to apply annual price adjustments or the true-up on a case-by-case basis, as part of our review process. In reaching this decision, we will consider any submissions from the regulated business, its customers and other relevant stakeholders. Neither option would be considered the default.

#### **Final Decision**

- 10 Update the regulatory cost of debt annually, and decide whether to pass through changes via annual price adjustments or a true-up in the subsequent period:
  - as part of the price determination, and
  - on a firm-by-firm basis.

### 4.7 Where we use a true-up we will discount changes by the WACC

Where we determine that we will use the true-up for a regulated firm, we must use a discount rate in the present value calculations. We have decided that we will apply the firm's regulatory WACC as the discount rate that we will use in the true-up calculation.

#### 4.7.1 One stakeholder advocated the cost of debt as the discount rate

While it did not comment in submission to the Draft Report, TCorp noted in consultations that the firm's cost of borrowing should be the discount rate. It argued that only that rate would preserve the par value of the interest rate changes when the true-up was paid.<sup>69</sup>

### 4.7.2 We will use the WACC as the discount rate

The true-up is a cash asset or liability of the regulated firm, depending on whether it is paid to the firm or by it. If it is an asset, then it could be used to avoid the need to raise additional funds for capital investments. The opportunity cost of those additional funds is the firm's regulatory WACC.

If it is a liability then it must be funded by raising additional capital. That would involve additional borrowing. However, if it is funded entirely by borrowing that would have the effect of altering the firm's gearing ratio. In order to maintain the current gearing ratio, which is the gearing ratio of an efficient benchmark firm, the firm would need to raise additional equity as well. The average cost of capital the firm would face to do this would be its regulatory WACC.

For this reason, the discount rate used in the true-up calculation should be the firm's regulatory WACC.

<sup>&</sup>lt;sup>69</sup> Consultations between IPART and TCorp, January 2018.

#### **Final Decision**

11 Where a true-up is used to pass through changes in the cost of debt, the discount rate used to calculate the true-up amount will be the firm's regulatory WACC.

### 4.8 Annualise bond yield data

In Australia, government and corporate bond yields are typically derived from semi-annual rates of return.<sup>70</sup> In other words, risk-free rates are based on semi-annual rates of return, and we assume that the RBA data we use to estimate the debt margin is also based on semi-annual rates of return. We currently calculate the average annual rate of return for a 10-year government bond (the yield to maturity) by simply doubling the rate of return that an investor would earn over half a year.

However, this ignores the impact of compounding on investment returns. Figure 4.5 illustrates the impact that adjusting annual rates of return for compounding would have on our cost of debt estimates. For example, if the cost of debt was 6% using semi-annual rates, the annualised rate of return would be 6.09%.



Figure 4.5 Effect of converting semi-annual yields to annualised yields (%)

Other regulators, including the AER, ERAWA and QCA, convert published yields into an effective annual rate.<sup>71</sup> Our draft decision was to adopt this same approach. All stakeholders who commented supported our draft decision.<sup>72</sup>

Therefore, our final decision is to convert published bond yield data into annualised yields, using the proposed method in Box 4.1.

<sup>&</sup>lt;sup>70</sup> Quoting the yield to maturity based on semi-annual rates of return is standard bond market convention in Australia. This is because AGS bonds typically pay interest every six months. For more details, see AFMA, *Long Term Government Debt Securities Conventions*, January 2017, p 4.

AER, Better Regulation, Rate of Return Guideline, December 2013; Economic Regulation Authority, Determination on the 2016 Weighted Average Cost of Capital for the Freight and Urban Railway Networks, and for the Pilbara railways, October 2016; Queensland Competition Authority, Final decision, Trailing average cost of debt, April 2015; Queensland Competition Authority, Cost of capital: market parameters, August 2014.

<sup>&</sup>lt;sup>72</sup> Hunter Water submission to Draft Report, December 2017, p 9; Sydney Water submission to IPART Draft Report, December 2017, p 4; SDP submission to IPART Draft Report, December 2017, p 13.

#### Box 4.1 Proposed method for annualising bond yield data

As outlined above, government and corporate bond yields are typically derived from semi-annual rates of return.

If the rate of return based on semi-annual yields is  $y_s$ , then the annualised rate of return,  $y_a$ , would be calculated as follows in equation (1) below:

(3) 
$$y_a = \left(1 + \frac{y_s}{2}\right)^2 - 1$$

We propose to adjust our cost of debt by the following factor,  $\Delta_d$ 

(4) 
$$\Delta_d = \left(1 + \frac{(y_{RF} + y_{DRP})}{2}\right)^2 - (1 + y_{RF} + y_{DRP})$$

where  $y_{RF}$  and  $y_{DRP}$  are the published risk-free rate and debt margin.

The risk-free rate also enters into the calculation of the cost of equity, which we propose to adjust by the factor  $\Delta_e$ 

(5) 
$$\Delta_e = \left(1 + \frac{y_{RF}}{2}\right)^2 - (1 + y_{RF})$$

#### **Final Decision**

12 Convert published bond yield data into annualised yields.

#### 4.9 Maintain a 10-year term-to-maturity

We currently use a 10-year term-to-maturity (TTM) to estimate the cost of debt under our 2013 method, and our draft decision was to maintain this approach. All stakeholders who provided commented on this issue supported our draft decision.<sup>73</sup>

We consider a 10-year TTM is appropriate for all industries we regulate because:

- adopting a shorter TTM may encourage firms to issue short-term debt to fund longterm assets
- the efficient cost of finance for an asset is the cost of financing the asset over its life, and the firms we regulate tend to have long lived assets
- there is broad evidence that firms operating long-lived assets seek to raise debt with a maturity of 10 years or longer, and
- there are benefits in adopting a single TTM for all industries.

At the same time, we recognise that estimating the current cost of debt as a short-term trailing average and assuming a 10-year TTM creates a mismatch between the timing of when the interest rate on debt is repriced, and how frequently underlying debt is refinanced.

<sup>&</sup>lt;sup>73</sup> Hunter Water submission to Draft Report, December 2017, p 9; Sydney Water submission to IPART Draft Report, December 2017, p 4; SDP submission to IPART Draft Report, December 2017, p 13.

With a short-term trailing average, the interest rate applied to each tranche of debt is assumed to reprice every 3-5 years in line with the length of the regulatory period. To match the repricing risk of our current cost of debt estimate, a firm with a 4-year regulatory period could simply issue 4-year debt on a rolling basis.

However, we have decided to maintain a 10-year TTM to estimate the current cost of debt as our analysis suggests that the firms we regulate should issue long-term debt, and because firms can manage the repricing mismatch through interest rate swaps. Box 4.2 presents analysis supporting our final decision.

#### Box 4.2 Our analysis supports a 10-year term to maturity

#### A 10-year term-to-maturity encourages long-term borrowing

We consider that using 10-year bond yields to estimate the cost of debt is more appropriate than using short-term bond yields because almost all regulated firms that we set a WACC for operate assets with long lives. As outlined in our Issues Paper, to the extent that regulated firms operate assets with long lives, they would be exposed to refinancing risk if they did not issue long-term debt.<sup>a</sup>

In addition, it is inefficient if the TTM we assume does not match the life of the firms' assets. The efficient cost of finance for an asset is the cost of financing the asset over its life. As we noted in our 2013 review:

The real asset is the underlying physical assets, which generate the cash flow over their expected economic lives...Investors seeking to invest in a utility, whether regulated or unregulated, would value the business based on the expected cash flow that would be generated by the business over the expected life of its assets.<sup>b</sup>

Therefore, the TTM we assume for the firm should as closely as possible reflect the average life of its assets. For example, using a 5-year TTM may be inefficient relative to a 10-year TTM for assets with long lives.

#### Firms operating long-lived assets raise long-term debt

There is also broad evidence that firms operating long-lived assets seek to raise debt with a maturity of 10 years or longer. Figure 4.6 shows a sample of domestic businesses investing in long-lived assets issue bonds with a maturity of 10 years or longer.



#### Figure 4.6 Bond maturity profile for a sample of domestic businesses (years)

**Note:** This figure presents the average maturity of bonds on an 'original maturity' basis (the maturity of the bond at issue). **Data source**: Bloomberg.

#### There are practical benefits in setting a single TTM for all industries

In principle, the TTM we use to set the WACC for a business should reflect an average asset life for the industry. That is, if we set a WACC for a firm operating in an industry which invested in short-lived assets, then it would be more efficient to set the WACC based on short-term bond yields. This would suggest the TTM should vary by industry.

In practice, we consider that using a 10-year TTM for all industries is more appropriate than determining industry-specific TTMs:

- Almost all regulated firms that we set a WACC for operate assets with long lives, of at least 10 years on average.
- The 10-year cost of debt can be measured reliably over time.
- ▼ A single TTM results in a simpler, more consistent approach, and reduces parameter uncertainty for the businesses that we regulate.
- a IPART, Review of our WACC Method Issues Paper, July 2017, p 25.
- **b** Ibid, p 11.

**c** Ideally we would match the TTM to the asset lives. However, in practice the debt market does not offer products to exactly match the asset lives for long-lived infrastructure assets.

#### **Final Decision**

13 Continue to use a 10-year term to maturity to estimate the cost of debt.

### 4.10 Continue to use 10-year coupon paying bond yields

To measure the cost of debt, under our 2013 method we use bond yield data for couponpaying bonds that mature in approximately 10 years' time. For example, our 2013 method to estimate the risk-free rate of return is to use the yield of an Australian Government bond, maturing in approximately 10 years' time, which pays interest every six months (ie, semiannual coupons).

This approach closely approximates the cost of borrowing for 10 years, although it is not conceptually equivalent to the true cost of borrowing for 10 years. This is because an investor who purchases this bond receives a series of cash payments every six months over a 10-year period. The interest rate risk associated with a 10-year government bond is a combination of the 10-year interest rate, which applies to the principal payment and final coupon payment, and the rates of return applying to the other coupons paid over the life of the bond.<sup>74</sup>

To estimate the interest rate risk of borrowing over a 10-year period, we could calculate a 'zero-coupon' bond yield using bond market data.<sup>75</sup> The RBA publishes risk-free rates based on zero-coupon yields on a daily frequency on the second business day of each month. However, to do this, the RBA uses coupon-bearing bonds to estimate zero-coupon bond prices using a modified Merrill Lynch Exponential Spline methodology.<sup>76</sup>

<sup>&</sup>lt;sup>74</sup> RBA, *Extracting Information from Financial Market Instruments*, RBA Bulletin, March Quarter 2012.

<sup>&</sup>lt;sup>75</sup> Nominal yields for Australian Government Bonds are adjusted for coupon payments to derive their zero coupon yields. See RBA, *Extracting Information from Financial Market Instruments*, RBA Bulletin, March Quarter 2012.

<sup>&</sup>lt;sup>76</sup> For more details, see Finlay and Chambers, A Term Structure Decomposition of the Australian Yield Curve, RBA Research Discussion Paper, December 2008.

While our 2013 method is not identical to the true cost of borrowing for 10 years, it is transparent, replicable and results in an accurate proxy of borrowing costs. We consider that this is important, and therefore our draft decision was to continuing using published coupon-paying bond yield data.

As all stakeholders who commented supported our draft decision,<sup>77</sup> our final decision is to continue to use 10-year coupon paying bond yields in our 2018 method.

#### **Final Decision**

14 Continue to use the 10-year coupon-paying bond yield data to estimate the cost of debt.

### 4.11 Continue to use the BBB debt margin published by the RBA

To estimate the debt margin, we currently use estimates published by the RBA of the spread between the yield of BBB-rated bonds issued by Australian non-financial corporations to AGS yields.<sup>78</sup> They are an aggregate of spreads for bonds issued with BBB+, BBB, and BBB-credit ratings, with a residual maturity close to the target 10-year tenor.<sup>79</sup>

Our draft decision was to continue to use the BBB debt margin published by the RBA because:

- We found that the BBB credit rating is generally the most appropriate measure of the debt margin for a benchmark firm operating in a competitive market, even if the firms we regulate might not be BBB rated.
- The RBA data is our preferred data source for estimating the debt margin.

The analysis we considered in making this decision is outlined in Box 4.3.

All stakeholders who commented supported our draft decision.<sup>80</sup> Therefore, our final decision is to continue to use the BBB debt margin published by the RBA in our 2018 method.

#### Box 4.3 Our analysis supports using the RBA's estimate of the BBB debt margin

In deciding how to estimate the debt margin, we addressed the following three issues:

- 1. Whether we adopt a single credit rating for all industries, or estimate a different credit rating in each industry for which we set prices.
- 2. If we continue to adopt a single credit rating across industries, whether the BBB rating is the most appropriate credit rating.
- 3. Whether we continue to calculate the debt margin using the RBA's measure of corporate debt spreads.

<sup>&</sup>lt;sup>77</sup> Hunter Water submission to Draft Report, December 2017, p 9; Sydney Water submission to IPART Draft Report, December 2017, p 4; SDP submission to IPART Draft Report, December 2017, p 13.

<sup>&</sup>lt;sup>78</sup> See: IPART, Fact Sheet: New Approach to Estimating the Cost of Debt: Use of the RBA's Corporate Credit Spreads, February 2014.

<sup>&</sup>lt;sup>79</sup> For further information about how bonds are chosen as part of the RBA's estimates, please see: Arsov, et al, *New Measures of Australian Corporate Credit Spreads*, RBA Bulletin Article, December Quarter 2013, pp 15-26.

<sup>&</sup>lt;sup>80</sup> Hunter Water submission to Draft Report, December 2017, p 9; Sydney Water submission to IPART Draft Report, December 2017, p 4; SDP submission to IPART Draft Report, December 2017, p 13.

#### It is practical to adopt a single credit rating for all industries

In principle, the credit rating we use to estimate the debt margin should vary, to some extent, by industry. For example, some industries operate in more stable markets than others, and therefore the risks of investing in those industries could be lower both for debt and equity investments.

In practice, it is not feasible to estimate a benchmark industry credit rating accurately. For example, to estimate an industry credit rating, we might look to use the proxy firms we currently use to estimate equity beta (and the gearing ratio). However there are at least two reasons why this is difficult to do in practice.

- 4. In many industries, only a small proportion of these proxy firms has received a credit rating from a ratings agency, and therefore may not be representative of an average across the industry.
- 5. Most of the proxy firms are foreign-based. The credit ratings for these firms are often not directly comparable to an equivalent firm operating in Australia. A BBB-rated proxy firm operating in a country where sovereign government debt has a BBB credit rating is unlikely to have the same risk profile as a BBB-rated firm operating in Australia (where sovereign debt is AAA-rated).

Therefore, we have decided to adopt a single credit rating for all industries we regulate.

#### A BBB credit rating is most appropriate

We consider that the BBB credit rating is most appropriate because we consider that the BBB rating will, on average, provide an efficient estimate of the WACC. We can adjust the gearing ratio for individual firms because the gearing ratio and the credit rating are endogenous.<sup>a</sup> A credit rating higher than BBB would mean the benchmark firm would need to rely on a higher proportion of relatively expensive equity. Conversely, if the benchmark firm was sub-investment grade, the increase in the debt margin would likely more than offset the reduction in equity costs.

#### We prefer the RBA data, to other data sources, to measure the BBB debt margin

We have decided we will continue to use only the RBA data. It is our preferred data source because we consider the estimates are reliable, it is publicly available, and the RBA has published its methodology for calculating the debt margin.<sup>b</sup> Alternative measures of the debt margin are currently available only with a paid subscription to these services, which would make it more expensive for stakeholders to replicate our method.

If the RBA should stop publishing this series, we could consider these alternatives, or calculate the debt margin ourselves by applying the RBA's published methodology to current market data.

**b** Arsov, Brooks and Kosev, *New Measures of Australian Corporate Credit Spreads,* RBA Bulletin Article, December Quarter 2013, pp 15-26.

#### **Final Decision**

15 Continue to use the 10-year BBB corporate bond spreads published by the RBA to measure the debt margin across all industries.

**a** For example, if a water utility has a credit rating of A or AA, then it is probably under-geared. It could borrow more, reducing its rating as far as BBB while remaining investment grade. Doing so could reduce its cost of capital, since it would need to rely on a smaller proportion of relatively expensive equity in its capital structure.

# 5 Determining the cost of equity

Under our 2013 WACC method, we use a Capital Asset Pricing Model (CAPM) to estimate the cost of equity. Under this model, the cost of equity equals the sum of the risk-free rate of return and the product of the market risk premium (MRP) and the equity beta.

Like most regulators in Australia and overseas, we use the Sharpe-Lintner CAPM (SL-CAPM). In applying this model, we estimate the current cost of equity and the historic cost of equity and select the midpoint value. This involves:

- estimating a historic and a current risk-free rate (as discussed in Chapter 4)
- estimating a historic and a current MRP, and
- estimating equity beta and gearing levels using a selection of proxy companies when we first estimate a benchmark WACC for a regulated industry, and reviewing this value in subsequent reviews.

As part of the review, we considered a range of refinements to this approach and the measures we use. The sections below provide an overview of our final decisions and then discuss them in detail.

### 5.1 Overview of final decisions on cost of equity

We have decided to continue to use the SL-CAPM, as there is not a sufficient case to replace it with an alternative model. However, we will monitor the impact that moving to the Fama-French model would have on our WACC decisions over the next five years.

We have also decided to continue to determine the cost of equity as the midpoint between our estimates of the current and historic cost of equity at the start of the regulatory period, and to not update this cost during the regulatory period. And we will continue to measure the historic MRP as a range with a midpoint of 6%.

However, we will modify our approach and measures for estimating the current MRP.

While we will still estimate this value using six different methods and then select a single point estimate, we will modify one of the methods – the market indicator method – by replacing two of the indicators we currently use (the dividend yield and the risk-free rate) with a single new indicator (earnings yield less the risk-free rate.

We will also modify the way we select a single point estimate for the current MRP so we:

- combine the estimates derived by the five dividend discount model (DDM) methods into a single DDM MRP by calculating the median estimate, and
- calculate the weighted average of this median DDM MRP and the market indicator MRP, giving a two-third weight to the former and a one-third weight to the latter.

Further, we will modify our approach and measures for estimating the equity beta. We will continue to re-estimate this value at each price review in order to engage effectively and transparently with all interested parties. However, we will only change the value we use in our WACC calculations where we consider there is sufficient evidence to support this. In addition, we will:

- use the broadest possible selection, but exclude thinly traded stocks to improve our selection of proxy companies
- amend our proxy selection process to make it more transparent, predictable and replicable for stakeholders
- continue to use the Vasicek adjustment, but no longer use the Blume adjustment to refine our approach to mitigating estimation bias in raw OLS beta estimates.

These decisions are consistent with our draft decisions, but we have made an additional decision to amend our proxy selection process in response to stakeholder feedback.

# 5.2 Continue to use the Sharpe-Lintner CAPM

We currently use the SL-CAPM to calculate the cost of equity. According to this model, only systematic risk affects the expected return required by the marginal equity investor (who determines the price of equity). This is because the marginal investor would hold a well-diversified portfolio of equities, and a diversification strategy can remove firm-specific risk.

The average cost of equity across the entire market comprises a risk-free rate (representing the rate an investor would receive for zero risk to their capital) plus a premium that reflects the additional systematic risk a marginal equity investor bears (representing the average premium the investor would be willing to accept for a less-than-certain return). This is premium is known as the MRP.

Movements in the stock market affect some firms more than others. For example, utility firms that offer essential services tend to maintain a fairly steady profit margin through market upturns and downturns because there is a relatively steady demand for these services. On the other hand, firms that offer discretionary consumer products, especially luxury items, tend to be highly exposed to market dynamics.

We capture this varying sensitivity to the state of the market through a firm-specific parameter called the equity beta ( $\beta_e$ ):

- An equity beta of one implies that the firm's rate of return (ie, after-tax profits divided by the value of equity) is the same as for the market as a whole at each point in time. That does not mean that the firm's rate of return is constant – rather it varies at the same time and in the same way as the overall market rate of return.
- An equity beta below one implies that the firm's rate of return is less sensitive to upturns and downturns than the market overall.
- An equity beta above one implies that the firm's rate of return is more sensitive to upturns and downturns than the market overall.

Given these points, the SL-CAPM states that:

### (6) Expected rate of return on equity = risk-free rate + MRP x $\beta e$

### 5.2.1 One stakeholder submitted that we should use an alternative model

Notwithstanding regulators' widespread use of the SL-CAPM, academic research indicates that it tends to underestimate the cost of equity for low-equity beta stocks (such as regulated natural monopoly firms).

To address this downward bias, Sydney Water submitted that we use an alternative model to the SL-CAPM to address this downward bias.<sup>81</sup> It stated:

In its 2013 Draft Determination, IPART expressed a view that the Sharpe CAPM used may exhibit a degree of downward bias and agreed corrective measures are required. This view is in line with views expressed by the Australian Energy Regulator (AER) on this issue and was supported by Sydney Water.

However, from our observations of IPART's historical WACC estimates since 2014, it is unclear if IPART has applied any corrective remedies discussed in its 2013 Draft Determination. As a basic principle Sydney Water seeks ongoing commitment from IPART to use alternative CAPMs such the Fama French, Black or Sharpe-Lintner models to address the acknowledged downward bias of the Sharpe CAPM.<sup>82</sup>

# 5.2.2 Our analysis for our Draft Report found insufficient evidence to support an alternative model

In our view, it is prudent to periodically assess whether the SL-CAPM is the most appropriate pricing model for our WACC method. We agree that other models may exhibit less bias than the SL-CAPM. However, there may be theoretical or practical reasons not to use them. We consider that we should only change the asset pricing model we use in estimating the cost of equity where:

- the alternative model more accurately estimates the cost of capital
- the alternative model produces results that are stable over time to give stakeholders certainty
- the alternative model produces results that are predictable, transparent and reduce resources required for each review, and
- we receive sufficient evidence that changing to the alternative model would increase the accuracy of our WACC estimates.

For our Draft Report, we assessed two alternatives pricing models – the Black CAPM and the Fama-French model. Our analysis (which is summarised in Appendix C) found insufficient evidence to suggest either alternative would be superior to the SL-CAPM for our purposes. Accordingly, our draft decisions were to:

continue to use the SL-CAPM with corrective remedies (ie, the Vasicek adjustment, discussed in section 5.3) to address the downward bias, and

<sup>&</sup>lt;sup>81</sup> Sydney Water submission to IPART Issues Paper, August 2017, p 13.

<sup>82</sup> Ibid.

• over the next five years, monitor the results that the Fama-French model would produce if we adopted it in place of the SL-CAPM in our WACC method, to help inform future periodical assessments of the most appropriate pricing model.

### 5.2.3 We will continue to use the SL-CAPM

In responses to our Draft Report, stakeholders who commented on this issue supported our draft decisions. For example, Hunter Water stated that it:

...agrees with IPART that there is insufficient evidence at this time to support implementing an alternative to the SL-CAPM. Accordingly, it makes sense to continue to use the SL-CAPM whilst tracking the relative performance of the FFM over the next five years to inform future WACC reviews.<sup>83</sup>

Sydney Water also supported the decision and noted that:

...IPART has considered Sydney Water's views and also agreed to refine their corrective remedies to address the downward bias of the SL-CAPM. We wish to engage with IPART in future in this space.<sup>84</sup>

Therefore, we have maintained our draft decisions

#### **Final Decision**

16 Continue to use the Sharpe-Lintner CAPM to estimate the cost of equity, and monitor the impact that the Fama-French model would have if we adopted it at a future review.

# 5.3 Continue to determine cost of equity as midpoint between current and historic estimates

Under our 2013 method, we determine the cost of equity as midpoint between our estimates of current and the historic cost of equity, and do not update this cost during the regulatory period.

Our draft decision was to maintain this midpoint rule in normal circumstances (ie, unless the uncertainty index is greater than one standard deviation from zero).<sup>85</sup> We consider that this is appropriate because investors take account of both long- and short-term values when making their investment decisions. It is also consistent with our approach for determining the cost of debt (discussed in Chapter 4). As stakeholders generally supported this draft decision,<sup>86</sup> we have adopted it as our final decision.

We have also decided to maintain our current approach of keeping the cost of equity fixed during the regulatory period. Although we have decided to update the cost of debt

<sup>&</sup>lt;sup>83</sup> Hunter Water submission to Draft Report, December 2017, p 10.

<sup>&</sup>lt;sup>84</sup> Sydney Water submission to Draft Report, December 2017, p 4.

<sup>&</sup>lt;sup>85</sup> IPART, *Review of our WACC Method - Issues Paper*, July 2017, p 31.

<sup>&</sup>lt;sup>86</sup> For example, see WaterNSW submission to IPART Issues Paper, August 2017, p 10; Hunter Water submission to IPART Issues Paper, August 2017, p A.4; Sydney Water submission to IPART Issues Paper, August 2017, p 13 SDP submission to IPART Issues Paper, August 2017, p 5; ARTC submission to IPART Issues Paper, August 2017, p 1.

<sup>&</sup>lt;sup>86</sup> ARTC submission to IPART Issues Paper, August 2017, p 1.

annually (see Chapter 4), we do not consider similar updates to the cost of equity would result in greater accuracy. For example:

- There is evidence to suggest that any increase (or decrease) in risk-free rate tends to be offset by a decrease (or increase) in the MRP. Therefore, sampling the two measurements at different time periods could introduce bias into our WACC estimates (see Chapter 3 for our discussion on synchronised sampling).
- Our estimates of the MRP tend to be fairly stable, and it is unlikely that any increase in accuracy would be sufficient to offset the increase in complexity and uncertainty for stakeholders.
- The MRP is a forward-looking estimate of the additional return investors require to hold equity, rather than an actual cost of a benchmark efficient firm.

Stakeholders did not raise any concerns with our current approach of keeping the cost of equity fixed during the regulatory period, so we have decided to maintain it.

### Final Decisions

- 17 Continue to estimate the cost of equity as the midpoint between our estimates of the current and historic cost of equity when the uncertainty index is at, or within one standard deviation of its long-term average.
- 18 Maintain our 2013 method of keeping the cost of equity fixed during the regulatory period.

# 5.4 Continue to use a range with a midpoint of 6% as historic MRP

We currently use a range with a midpoint of 6% as the historic MRP because, over long periods (eg, many decades), the average MRP value is fairly steady at about 6%.<sup>87</sup> In our Draft Report, we expressed a preliminary view to maintain this approach.

Other regulators, notably the AER and ACCC, only give weight to the historic average MRP in estimating the cost of equity (see Appendix A). In our view, the case for this approach would be strongest if deviations from the historic average were short-lived and mean-reverting. If so, the historic average would be a reasonable indicator of the actual cost of equity a regulated firm would face during the regulatory period. However, if deviations were persistent over a period of several years, then the case for using the historic average MRP only would be weaker.

In the past decade, deviations from the historic average MRP have been persistent. As Figure 5.1 below illustrates, the current MRP has been mostly above 6% since 2008, and above 8% for most of the time since 2011. We consider some weight needs to be given to this fact, so we calculate both a historic and a current MRP.

We consider it would be invalid to combine a current risk-free rate with a historic MRP, because the result of that calculation would not represent the state of the equity market at any point of time. By combining a current estimate of the risk-free rate with a current MRP estimate, we can approximate the current market price of equity. Likewise, by combining a historic estimate of the risk-free rate with a historic MRP estimate, we can approximate the historic MRP estimate, we can approximate the historic average market price of equity. Either of these benchmarks would be a valid point

<sup>&</sup>lt;sup>87</sup> IPART, *Review of our WACC Method - Issues Paper*, July 2017, p 30.

of reference. When we combine the risk-free rates and MRP estimates in this time-consistent way, the current cost of equity is closer to the historic average cost of equity than either of them is to the time-inconsistent sum.

As stakeholders generally agreed with our preliminary view to continue to use a range with a midpoint of 6% as the historic MRP,<sup>88</sup> we have adopted it as our final decision.

### **Final Decision**

19 Continue to use a range with a midpoint of 6% as the estimate of historic MRP.

# 5.5 Modify our approach for measuring the current MRP

Unlike the historic MRP, the current MRP is difficult to measure reliably. Typically, estimates of this value rely on dividend discount models (DDMs). These models require assumptions about future growth rates and some other inputs. Different analysts adopt different assumptions, so there is a dispersion of views. Nevertheless, factors that cause the current MRP to rise or fall tend to affect all these estimation methods in a similar way. By taking an average or median of these different estimates, we can observe trends in changes to the current MRP.

Under our 2013 method, we measure the current MRP using the following six methods and then determine a single point estimate:

- 1. Damodaran 2013 method
- 2. Bank of England 2002 method
- 3. Bank of England 2010 method
- 4. Bloomberg method
- 5. SFG (now Frontier Economics) analysts forecast method
- 6. SFG (now Frontier Economics) market indicator method.

The first four of these methods are variations of the DDM. They differ in detail, but all infer a forward-looking market average return on equity based on expected dividends. The fifth is another variation of the DDM, which uses the forecasts of stock market analysts for individual stocks and a DDM. The sixth method uses four economic indicators to derive an indirect estimate of the MRP.

# 5.5.1 Our draft decisions were to maintain our 2013 method for calculating the four DDM estimates and modify the market indicator method

In our Draft Report, we made the draft decisions to continue to use:

- the same six methods to measure the current MRP, and
- the ASX 200 share price index and consensus earnings per share (EPS) forecasts to measure the four DDM methods.

<sup>&</sup>lt;sup>88</sup> Sydney Water submission to IPART Draft Report, December 2017, p 4; WaterNSW submission to IPART Draft Report, December 2017, p 15; Hunter Water submission to IPART Draft Report, December 2017, p 10; SDP submission to IPART Draft Report, December 2017, p 13.

We assessed the pros and cons of modifying this method by using analyst **price targets** instead of **share prices**, and **individual analyst EPS forecasts** instead of **consensus forecasts** (see Box 5.1). But we found that using consensus forecasts would be more volatile over time. Compared to our existing method, using analyst price targets and individual analyst EPS forecasts would yield MRP estimates that are lower and less variable over time.

In addition, we proposed to modify two of our existing indicators – the dividend yield and the risk-free rate – by replacing them with one new indicator – the earnings yield less the risk-free rate.<sup>89</sup> We considered that:

- the earnings yield is a better indicator than the dividend yield of changes in the MRP over time because the earnings yield is less affected by corporate regime changes (eg, the dividend yield is affected by corporate policy on whether to issue dividends or repurchase shares and invest in real assets), and
- comparing the earnings yield to the risk-free rate, rather than using the risk-free rate as a separate indicator, avoids double counting the impact of common factors that affect both equity and bond returns (eg, lower inflation expectations would lead to lower earnings yields and government bond yields even if the MRP did not change).<sup>90</sup>

We also noted that the observed equity returns we use to estimate the current MRP are taken after corporate tax.<sup>91</sup> However, they do not take account of the franking credit benefits that Australian investors receive. To take account of this benefit, our current MRP estimates make an adjustment for dividend imputation. This adjustment currently assumes a dividend imputation credit factor (gamma) of 0.25, in line with our 2013 WACC method. We discuss the derivation of this gamma in Chapter 7.)

<sup>89</sup> IPART, Review of our WACC Method: Draft Report, December 2017, p 55.

<sup>&</sup>lt;sup>90</sup> Ibid.

<sup>&</sup>lt;sup>91</sup> Ibid.

# Box 5.1 Comparing price targets and share prices, and individual analyst EPS forecasts and consensus forecasts

To apply four methods for measuring the current MRP (the Damodaran and Bloomberg methods and the two Bank of England methods), we currently use the ASX 200 share price index and consensus earnings per share (EPS) forecasts. However, we noted in our Draft Report that it would be possible to use analyst **price targets** instead of **share prices**, and to use **individual analyst EPS forecasts** instead of **consensus forecasts**. We outlined possible pros and cons of these approaches and determined that the consensus forecasts may be more volatile over time.<sup>92</sup>

Like their EPS forecasts, analysts' price targets are likely to reflect their optimism. This means they are likely to be higher than the actual market prices. If we used price targets instead of share prices, we could avoid or mitigate the risk of a mismatch in the optimism between analysts making earnings forecasts and investors trading shares.

Individual analyst EPS forecasts contain more up-to-date data than consensus forecasts. In addition, using these individual forecasts would allow us to aggregate them to a market-based EPS forecast ourselves, using a method suited to our purpose. It would also allow us to match the date that the individual analyst EPS forecast was released to the market with the target price of the analyst from approximately the same date (we can also match the share price from the same date). This would improve the accuracy of our estimates.

There can be a delay in analysts updating their forecasts, so when consensus forecasts are used in the analysis and there is a large share price change, the DDM would incorrectly attribute this to a change in the cost of capital. If the market rises by 20% this month or falls by 20%, this change could be partly because of a change in discount rates but could be largely due to changes in the market's expectations for earnings. The consensus forecast lags share price changes due to delays in analysis updating their forecasts.

We consider that the use of consensus forecasts (rather than matching the individual analyst forecasts with prices from the same date) would produce the same cost of capital on average, but it would be more volatile over time. The volatility is due to stale information in the consensus forecasts.

Compared to our 2013 method for calculating these four MRP estimates, the use of analyst price targets and individual analyst EPS forecasts would yield MRP estimates that are lower (due to the use of price targets) and less variable over time (due to matching of earnings forecasts with prices at the same point in time).

### 5.5.2 Most stakeholders supported our draft decisions

Most stakeholders agreed we should continue to use same six methods to measure the current MRP, and the ASX 200 share price index and consensus earnings per share (EPS) forecasts to measure the four DDM methods. For example, in its response to our Issues Paper, WaterNSW agreed with the continued use of the existing MRP measures, but noted that:

...analyst price targets are factored into share prices upon their release, with the market (actual prices) reflecting more comprehensive information than analyst forecasts alone. Accordingly, we

<sup>&</sup>lt;sup>92</sup> IPART, Review of our WACC Method: Draft Report, October 2017, pp 53-54.

support the current approach of using an average (median - per response to Question 14 below) of the existing six methods to calculate the current MRP.<sup>93</sup>

Sydney Water expressed a similar view, also supporting the six current MRP measures, but not supporting analyst price targets:

We agree that there has been volatility in the in the short-term market risk premium (MRP) and that, maintaining stability in short-WACC parameters is an appropriate goal. However, we do not believe that the evidence presented by IPART sufficiently address the probable cause of the volatility, and so it is unclear if the proposed remedy is appropriate. We believe that more work ought to be conducted by IPART to establish the cause of the volatility and impact on the WACC of any proposed remedy.<sup>94</sup>

In response to our Draft Report, Hunter Water supported Sydney Water's view on our Issues Paper, stating:

...more work needs to be done on the underlying causes of volatility in the short term market risk premium to support any proposed modification to these methods.<sup>95</sup>

Most stakeholders also supported our draft decision to modify the market indicator method. For example, Hunter Water stated:

IPART's reasoning that the modified approach will be less impacted by corporate regime factors and avoids double counting of common factors makes sense.<sup>96</sup>

Sydney Water stated that "...this change would not make a notable variation to the overall MRP estimate".<sup>97</sup> However, it reiterated its concern that "volatility in the current MRP estimates...could instil unnecessary volatility in the WACC outcome".

#### 5.5.3 Our final decisions are in line with our draft decisions

We consider that using analyst price targets instead of market prices has theoretical merit. However, given the strongly expressed views of some stakeholders and the risk that the process by which individual analysts derive their price targets may not be transparent, we have decided we will make no change to the way we estimate the current MRP using the first four DDM methods.

We consider that modifying the indicators we use in applying the market indicators method would improve the accuracy and robustness of this method. For this reason, we have decided to make this modification.

#### **Final Decisions**

- 20 Continue to use our existing six methods to measure the current MRP.
- 21 Continue to use the ASX 200 share price index and consensus earnings per share forecasts to measure the current MRP using the Damodaran and Bloomberg methods and the two Bank of England methods.

<sup>&</sup>lt;sup>93</sup> WaterNSW submission to IPART Issues Paper, August 2017, p 10.

<sup>&</sup>lt;sup>94</sup> Sydney Water submission to IPART Issues Paper, August 2017, p 5.

<sup>&</sup>lt;sup>95</sup> Hunter Water submission to IPART Draft Report, December 2017, p 10.

<sup>&</sup>lt;sup>96</sup> ibid.

<sup>&</sup>lt;sup>97</sup> Sydney Water submission to IPART Draft Report, December 2017, p 5.

22 Modify the indicators we use to measure the current MRP using the market indicator method by replacing two of our existing indicators – the dividend yield and the risk-free rate – with one new indicator – the earnings yield less the risk-free rate.

# 5.6 Modify our approach for selecting single value for current MRP

To select a single value for the current MRP from the six estimates discussed above, we currently use the midpoint of the highest and lowest current MRP estimate in each month. However, an alternative approach would be to use the median of the six indicators.

For most of the years shown in Figure 5.1 the midpoint and median would have produced a similar estimate. However, throughout 2010:

- the midpoint estimate was higher than five of the six indicators, indicating it is affected by extreme outliers, and
- the median estimate closely matched three of the six indicators, indicating it is less influenced by the high values in the Bloomberg indicator.

To consider which approach is preferable, we assessed how well each approach tracks the BBB corporate bond spread, which also measures the risk premium. Figure 5.1 compares the midpoint of the highest and lowest MRP indicator and the median of the six indicators, to the BBB corporate bond spread. It shows that the median measure of the MRP appears to move more closely with changes in the corporate bond spread than the midpoint measure. This provides some evidence that the median approach might be less affected by outliers than the midpoint approach.



### Figure 5.1 MRP estimates and debt margin (bps, %)

Data source: IPART and SFG analysis of RBA, Bloomberg and Thomson Reuters data

In addition, from time to time, one of the six current MRP estimates may be unavailable. In those instances, the median approach provides a more accurate estimate than the current midpoint approach. For these reasons, our draft decision was to change our method of combining the six (or as many as are available) MRP estimates from the midpoint rule to a median rule.<sup>98</sup>

<sup>98</sup> IPART, Review of our WACC Method: Draft Report, October 2017, pp 57-58.

#### 5.6.1 Most stakeholders supported using a median and retaining outliers

Sydney Water supported moving to a median approach, as it agreed that the median is less affected by outliers than the mid-point. In response to our Issues Paper, it noted that "outliers should not be removed as this can become either an arbitrary approach or may overly rely on mechanistic outlier detection."<sup>99</sup> WaterNSW also supported the use of the median and the retention of outliers.<sup>100</sup> Hunter Water agreed with the use of the median, but noted that "IPART could monitor the relative accuracy of using midpoints, medians and means in the lead up to the next WACC review".<sup>101</sup>

However, SDP disagreed with our draft decision and submitted that "...the six approaches used to estimate the current MRP should all receive equal weight and, therefore, IPART should...apply a mean rather than a median approach".<sup>102</sup> Frontier Economics, on behalf of SDP, contended that:

If an approach:

- does not produce consistently high or low estimates; and
- if it is not obviously inferior, methodologically than other methods,

Then in our view the presumption should be that the approach contributes useful information about the true MRP, and should receive equal weight to all other approaches. The mean approach, rather than the median approach, would achieve this.<sup>103</sup>

Frontier reiterated its view that "historical data published by IPART does not suggest that any of the six methods used by IPART to estimate the current MRP are "extreme outliers".<sup>104</sup>

<sup>&</sup>lt;sup>99</sup> Sydney Water submission to IPART Issues Paper, August 2017, p 14.

<sup>&</sup>lt;sup>100</sup> WaterNSW submission to IPART Issues Paper, August 2017, p 10.

<sup>&</sup>lt;sup>101</sup> Hunter Water submission to IPART Draft Report, December 2017, p 11.

<sup>&</sup>lt;sup>102</sup> SDP submission to IPART Draft Report, December 2017, p 13.

<sup>&</sup>lt;sup>103</sup> Frontier Economics, Review of WACC method: response to IPART Draft Report: A report prepared for Sydney Desalination Plan, December 2017, p 32.

<sup>&</sup>lt;sup>104</sup> Ibid, p 33.

# 5.6.2 Most stakeholders supported placing two-thirds weight on the median DDM estimate

Under our 2013 method, we calculate five different DDM estimates and only one estimate using the market indicators method. In combining these estimates, we could give excessive emphasis to the DDM methodology to the detriment of alternative methodologies. To overcome this potential source of bias, we made the draft decision to combine the median DDM estimate with the market indicators estimate using a weighted average, rather than finding a central estimate of all six MRP estimates.

Most stakeholders supported this draft decision.<sup>105</sup> Hunter Water also suggested that we monitor the relative accuracy of using these and other weightings in the lead up to the next WACC review.<sup>106</sup>

However, SDP considered that we should "...not take a weighted average of the DDM and market indicator approaches (with a two-third weight on the former and one-third weight on the latter).<sup>107</sup> A Frontier Economics report submitted by SDP contended that:

Whilst IPART is correct that five of the methods it uses to derive the current MRP are based on some version of the DGM, all of these models are specified differently, and use different assumptions and inputs. Consequently...the resulting outputs from these five DGMs vary significantly...This wide dispersion of outcomes suggests that each of these models is contributing different information about the true MRP...Therefore, IPART's approach of grouping these very different DGMs into a single category, and giving that category a weighting of two-thirds seems inappropriate.<sup>108</sup>

Frontier also contended that, combined with a median of the DDM approaches, "...IPART effectively gives a two-third weighting to just one of the DGM estimates."<sup>109</sup>

# 5.6.3 Our final decision is to use a median approach to select a single estimate of the DDM MRP, and give this estimate a weight of two-thirds

We acknowledge the comments put forward by SDP and Frontier Economics that if an indicator is not consistently high or low, and if it is not an inferior method, then it should receive equal weight. However, during and after the GFC, the Bloomberg MRP estimate was consistently the high estimate, sitting significantly higher than the others in the group. Therefore, we consider that it was an outlier at that time and the mean approach would have given it too much weight.

We do not consider that the median approach effectively gives the Bloomberg MRP or any one particular MRP estimate less weight. If an MRP estimate was added to the selection, the mean and median of the distribution would both be influenced. However, the median would be more moderately influenced than the mean, if the new addition was at one or other extremes of the distribution.

WaterNSW submission to IPART Draft Report, December 2017, p 15; Sydney Water submission to IPART Draft Report, December 2017, p 5; Hunter Water submission to IPART Draft Report, December 2017, p 11.

<sup>&</sup>lt;sup>106</sup> Hunter Water submission to IPART Draft Report, December 2017, p 11.

<sup>&</sup>lt;sup>107</sup> SDP submission to IPART Draft Report, December 2017, p 13.

 <sup>&</sup>lt;sup>108</sup> Frontier Economics, *Review of WACC method: response to IPART Draft Report: A report prepared for Sydney Desalination Plan*, December 2017, p 30.
<sup>109</sup> Herei

<sup>&</sup>lt;sup>109</sup> Ibid.

We also agree with Frontier Economics' point that MRP estimates should not be excluded (or given virtually no weight) simply because they are different from the other estimates. The fact that they are different may indicate that they contain useful information about the true MRP. This is especially likely to be the case when virtually all of the other MRP estimates use the same alternative method.

Nevertheless, we still consider that placing equal weight on the market indicators MRP and the median DDM MRP would not be appropriate because the DDM method has a longer history and wider acceptance. On the other hand, giving the market indicators MRP less than 20% weight would tend to reduce its impact below the impact it would have under a straight average of five estimates. While acknowledging the impreciseness of the weighting decision, we consider that giving the market indicators MRP a weight of one-third and the median DDM MRP a weight of two-thirds in the weighted average strikes a balance between including the useful information that the market indicators MRP provides, without placing too much reliance on a potentially less accepted method. The one-third weight to market indicators MRP is roughly in the middle of the 20% to 50% range.

On balance, we have decided to maintain our draft decision to use the median of the DDM MRP estimates, and take a weighted average of the DDM MRP estimates and market indicator estimate in a two-thirds to one-third ratio.

#### **Final Decisions**

- 23 In combining different DDM MRP estimates, move from the midpoint to a median approach, but do not exclude outliers.
- 24 Determine the point estimate of current MRP as the weighted average of the market indicators MRP and the median DDM MRP, with a one-third weight to the market indicators MRP and two-thirds weight to the median DDM MRP.

### 5.7 Re-estimate the equity beta at each price review

For a listed firm, it is possible to measure the equity beta directly, by calculating the historic correlation between the firm's returns and the returns to the stock market overall. However, most of the businesses we regulate are not listed. In addition, our approach is to determine the WACC for a benchmark firm, not the actual regulated firm, because the actual firm might have an inefficient capital structure or borrowing arrangements (see Chapter 3). The benchmark firm operates in a competitive market but otherwise faces similar risks to the firm that we regulate.

Therefore, to estimate the equity beta, we select a group of listed companies that face similar risks to the regulated firm (or industry) as proxies. For each company in this group, we estimate the equity beta using market model regression and derive an asset beta (ie, de-levered beta) using its gearing ratio.

After considering the asset betas across the set of proxy firms, we then decide on an appropriate asset beta for the regulated business and use our benchmark gearing level to relever the asset beta to the final equity beta.

Currently, we review the equity beta each time we estimate a WACC for a business. For utilities that we periodically set prices for, we consider whether our existing estimates

remain appropriate, in light of updated market data and having regard to other regulators' recent WACC decisions. We review the market evidence on gearing levels for proxy firms at the same time that we review the equity beta, as we need both to estimate asset betas and these form part of our analysis of systematic risk.

#### 5.7.1 Stakeholders expressed mixed views on when to review equity betas

SDP agreed we should re-estimate equity beta at each price review, but suggested that we:

Should use the broadest sample of comparators and longest estimation period possible; and

Should change its beta estimate only if there is compelling evidence to do so - in view of the significant challenges in estimating betas precisely.<sup>110</sup>

WaterNSW maintained its view that we should review the appropriate equity beta outside of price reviews. It suggested that this would provide regulated utilities "with more certainty on these parameters ahead of price-review submissions, and enhance the predictability and transparency of the IPART regulatory process".<sup>111</sup> Nevertheless, it also considered that:

... both IPART and the regulated entity should still be able to submit a case for different parameters at the time of an individual price review, if there are strong grounds. This is important to ensure there is an opportunity for re-estimation in the event of significant market changes between the prior review and the time of the price submission.<sup>112</sup>

In response to our Issues Paper, Hunter Water submitted that it would prefer us to provide regulated utilities with advance notice of the equity beta estimate prior to the commencement of each price review:

Early notice would enable the utility to more accurately model likely revenue requirements, assess customer bill impacts and conduct financeability assessments. This would improve the robustness of price submissions and pricing proposals. Alternatively, a review or a sense check of the equity beta could occur on a periodic basis or in response to significant economic events.<sup>113</sup>

Hunter Water reiterated this in its submission to our Draft Report, but noted that:

An alternative would be that IPART indicate ahead of price review the likelihood of changes to the beta in the context of new market data or significant financial events. This would be consistent with IPART's statement in the draft report that it would only change the equity beta estimate if there is sufficient evidence.<sup>114</sup>

In its response to our Issues Paper, Sydney Water did not support re-estimation of betas at each price review, suggesting that re-estimation should occur "only after a significant structural change in financial markets" such as the GFC.<sup>115</sup> It put the view that "re-estimation of the equity beta at each price review may increase the volatility in IPART's regulatory WACC estimates unnecessarily".<sup>116</sup>

<sup>&</sup>lt;sup>110</sup> SDP submission to IPART Issues Paper, August 2017, p 14.

<sup>&</sup>lt;sup>111</sup> WaterNSW submission to IPART Issues Paper, August 2017, p 10.

<sup>112</sup> Ibid.

<sup>&</sup>lt;sup>113</sup> Hunter Water submission to IPART Issues Paper, August 2017, p 8.

<sup>&</sup>lt;sup>114</sup> Hunter Water submission to IPART Draft Report, December 2017, p 11.

<sup>&</sup>lt;sup>115</sup> Sydney Water submission to IPART Issues Paper, August 2017, p 6.

<sup>&</sup>lt;sup>116</sup> Ibid.

However, Sydney Water accepted our draft decision on the condition that "any change to the value of equity beta would only be effected if there is sufficient evidence to do so". Sydney Water added that IPART should "...take sufficient care not to instil volatility in the WACC outcome by unnecessarily changing the equity beta value".<sup>117</sup>

# 5.7.2 Our final decision is to re-estimate equity betas at each review but not necessarily change the equity beta in our WACC calculations

We consider that, for each price review, we should take the opportunity to employ new market data on equity beta, if it becomes available. That is not to say that we would automatically change the equity beta that we use in WACC calculations. We are mindful of the estimation difficulties noted by SDP, and agree with SDP and Sydney Water's suggestions only to change the equity beta estimate if there is sufficient evidence that it would improve the accuracy of the WACC estimate.

As with gearing, we maintain our view that the equity beta analysis should be undertaken within a price review process (generally every 4-5 years). There is a risk that an equity beta analysis outside a price review may not achieve a sufficient level of stakeholder engagement since any application of that equity beta would be some time away. It also allows a broader scope of stakeholders, including customer representative groups, to engage in the process, which they may otherwise not have the resources to do.

However, taking into account stakeholders' views, we propose to undertake this analysis earlier in the review process so that our proxy firm selection, gearing and beta analysis could be included at the Issues Paper stage. This would give stakeholders more time to consider our analysis and respond before we proceed with our draft decisions, which would be based on the results.

We acknowledge stakeholders' concerns that the equity beta should only be changed in response to significant evidence, in order to maintain certainty. Therefore we have decided to review the equity beta at each price review (currently every 4-5 years), but only change it when there is sufficient evidence that our existing estimate is no longer appropriate.

# **Final Decision**

25 Continue to re-estimate equity betas at each price review to inform our assessment of whether the existing estimates remain appropriate.

# 5.8 Use a broad selection of proxy companies to estimate the equity beta

One of the main weaknesses of our current approach for estimating the equity beta is that the selected proxy companies may not represent a benchmark firm well, leading to an inaccurate estimate. Often, the type of regulated industry will dictate the range of proxy firms available.

We also need to consider several statistical issues. To get valid estimates of beta, we need to have a sufficient number of market observations. We can increase the number of

<sup>&</sup>lt;sup>117</sup> Sydney Water submission to IPART Draft Report, December 2017, p 5.

observations by including a larger number of proxy firms, or by examining a smaller number of firms over a longer period of time, or both. Each approach has drawbacks:

- To examine more firms, we may need to include firms that do not face sufficiently similar risks to the firm in question.
- To examine the same number of firms over a longer time period, we may need to not exclude periods where market behaviour was not sufficiently similar to the expected future market performance (for example, periods such as the GFC).

#### 5.8.1 Stakeholders supported using a broader sample, but cautioned about the 'validity' of additional firms

In response to our Issues Paper, Frontier Economics, on behalf of SDP, made specific suggestions on how to improve our selection of proxy firms. Frontier noted the trade-off between the comparability of proxy firms and the statistical reliability of the equity beta estimates. Of the two broad approaches (broadest possible sample or more selective sample), it preferred the broad sample method because it is:

- more objective
- more likely to yield statistically reliable estimates, and
- more resistant to problems caused by companies dropping out of the sample over time (for example, because they become de-listed).<sup>118</sup>

Frontier suggested that if we move to the broad sample method, we should exclude from the sample thinly traded stocks because their beta estimates are likely to be distorted by the small sample of trades.<sup>119</sup> It suggested the Amihud measure for testing the degree of illiquidity (hence thinness of trading in that stock).<sup>120</sup> In simple terms, this measure is the daily ratio of absolute stock return to its dollar volume, averaged over a relevant time period.

PIAC's submission to our Issues Paper stressed the importance of what it called 'validity', meaning relevant proxy firms, over and above statistical reliability, which refers to larger sample sizes.<sup>121</sup> PIAC submitted that:

Simply adding more entities to the sample may make the data more statistically unreliable but may also make the comparison less valid.<sup>122</sup>

Our draft decision was to use the broadest selection of comparable stocks, excluding thinly traded stocks. This was in response to stakeholder feedback about illiquid stocks, which may have distorted beta estimates. In particular, we considered that Frontier's suggestions were practical and useful and proposed to adopt them. We noted that the Amihud measure is a rough measure of the price impact of one dollar of trading volume. While there are measures of illiquidity that are more precise in theory, such as the bid-ask spread, they

<sup>&</sup>lt;sup>118</sup> Frontier Economics, *Review of WACC method: response to IPART Issues Paper: A Report Prepared for Sydney Desalination Plant*, August 2017, p 39.

<sup>&</sup>lt;sup>119</sup> Ibid, p 39.

<sup>&</sup>lt;sup>120</sup> Ibid, pp 39-40.

<sup>&</sup>lt;sup>121</sup> PIAC submission to IPART Issue Paper, August 2017, p 2

<sup>&</sup>lt;sup>122</sup> Ibid.

require a lot of microstructure data that is often unavailable or difficult to obtain.<sup>123</sup> For our purpose, a simple measure such as the Amihud measure is appropriate.

We agreed with PIAC that proxy firms should be relevant. It is usually difficult to find proxies that closely match the regulated firm's risk profile. Therefore, from a practical point of view it is usually necessary to select a broader sample of proxy firms and rely on statistical methods to separate the 'noise' from the relevant data.

We noted that there are additional difficulties to the empirical estimation of equity beta. The main data sources that regulators in Australia use for equity beta estimation are Bloomberg and Thomson Reuters. These sources provide raw data (stock prices and indices for the regression analysis) as well as published beta estimates. The published equity beta estimates reflect analyst-specific methodology choices, and can vary considerably. Some of these methodology choices are not always easy to replicate. For this reason, it is more common for regulators to do their own regression analysis using raw data.

Unless the regression analysis uses daily data, it is necessary to select weekly or monthly returns, which means we must choose a reference day (eg, Monday for weekly returns or the first day of the month). The chosen reference day can make a material difference to the estimate, so we must take care in selecting it.

# 5.8.2 Stakeholders requested more transparency, replicability and predictability of our proxy selection process

Hunter Water agreed with our draft decision, subject to the inclusion of some specific process steps to enhance transparency, replicability and predictability. Hunter Water stated:

The draft decision is broadly worded and does not indicate how issues like the proxy selection process, times periods and consultation with utilities are to be specifically addressed.<sup>124</sup>

Hunter Water suggested IPART could:

- Use the longest history of returns data available for each of the firms in the selected comparator set
- Generate a preliminary list of companies from the main data sources used in the Australia for beta estimation (Bloomberg and Thomson Reuters) classified as falling within the relevant industry
- Supplement the preliminary list of companies using additional comparators identified by other Australian regulators, and
- Consult with stakeholders whenever IPART is considering revisions to its comparator sample.<sup>125</sup>

PIAC reiterated its concern that "Simply adding more entities to the sample may make the data more statistically reliable but may also make the comparison less valid".<sup>126</sup>

<sup>&</sup>lt;sup>123</sup> Amihud, Y, *Illiquid and stock returns: cross-section and time-series effects*, Journal of Financial Markets, Volume 5, 2002, pp 31-56.

<sup>&</sup>lt;sup>124</sup> Hunter Water submission to IPART Draft Report, December 2017, p 6.

<sup>125</sup> Ibid.

<sup>&</sup>lt;sup>126</sup> PIAC submission to IPART Draft Report, December 2017, p 3.

Sydney Water supported our draft decisions, but cautioned IPART "against including thinly traded stocks that could have an unnecessary influence on the beta outcome and also the inclusion of additional firms that may have less validity as proxies".<sup>127</sup>

# 5.8.3 Our final decision is to maintain our draft decision but amend our proxy selection process

Our final decision is to maintain our draft decision to use a broad selection of proxy companies, excluding thinly traded stocks. We consider that this is consistent with stakeholders' feedback and an improvement on our existing process. However, we will also amend our proxy selection process to make it more transparent, predictable and replicable for stakeholders. In particular, we will:

- publish our criteria for proxy selection, and our list of comparator companies that meet our criteria at the start of the relevant review, and
- give stakeholders the opportunity to propose additional comparable **industries** that meet our criteria, but not individual **stocks**.

We consider that this is an improvement to our existing process as it gives stakeholders the same information as we use to make our equity beta decisions, and gives them an opportunity to put forward their views on comparable industries, while limiting debate about individual firms.

#### Final Decisions

- 26 Use the broadest possible selection of proxy companies to estimate equity beta, but exclude thinly traded stocks.
- 27 Adopt a proxy selection process that includes:
  - publishing our criteria for proxy selection, and our list of comparator companies that meet our criteria at the start of the relevant review, and
  - giving stakeholders the opportunity to propose additional comparable industries that meet our criteria.

# 5.9 Modify our approach for adjusting equity betas to mitigate estimation bias

Several studies in finance literature have found equity betas obtained from ordinary least squares (OLS) regression analysis are likely to be subject to a high degree of estimation bias due to sampling error. To mitigate this bias, regulators commonly adjust for this bias using the Vasicek (1973) and Blume (1975) methods:

 The Blume technique adjusts for bias in individual securities by placing two-thirds of weight to the OLS equity beta and a third to an equity beta of one.<sup>128</sup>

<sup>&</sup>lt;sup>127</sup> Sydney Water submission to IPART Draft Report, December 2017, p 5.

<sup>&</sup>lt;sup>128</sup> Blume, M, *Betas and Their Regression Tendencies*, Journal of Finance, Vol. 30, No. 2, June 1972, pp 785-795.

 Vasicek adjusts the OLS equity betas towards the best prior beta estimate with the degree of adjustment based on the standard error of the OLS estimates. OLS estimates that have lower (higher) standard errors get more (less) weight.<sup>129</sup>

In some of our recent WACC decisions we have made a judgement about the appropriate equity beta after considering the OLS beta with no adjustments, the Blume-adjusted and Vasicek-adjusted equity betas. In our Draft Report, we made the draft decision to discontinue considering the Blume-adjusted equity betas and to use the Vasicek adjustment only.

### 5.9.1 Most stakeholders supported using the Vasicek adjustment only

Most stakeholders accepted our draft decision to use the Vasicek adjustment only.<sup>130</sup>

For example, in response to our Issues Paper, Hunter Water expressed support for the 2013 method, but also saw merit in the Vasicek adjustment. It noted that this approach allows for transparent and objective adjustment of OLS estimates with a high standard error.<sup>131</sup>

Sydney Water accepted our draft decision to use the Vasicek adjustment and noted that we should consider or account for potential biases in capital structure, data frequency, portfolio weighting, estimation period, and known downward bias of equity betas in the CAPM for betas less than one.<sup>132</sup>

At our public hearing, Dr Reddick from TCorp supported using the Vasicek adjustment only, as TCorp considers "it has a little more science around it than the other adjustment".<sup>133</sup>

### 5.9.2 Our final decision is to use the Vasicek adjustment only

We have maintained our draft decision to continue to use the Vasicek adjustment, but to discontinue the Blume adjustment. The reason for discontinuing the Blume adjustment is that it is an automatic, formulaic and arbitrary adjustment to an equity beta estimated from proxy company data. We consider that the Vasicek adjustment is preferable because it relies on firm-specific information to make adjustments to the empirical results.

### **Final Decision**

28 Determine the appropriate equity beta having regard to equity betas calculated using the OLS method with the Vasicek adjustment.

<sup>&</sup>lt;sup>129</sup> Vasicek, O.A, A Note on Using Cross-Sectional Information in Bayesian Estimation of Security Betas, Journal of Finance, Vol. 28, No. 5, December 1973, pp 1233-1239.

<sup>&</sup>lt;sup>130</sup> Hunter Water submission to IPART Draft Report, December 2017, p 11; SDP submission to IPART Draft Report, December 2017, pp 11-12; WaterNSW submission to IPART Draft Report, December 2017, p 15; Sydney Water submission to IPART Draft Report, December 2017, p 5.

<sup>&</sup>lt;sup>131</sup> Hunter Water submission to IPART Issues Paper, August 2017, p A.5.

<sup>&</sup>lt;sup>132</sup> Sydney Water submission to IPART Draft Report, December 2017, p 5.

<sup>&</sup>lt;sup>133</sup> IPART public hearing transcript, August 2017, p 17.

# 6 Combining measurements to derive the WACC

Once we have estimated the cost of debt and equity (as outlined in Chapters 4 and 5), we have four measurements – our estimates of the:

- current and historic cost of debt, and
- current and historic cost of equity.

We currently calculate a single cost of debt by combining the current and historic costs, and then do the same for equity. We then combine our debt and equity costs according to the gearing ratio of the benchmark entity.

In normal market circumstances, we take a simple average of the current and historic measurements for both the cost of debt and the cost of equity. This is referred to as the midpoint approach. We consider that the market is in a normal state when our uncertainty index is at, or within one standard deviation of, its long run average value of zero:

- When the market is in a normal state, our decision rule is to apply the midpoint approach.
- When the market is not in a normal state, we use our discretion to decide how these data are combined.

We review the gearing ratio each time we estimate the WACC for a business, but do not necessarily change it.

For this review, we considered whether we should make incremental improvements to this approach – including: how we construct our uncertainty index and define our decision rule; what we do when our uncertainty index is outside the normal range; and, when and how we review the gearing ratio. The sections below outline our final decisions then discuss each decision in detail.

### 6.1 Overview of final decisions on deriving the WACC

We have decided to maintain our approach to how we construct our uncertainty index and apply our decision rule, in line with stakeholder feedback.

We have also decided that, when the uncertainty index is outside of the normal range, we will continue to use our discretion to decide how the current and historic data are combined, and consult with stakeholders before making our decision.

In addition, we have decided we will continue to review the gearing of the benchmark entity at each price review. However, as for the equity beta, we would only revisit the gearing we use in our WACC calculations where there is sufficient evidence to support this.

These decisions are consistent with our draft decisions, but we have also made amendments to our process related to reviewing the gearing to improve its transparency and provide more time for stakeholder consultation.

# 6.2 Maintain our 2013 method of constructing the uncertainty index

Our uncertainty index aims to capture changes in the level of uncertainty about future economic conditions. We estimate the uncertainty index using principal component analysis (PCA), extracting a single time series variable which proxies the level of economic uncertainty in Australia from four financial variables. This approach closely follows the approach taken by the Bank of England.<sup>134</sup> It involves analysing data for the following four variables:

- implied volatility of annual ASX 200 returns
- dispersion in analysts' forecasts of ASX 200 returns
- the credit spread between investment-grade corporate bonds and Australian Government bonds, and
- the spread between 90-day bank bill swap rates and 3-month overnight index swaps (OIS).

We assume that changes in economic uncertainty in Australia are reflected in similar movements in these four variables. The PCA identifies common trends in data and expresses it in a way that highlights changes in these trends over time. Using this method we combine the four variables and extract a single variable that explains most of the variation in the original set of four proxy variables (this is known as the first principal component). This gives us a single time series that shows how the level of economic uncertainty has tracked against its historic average over time (see Appendix D).

Stakeholders generally supported our 2013 method of constructing the uncertainty index. For example, WaterNSW submitted:

We consider the uncertainty index to be a transparent and logical approach to making adjustments to the WACC.<sup>135</sup>

Hunter Water noted that:

...IPART's uncertainty index would act as a safety valve during extreme or unusual events that materially affect financial decisions.<sup>136</sup>

We have decided to maintain the 2013 method of constructing the index at this time as it is working well and promotes certainty.

### **Final Decision**

29 Maintain our 2013 method of constructing the uncertainty index.

<sup>&</sup>lt;sup>134</sup> Bank of England, *Macroeconomic uncertainty: what is it, how can we measure it and why does it matter?,* Quarterly Bulletin, June 2013, vol. 53, issue 2, pp 103-104.

<sup>&</sup>lt;sup>135</sup> WaterNSW submission to IPART Issues Paper, August 2017, p 12.

 $<sup>^{136}</sup>$  Hunter Water submission to IPART Issues Paper, August 2017, p 9.

### 6.3 Maintain our current decision rule

As noted above, we currently consider that market circumstances are normal when our uncertainty index is at, or within one standard deviation of, its historic (since mid-2001) average of zero. In our Issues Paper, we raised two questions about this approach:

- 1. whether our current one standard deviation threshold is appropriate, and
- 2. whether the decision rule should be applied to a fixed period of time such as the last 10 years of uncertainty index data.

Sydney Water considered our current one standard deviation threshold to be a transparent and logical approach.<sup>137</sup> Hunter Water acknowledged that:

IPART's analysis of the uncertainty index in the issues paper shows the index exceeding the threshold during the global financial crisis and a seven month period in 2011, while going close to the threshold at other times. This appears reasonable with the benefit of hindsight. While supportive of the uncertainty index, Hunter Water is not convinced that there is a strong case for narrowing the current threshold.<sup>138</sup>

Stakeholders continued to support our draft decision to maintain the current decision rule.<sup>139</sup>

Our analysis also suggests the current sensitivity of the decision rule is appropriate. As Figure 6.1 below shows, the threshold of one standard deviation from the long-term (mid-2001) mean would have identified historic periods of heightened economic uncertainty. These periods include most of 2008-09 corresponding to the global financial crisis (GFC), as well as a seven-month period beginning in late-2011, corresponding to the Eurozone crisis. This indicates that it is functioning as intended. If we applied a tighter threshold, we would deviate from the midpoint more often. While it is difficult to determine exactly what periods are normal, a tighter threshold may pinpoint 'normal' periods of fluctuation as being abnormal conditions.

Likewise, while applying the decision rule to a fixed window could reflect periods with more similar structural conditions, the choice of time period is subjective and limiting it could reduce the amount of information used to apply the decision rule. We consider that the more information that is included in the calculation of the uncertainty index, the greater its ability to predict genuine out-of-range periods.

#### **Final Decision**

30 Maintain our 2013 method decision rule.

### 6.4 Maintain our discretion to consult on out-of-range situations

If the uncertainty index is more than one standard deviation from its historic average, our current approach is to exercise our discretion about whether to move from the midpoint. In

<sup>&</sup>lt;sup>137</sup> Sydney Water submission to IPART Issues Paper, August 2017, p 6.

<sup>&</sup>lt;sup>138</sup> Hunter Water submission to IPART Issues Paper, August 2017, p 9.

<sup>&</sup>lt;sup>139</sup> Sydney Water submission to IPART Draft Report, December 2017, p 5; Hunter Water submission to IPART Draft Report, December 2017, p 11; WaterNSW submission to IPART Draft Report, December 2017, p 15; SDP submission to IPART Draft Report, December 2017, p 14.
exercising that discretion, we consider the value of the uncertainty index and financial market information including:

- debt and equity transaction data
- interest rate swap curves
- equity analyst reports, and
- independent expert reports.

We currently provide no formal guidance as to how we might exercise discretion when the uncertainty index indicates a period of high market volatility.

In response to our Issues Paper, stakeholders requested guidance on how we would apply discretion in such circumstances. For example, SDP requested that we explain what our response would have been in past instances where the uncertainty index moved outside the range of one standard deviation. It also contended that any movement in the index within a regulatory period should not lead to a reopening of an existing determination.<sup>140</sup>

WaterNSW stated that we should not retain discretion to adjust weightings of current and historic market data without providing sufficient transition opportunity for a regulated entity to replicate the debt maturity profile in response to the adjustment.<sup>141</sup> However, Sydney Water supported us maintaining discretion so long as we specify and apply a consultative, consistent and transparent framework for exercising such judgement.<sup>142</sup>

### 6.4.1 We do not consider it is possible to provide general guidance

In our Draft Report, we put the view that it is not possible to provide general guidance on what we would do in an out-of-range situation.<sup>143</sup> During periods of high market volatility, such as the GFC, important variables like the risk-free rate, the debt margin and the MRP can move far from historic average values. To capture the market conditions facing regulated firms, there is an argument that greater weight should be given to current measurements in such periods.

However, if market conditions change rapidly, there is also a risk that current estimates are more unreliable than historic average estimates. That consideration suggests giving greater weight to the historic measurements in volatile periods.

If a regulator was of the view that the conditions were likely to be transient, then the current estimates may not reflect the likely conditions over the regulatory period.

Box 6.1 discusses how we might have handled the GFC if our decision rule was in place. We consider this demonstrates the need to evaluate each episode of volatility on its particular features based on the information available at the time. Without knowing what is driving an out-of-range uncertainty index result, it is not possible to predict how a prudent utility would respond. For this reason, we made the draft decision to maintain our discretion on

<sup>&</sup>lt;sup>140</sup> SDP submission to IPART Issues Paper, August 2017, p 7.

<sup>&</sup>lt;sup>141</sup> WaterNSW submission to IPART Issues Paper, August 2017, p 12.

<sup>&</sup>lt;sup>142</sup> Sydney Water submission to IPART Issues Paper, August 2017, pp 6-7.

<sup>&</sup>lt;sup>143</sup> IPART, *Review of our WACC Method: Draft Report*, October 2017, pp 66-67.

how we would weigh the current and historic market data when the market is in an abnormal state.

Stakeholders supported our draft decision.<sup>144</sup> As part of SDP's submission to our Draft Report, Frontier Economics' report stated that there were a number of problems with our preliminary conclusions about how we may have responded to movements in the uncertainty index during the GFC (see Box 6.1 below), including that:

- it may be counterintuitive to place less weight on the current WACC estimate, when the overall WACC estimate should reflect prevailing market conditions more closely
- it could produce asymmetric outcomes for regulated businesses whereby the regulated business would receive a low WACC when the uncertainty index increases significantly and a low WACC when the uncertainty index falls significantly, and
- some of our assumptions about debt financing may not be realistic, including that businesses may not have the ability to defer refinancing for maturing debt in that period.<sup>145</sup>

Frontier Economics concluded that "This underscores the need for IPART to consult properly with stakeholders on the appropriate response, in the event that the one standard deviation threshold is crossed."<sup>146</sup> As such, it endorsed our approach.<sup>147</sup>

Given stakeholder support, we have decided to retain the discretion to modify the decision rule in light of market information at the time. In such a situation, we would consult with stakeholders at the time.

### **Final Decision**

31 Continue to use our discretion to determine the appropriate weighting of current and historic average market data when the market is in an abnormal state, and to consult with stakeholders before we make our decisions.

<sup>&</sup>lt;sup>144</sup> Sydney Water submission to IPART Draft Report, December 2017, p 5; Hunter Water submission to IPART Draft Report, December 2017, p 11; WaterNSW submission to IPART Draft Report, December 2017, p 15; SDP submission to IPART Draft Report, December 2017, p 14

<sup>&</sup>lt;sup>145</sup> Frontier Economics, *IPART review of WACC method – Response to Draft Report, Report prepared for Sydney Desalination Plant*, December 2017, pp 33-34.

<sup>&</sup>lt;sup>146</sup> Ibid, p 34.

<sup>&</sup>lt;sup>147</sup> Ibid, p 35.

### Box 6.1 How would we have handled the GFC?

We now know that the GFC was a transient event for Australian financial markets. Had utilities known this, they may have refrained from refinancing, to the extent possible, while interest rates were high. Where they could not avoid refinancing tranches of debt, they may have rolled these over for the shortest tenor, to avoid locking in high rates for a long period.

In that situation, it may have been appropriate to give more weight to the historic interest rate. However, the regulated businesses did not know that it was transient and neither did we.

An analysis of historic data suggests:

- ▼ an increase in the uncertainty index may be correlated with weak economic conditions
- when the uncertainty index is elevated, the current estimate of the WACC has been higher than the historic average, and
- ▼ if financial markets are relatively illiquid, current estimates may not reflect actual market conditions.

Figure 6.1 plots our uncertainty index and the Westpac Melbourne Institute measure of consumer sentiment over the period including the GFC. In the periods where the uncertainty index was more than one standard deviation above its long-term average (shaded grey), consumer sentiment was below its long-term average. In other words, when financial market volatility is high, consumers' confidence about the economy and their finances tends to be low.



#### Figure 6.1 IPART uncertainty index and consumer sentiment

**Note:** Consumer sentiment is measured using "The Westpac Melbourne Institute Index of Consumer Sentiment" Index. We plotted the deviation in this index from its neutral sentiment. A higher number indicates more positive consumer sentiment. **Data source:** Bloomberg; The Westpac Melbourne Institute Index of Consumer Sentiment; IPART analysis.

This suggests that we may have needed to be mindful of the impact of a higher WACC on consumers' ability to pay and the social impact of our decision. It also suggests that in periods of high volatility, investment opportunities may be scarce compared to when consumer sentiment is high.

Figure 6.2 shows that during the GFC, the current WACC estimate was 1-2 % above our midpoint.



Figure 6.2 Nominal vanilla WACC estimates and the uncertainty index (%)

**Note:** The WACC estimates in this chart assume a 60% gearing ratio and an equity beta of 1. **Data source:** IPART analysis.

When financial conditions are volatile, liquidity in debt and equity markets may fall, particularly in corporate bond markets. For example, we might be able to observe the debt margin, but a firm might not be able to issue debt at this time due to lack of investors.

Figure 6.3 plots non-government bond issuance during the GFC. It shows that while the average level of debt issuance remained fairly robust during the GFC period, issuance patterns were far more sporadic compared to pre-crisis conditions.



Figure 6.3 Non-government bond issuance during the GFC (A\$b)

This suggests:

- the current estimate of the WACC may not always reflect debt raising costs incurred by firms during periods of financial stress, and
- firms avoid issuing debt and equity when these costs are at their highest, which would tend to reduce their average cost of capital.

### 6.5 Re-estimate the gearing ratio at each price review

Our current approach is to review the gearing ratio each time we estimate the WACC for a business, considering updated market data and decisions made by other regulators. In practice, the gearing ratio should be stable over time, particularly as most firms we regulate operate a stable base of historic assets. On the other hand, the efficient gearing ratio for a benchmark firm could change over time, for example, if there are changes in investor preferences, tax reforms or other policy changes.

In our Draft Report, we proposed to continue to re-estimate gearing at each price review.148

# 6.5.1 Stakeholders expressed a preference to review gearing outside of price reviews

In response to our Draft Report, WaterNSW considered that "...an enhancement to the regulatory process would be to conduct a review of the appropriate equity beta, gearing and the selection of proxy firms outside of price reviews. This will provide IPART-regulated utilities with more certainty on these parameters ahead of price-review submissions, and enhance the predictability and transparency of the IPART regulatory process".<sup>149</sup>

SDP referred to its response to our Issues Paper, which was that it supported maintaining our current approach, but considers we should:

- use the capital structure of the benchmark firm
- have regard to other regulatory decisions, and
- only change our determination of the benchmark gearing if there is sufficient evidence to do so.<sup>150</sup>

While Sydney Water had expressed reservations in its response to our Issues Paper, it was satisfied with our draft position. In particular, it originally submitted that "gearing should only be reviewed if there are obvious structural changes within Australia that would bring about the need to assess gearing".<sup>151</sup> It noted that if gearing was reviewed at each price review, because the review was largely based on proxy international firms, it may "import structural changes and unnecessary instability that may not be representative of the Australian experience".<sup>152</sup> However, it contended that if gearing were to be reviewed periodically, "it is critical that such reviews are conducted sufficiently prior to each firm's

<sup>&</sup>lt;sup>148</sup> IPART, *Review of our WACC Method: Draft Report*, October 2017, p 69.

<sup>&</sup>lt;sup>149</sup> WaterNSW submission to IPART Draft Report, December 2017, p 15.

<sup>&</sup>lt;sup>150</sup> SDP submission to IPART Issues Paper, August 2017, p 6.

<sup>&</sup>lt;sup>151</sup> Sydney Water submission to IPART Issues Paper, August 2017, p 16

<sup>&</sup>lt;sup>152</sup> Ibid, p 17.

price review to enable timely utility modelling and sound business plans to be developed and submitted".<sup>153</sup>

However, in response to our Draft Report, Sydney Water concluded:

..IPART's draft position elaborated that gearing will be reviewed along with the beta and any adjustments to the gearing will be backed by sufficient evidence. Further, IPART have stated they will undertake reviews early in price review processes, allowing incorporation into price submissions. On this basis, we accept this change.<sup>154</sup>

Hunter Water maintained its view, in response to our Draft Report, that:

Gearing should be reviewed prior to a price review to allow for enhanced accuracy in price submission planning and modelling. An alternative would be that IPART indicate ahead of a price review the likelihood of hearing changes in the context of new market data, significant financial events or regulatory policy developments.<sup>155</sup>

### 6.5.2 Our final decision is to continue to review gearing at each price review

Overall, we consider that a periodic review (every 3-5 years) of gearing is good practice and that we should review the gearing of the benchmark entity at the same time that we review the equity beta. Both of these reviews would rely on the same proxy firm analysis.

We consider that given the stakeholder administration and consultation involved, it would be pragmatic to do it within a price review (which generally occurs every 4-5 years). It also allows a broader scope of stakeholders, including customer representative groups, to engage in the process, which they may otherwise not have the resources to do.

However, taking into account stakeholders' views, we will undertake this analysis earlier in the review process, to give stakeholders more time to consider our proxy firm selection, gearing and beta analysis and respond before we proceed with our draft decisions, which would be based on the results. In line with Final Decision 27, we will also improve the transparency of our process by:

- publishing our criteria for proxy selection, and our list of comparator companies that meet our criteria at the start of the relevant review, and
- giving stakeholders the opportunity to propose additional comparable industries that meet our criteria, but not individual stocks.

As for the equity beta, we would not automatically change the gearing we use in WACC calculations in line with the results of a periodic review. Rather, we would adjust it only if there were sufficient evidence.

### **Final Decision**

32 Continue to re-estimate the gearing of the benchmark entity at each price review to inform our assessment of whether the existing estimates remain appropriate.

<sup>&</sup>lt;sup>153</sup> Ibid, p 7.

<sup>&</sup>lt;sup>154</sup> Sydney Water submission to IPART Draft Report, December 2017, p 6.

<sup>&</sup>lt;sup>155</sup> Hunter Water submission to IPART Draft Report, December 2017, p 12.

# 7 Measuring inflation and gamma

Under our 2013 method for setting the WACC, we first measure the cost of debt and equity in nominal terms. Therefore, in line with our policy of setting and applying a real post-tax WACC, we need to adjust these nominal measurements by inflation to derive a real WACC.

Since December 2014, we have applied a single, forward-looking inflation forecast to both the current and historic costs. This forecast is the expected rate of inflation over the next 10 years, which we calculate as the geometric average of:

- a current 1-year forecast based on quarterly data from the RBA's Statement of Monetary Policy (SMP), and
- the middle of the RBA's target band for inflation (2.5%) for Years 2 to 10.

In this review, we have considered: what period over which we forecast inflation; whether we continue to estimate inflation using a geometric average method or use a breakeven inflation method; and whether we should change our approach for calculating the geometric average.

Another aspect of the impact of taxation on the WACC is the imputation credit factor, gamma. We currently assume that gamma has a value of 0.25, and have considered whether this remains appropriate.

The sections below provide an overview of our final decisions on inflation and gamma, and then discuss them in more detail.

### 7.1 Overview of final decisions on inflation and gamma

We will continue to set a real post-tax WACC by adjusting our nominal cost estimates for inflation. However, we have decided to make some modifications to our current approach for this adjustment.

We will adjust both current and historic cost inputs by the expected rate of inflation over the regulatory period instead of the next 10 years. We consider this will reduce the risk under our current approach that, at different points in the economic cycle, we over- or underestimate inflation.

We will continue to use a geometric average method to calculate this rate of inflation because, despite the in-principle benefits of using the break-even inflation method, as our analysis indicates that currently there is not a convincing case for change. However, we will make two small modifications to the way we apply the method:

• We will calculate expected inflation as the geometric average of the **change in the level of prices** (rather than the **inflation rate**).

 We will define the 1-year ahead RBA forecast as the inflation forecast in the RBA's most recently issued SMP that is closest to 12 months ahead of the start of the regulatory period.

We have also decided to continue to use 0.25 as the value of gamma.

All of these final decisions are consistent with our draft decisions.

# 7.2 Setting a real post-tax WACC

As Chapter 2 discussed, in this review we are not considering broader policy issues related to how we apply the WACC in this review. We will continue to apply a real post-tax WACC.

The post-tax framework avoids overcompensating firms who, in practice, tend to pay less than the statutory rate of tax. In many cases, the post-tax framework provides a more accurate estimate of the revenue that regulated businesses require to meet their tax obligations. This is consistent with the approach taken by many other Australian regulators, including the ACCC and AER (see Appendix A). We intend to review the way that we apply the post-tax framework in the building block model in 2018.

By applying a real WACC to a RAB that we index for inflation, we ensure that inflation is accounted for only once. Indexing the RAB for inflation affects the price path and hence, the business' cash flow, even though it is net present value (NPV) neutral over the life of the assets. That is because the decision to capitalise inflation alters the RAB and cash flow profile over time. Our financeability test allows us to examine whether the cash flows allow the business to remain financially viable.

# 7.3 Adjust for expected inflation over the regulatory period

We currently deflate our nominal WACC inputs by applying a single, forward-looking rate that is the expected rate of inflation over the next 10 years, regardless of the length of the regulatory period. In our Issues Paper, we expressed a preliminary view to maintain our existing approach of using a 10-year forward-looking inflation rate for this adjustment.

# 7.3.1 Stakeholders suggested alternative approaches

Stakeholders expressed a range of views on this question. For example, Sydney Water did not agree with our preliminary view, and stated that we should "use a best estimate of expected inflation over the regulatory period instead of using long-term inflation expectations".<sup>156</sup> It also noted our current approach, which is an estimate of long-term inflation expectations, might be "problematic when long-term inflation expectations differ substantially from forecast inflation over the regulatory period".<sup>157</sup>

<sup>&</sup>lt;sup>156</sup> Sydney Water submission to IPART Issues Paper, August 2017, p 7.

<sup>&</sup>lt;sup>157</sup> Ibid.

In contrast, NSW Treasury proposed that we calculate inflation on the same basis that the risk-free rate is calculated.<sup>158</sup> For example, if we set the WACC as the midpoint of a current estimate and a historic average over the past 10 years, we should deflate the WACC by a midpoint of a current and a historic estimate of inflation. In particular, deflating the historic estimate of the WACC by a historic estimate of inflation, would reflect the real cost of finance at the time that debt, or equity, was issued.

## 7.3.2 Our draft decision was to maintain our existing approach

We agreed with Sydney Water's response to our Issues Paper, including its concern about our current approach. A 10-year geometric average, with a 2.5% inflation rate for nine out of the 10 years, would produce an inflation estimate that is very close to 2.5%. Therefore, at different points in the economic cycle, there is a risk that our current approach would over-or under-estimate actual inflation.

We did not agree with Treasury's view, preferring a forward-looking inflation forecast over the regulatory period as the appropriate measure to deflate the nominal WACC. This is because the real WACC should reflect an efficient firm's expected real cost of capital over a regulatory period. Even though the nominal cost of capital might reflect a mix of current and historic debt and equity costs, it is the forward-looking inflation over the regulatory period that matters. It would determine how that nominal cost of capital is converted to real terms. We noted that this could mean using a slightly different inflation rate in two concurrent reviews, if we decide to set a different regulatory period for the businesses concerned.

# 7.3.3 Stakeholders supported our draft decision

Stakeholders generally supported our draft decision.<sup>159</sup> However, WaterNSW reiterated its support for using breakeven inflation (discussed below).<sup>160</sup>

Hunter Water supported our draft decision to adjust nominal WACC inputs by expected inflation over the regulatory period.<sup>161</sup>

### **Final Decision**

33 In converting our nominal WACC inputs into real terms, adjust them by the expected rate of inflation over the regulatory period.

# 7.4 Use a geometric average method to calculate expected inflation

We currently calculate the expected inflation rate as the geometric average of the midpoint of the RBA's 1-year ahead inflation forecast and the midpoint of the RBA's target inflation band. However, prior to 2009, we used the break-even inflation method (BEI method).

<sup>&</sup>lt;sup>158</sup> NSW Treasury submission to IPART Issues Paper, August 2017, p 5.

<sup>&</sup>lt;sup>159</sup> Sydney Water submission to IPART Draft Report, December 2017, p 6; WaterNSW submission to IPART Draft Report, December 2017, p 15; Hunter Water submission to IPART Draft Report, December 2017, p 12, SDP submission to IPART Draft Report, December 2017, p 14.

<sup>&</sup>lt;sup>160</sup> WaterNSW submission to IPART Draft Report, December 2017, p 15.

<sup>&</sup>lt;sup>161</sup> Hunter Water submission to IPART Draft Report, December 2017, p 12.

The BEI method estimates inflation as the difference between the yield on an inflation linked bond and a nominal bond of equivalent maturity (implied by the Fisher equation below), to calculate expected inflation as the rate of inflation that would make an investor indifferent between the two bonds:

(7) 
$$(1+i) \equiv (1+r) \times (1+\pi_e)$$

where:

- *i* is the yield on the nominal bond
- *r* is the yield on the inflation linked bond, and
- $\pi_e$  is the expected inflation rate.

Rearranging, the inflation rate under the BEI method is:

(8) 
$$\pi_e = \left(\frac{1+i}{1+r}\right) - 1$$

In May 2009, we moved away from the BEI method, in part, due to concerns about the breadth of liquidity in the inflation-linked bond market.

The AER currently estimates inflation using a geometric average approach, forecasting inflation as the geometric average of:

- 1-year and 2-year forecasts based on quarterly data from the RBA's SMP, and
- the middle of the RBA's target (2.5%) for Years 3 to 10.

The AER recently reviewed its approach to inflation. In its final position paper, the AER decided to estimate inflation using a geometric average method over other methods including the BEI method because, in its view, it is 'the simplest to apply, most transparent and easily replicable'.<sup>162</sup>

### 7.4.1 Some stakeholders supported moving back to the BEI method

In response to our Issues Paper, Sydney Water and SDP expressed some support for continuing to use a geometric average method.<sup>163</sup> However, WaterNSW and Hunter Water encouraged us to consider the BEI method.<sup>164</sup> NSW Treasury strongly supported moving to the BEI method. NSW Treasury preferred the BEI method because, in its view:

- this method reflects the current market expectation of future inflation which feed directly into the price of debt at the time of the measurement
- RBA forecasts of inflation are only updated quarterly, and
- other regulators, including OFGEM and ORR in the UK, use BEI method.<sup>165</sup>

<sup>&</sup>lt;sup>162</sup> AER, *Regulatory treatment of inflation, Final position*, December 2017, p 47.

<sup>&</sup>lt;sup>163</sup> Sydney Water submission to IPART Issues Paper, August 2017, p 18 and SDP submission to IPART Issues Paper, August 2017, pp 42-43.

<sup>&</sup>lt;sup>164</sup> WaterNSW submission to IPART Issues Paper, August 2017, p 13 and Hunter Water submission to IPART Issues Paper, August 2017, p 10.

<sup>&</sup>lt;sup>165</sup> NSW Treasury submission to IPART Issues Paper, August 2017, p 6.

NSW Treasury also provided evidence that previous concerns with BEI method are no longer as acute:

- The depth and liquidity of inflation-linked bond markets have improved significantly in recent years, with investor demand, bond issuance and turnover data increasing significantly in recent years. In addition, the Australian Office of Financial Management (AOFM) – which is responsible for issuing inflation-linked bonds – has committed to maintaining an inflation-linked bond market.
- Inflation and liquidity premia are likely to have fallen in line with the increase in the size of the inflation-linked bond market.

# 7.4.2 Our draft decision was to maintain our existing approach and reconsider moving to BEI method at next WACC review

We analysed the BEI method and the geometric average method to consider the points it raised. In particular, we compared two methods using four criteria:

- economic theory
- reliability of market data
- accuracy of historic forecasts, and
- simplicity, transparency and replicability.

We found that, overall, that there was not a sufficient case to change from a geometric average method to the BEI method. (Appendix E provides more detail on this analysis.) Therefore, our draft decision was to continue to calculate the average expected inflation rate using our geometric average approach, but reconsider whether we should move to a break-even inflation method at the next review of our WACC method.<sup>166</sup>

### 7.4.3 Our final decision is in line with our draft decision

Stakeholders generally supported our draft decision.<sup>167</sup> However, WaterNSW reiterated its support for using the BEI method.<sup>168</sup>

We recognise the in-principle benefits of using the BEI method to calculate inflation. However, on-balance, we have decided to maintain our draft decision to use a geometric average approach as we consider that currently, there is not a sufficient case for change:

- 1. While our analysis suggests that liquidity in the inflation-linked bond market not currently an acute concern, we remain concerned that the market may not remain sufficiently liquid throughout the business cycle. Therefore, the accuracy of the BEI method may vary at different points in the economic cycle.
- 2. In part, due to data limitations, the BEI method is a slightly more complex, and less replicable, method compared to a geometric average.

<sup>&</sup>lt;sup>166</sup> IPART, *Review of our WACC Method: Draft Report*, October 2017, p 81.

<sup>&</sup>lt;sup>167</sup> Sydney Water submission to IPART Draft Report, December 2017, p 6; WaterNSW submission to IPART Draft Report, December 2017, p 15; Hunter Water submission to IPART Draft Report, December 2017, p 12, SDP submission to IPART Draft Report, December 2017, p 14; PIAC submission to our Draft Report, December 2017, p 3.

<sup>&</sup>lt;sup>168</sup> Hunter Water submission to IPART Draft Report, December 2017, p 12.

We have also maintained our draft decision to reconsider moving to the BEI method at our next WACC review.

### **Final Decisions**

- 34 Calculate the average expected inflation rate as the geometric average of:
  - the RBA's 1-year ahead inflation forecast in its most recently issued Statement of Monetary Policy for the first year of the regulatory period, and
  - the midpoint of the RBA's target inflation band (2.5%), for the remaining years in the regulatory period.
- 35 Reconsider whether we should move to a break-even inflation method to calculate the average expected inflation rate at the next review of our WACC method.

## 7.5 Refine our approach for calculating the geometric average

In applying the geometric average method, we currently calculate expected inflation as the geometric average of the **inflation rate**. This approach is expressed in equation (9) below:

(9) 
$$\pi_0^e = \sqrt[n]{(\pi_1^{RBA}) \times (\pi_2^{MP}) \times ... \times (\pi_n^{MP})}$$

where:

- $\pi_0^e$  is the expected inflation rate
- $\pi_1^{RBA}$  is the RBA's 1-year ahead inflation forecast, which applies in Year 1, and
- $\pi_2^{MP} \dots \pi_{10}^{MP}$  are the midpoint of the RBA's target inflation band, which applies in Years two through 10.

In our Draft Report, we made draft decisions to modify our approach so we measure expected inflation as the geometric average of the **change in the level of prices**, with this average converted into an inflation rate separately.<sup>169</sup> This alternative is expressed in equation (10):

(10) 
$$\pi_0^e = \sqrt[n]{(1 + \pi_1^{RBA}) \times (1 + \pi_2^{MP}) \times ... \times (1 + \pi_n^{MP})} - 1$$

As stakeholders supported our draft decision, we have decided to make this modification, and use equation (10). The CPI is a price index, and the average inflation rate between two points should be based on the change in the level of prices between those two points. This approach is consistent with the AER's current method.<sup>170</sup> In addition, our 2013 method would not work in the (unlikely) event that the 1-year inflation forecast is negative.

In addition, in comparing the BEI method and the geometric average method, we noted that it might not be clear to stakeholders how we use the RBA's inflation forecasts to calculate our 1-year ahead inflation forecast. To address this issue, we have decided to define our 1-year ahead inflation forecast more precisely, as the inflation forecast, in the RBA's most recently issued SMP, that is closest to 12 months ahead of the start the regulatory period.

<sup>&</sup>lt;sup>169</sup> IPART, Review of our WACC Method – Issues Paper, July 2017, p 47.

<sup>&</sup>lt;sup>170</sup> ACCC, Best estimates of expected inflation: a comparative assessment of four methods, ACCC/AER Working Paper Series No. 11, February 2017, p 109.

### **Final Decisions**

- 36 Calculate expected inflation as the geometric average of the change in the level of prices.
- 37 Define the 1-year ahead RBA forecast we use to estimate inflation, as the inflation forecast:
  - in the RBA's most recently issued Statement of Monetary Policy, and
  - that is closest to 12 months ahead of the start of the regulatory period.

### 7.6 Use 0.25 as the value of gamma

Under the Australian imputation tax system, shareholders may receive dividends with imputation tax credits, which offset tax liabilities. Therefore, investors would accept a lower rate of return for an investment with imputation credits attached than if there were no imputation tax credits attached.

The imputation credit factor, gamma, is most relevant for converting a post-tax WACC to a pre-tax WACC. As we have adopted a post-tax WACC framework, we do not directly use gamma in our calculations. However, as noted in Chapter 5, gamma does have an influence over the current MRP estimates we use.

### 7.6.1 How we derived our point estimate of gamma used in our 2013 method

We have used a 0.25 value of gamma since our December 2011 pricing decision for SDP. That decision took account of a dividend drop-off study by then SFG Consulting (SFG)<sup>171</sup> that was done for the Australian Competition Tribunal. This value was reconfirmed by a follow-up report by SFG that was done for Jemena Gas Networks in 2015.

SFG based its estimate primarily on implied market valuation methods, such as dividend drop-off studies. Such studies compare the value of equities in specific firms just before and just after a dividend is paid. While these estimates tend to be 'noisy', the underlying signal contains information about the value investors place on those dividends, taking full account of their tax position and ability to use imputation credits.

SFG also undertook another study, which took into account valuation information obtained from analysis of equity ownership and of Australian Taxation Office (ATO) taxation statistics. The equity ownership method uses data from the Australian Bureau of Statistics (ABS) to determine what proportion of Australian equity is held by domestic investors and what proportion by foreign investors. The main assumption of the method is that domestic investors take full advantage of imputation credits while foreign investors are unable to take any advantage of them. While providing a point of reference, this assumption is imprecise, and may tend to overestimate the use of imputation credits. Further, domestic ownership ratios fluctuate considerably over time, and are quite different for listed equities as compared to all (listed and non-listed) equities. All of these factors tend to make the equity ownership method imprecise.

<sup>&</sup>lt;sup>171</sup> SFG is now part of Frontier Economics.

The ATO taxation statistics approach uses aggregate data on the tax returns of payers of Australian tax. From this data it is possible to understand the extent to which taxpayers actually claim imputation credits. While this method also has its limitations, it tends to produce gamma estimates that are lower than those from the equity ownership method, because it does not make such imprecise assumptions about the behaviour of investors.

### 7.6.2 Most stakeholders supported gamma of 0.25

Most stakeholders supported gamma of 0.25. In its submission to our Issues Paper, SDP included a report from Frontier Economics that maintains that the best dividend drop-off (market value) estimate of gamma currently available is 0.25.<sup>172</sup> Frontier Economics contends that there are two possible interpretations of gamma: a market value concept, under which gamma represents the price that an investor would be willing to pay for an imputation credit; and, a redemption or utilisation concept, which represents the rate at which imputation tax credits are redeemed by taxpayers to reduce their personal tax liabilities. Under IPART's framework, gamma is the amount by which the total allowed return on equity is reduced to reflect the imputation credits that investors will receive. As such, it must reflect the market value of credits relative to dividends and capital gains. This suggests that the market value interpretation is appropriate.<sup>173</sup>

However, PIAC expressed concerns that this value is significantly lower than the gamma value used by other regulators. It noted that the "...Australian Competition Tribunal since found in favour of the AER's calculation of a gamma of 0.4 in its decision regarding SA Power Networks, as did the Full Federal Court with respect to the AER's decision regarding the NSW and ACT DNSPs [Distribution network service providers]".<sup>174</sup>

Stakeholders made no further comments about gamma in submissions to our Draft Report.

# 7.6.3 We consider there is not sufficient evidence to adopt a different value of gamma at this time

Unfortunately, because it is not possible to directly observe the after-tax returns that investors make, gamma is extremely difficult to establish empirically. We acknowledge that other regulators adopt different values for gamma (see Appendix A) and at times the selection of gamma has been controversial.

In recent years, some regulators have moved towards a higher value of gamma than 0.25.<sup>175</sup> In 2016, the SA Power Networks (SAPN) appealed the AER's final determination that the valued attributed to gamma should be 0.4 to the Australian Competition Tribunal (ACT). SAPN's proposal was a value of 0.25.<sup>176</sup> In its final decision, the ACT noted the difficulties in estimating gamma accurately from market data. It stated:

<sup>&</sup>lt;sup>172</sup> Frontier Economics, *Review of WACC method: response to IPART Issues Paper: A report prepared for Sydney Desalination Plant,* August 2017, p 52.

<sup>&</sup>lt;sup>173</sup> Ibid, p 45.

<sup>&</sup>lt;sup>174</sup> PIAC submission to IPART Issues Paper, August 2017, p 3.

<sup>&</sup>lt;sup>175</sup> See Appendix A – this includes the AER, ACCC and ERAWA which have adopted 0.4 and the QCA, which adopted 0.47.

<sup>&</sup>lt;sup>176</sup> Australian Competition Tribunal, *Final decision on application by SA Power Networks*, 2016, paragraph 125.

Unfortunately, the available empirical evidence is inadequate to enable confident discrimination between these alternative perspectives. There are a range of studies, reviewed in the AER's Final Decision, using market prices which attempt to estimate the extent to which imputation credits are capitalised into stock prices and thus their market valuation. There are a range of results, and experts are divided on the merits of the various approaches and techniques

Ultimately, the ACT found in favour of the AER's value of gamma, its reasoning being:

...the AER did not err, nor was unreasonable, in giving most weight to the "utilisation" approach. It considered the range of alternative approaches, recognised the diversity of views of experts on their merits (both theoretical and empirical), and made a judgement call. In doing so, it demonstrated responsiveness to the empirical evidence in lowering its estimate of gamma from 0.5 as proposed in its ROR Guidelines to a value of 0.4.<sup>177</sup>

However, while the ACT found that the AER's decision-making *process* for arriving at its value of gamma was not unreasonable in the circumstances, this does not necessarily infer that the ACT endorsed the AER's *decision*.

We agree with Frontier Economics that the value of gamma should be interpreted as the market value of dividends and capital gains that investors would be willing to forgo in exchange for imputation credits.<sup>178</sup> Further, we maintain our view that dividend drop-off studies are currently the best method to estimate the market value of gamma. Its advantage is that it measures the observed value of dividends and imputation credits by examining share price changes on ex-dividend days.

Since the 2011 SFG study that we relied upon in our 2013 method, Frontier updated its analysis in 2013<sup>179</sup> and again in 2017<sup>180</sup>. The latter study employed a large sample and improved econometric techniques to estimate the value of both cash dividends and distributed imputation credits using dividend drop-off analysis. Both of these studies reconfirmed that the best estimate of the market value of gamma was 0.25.

### 7.6.4 Our final decision is to continue to use 0.25

Based on our analysis and stakeholder feedback, we consider that there is not sufficient evidence to suggest a more accurate method of determining gamma. Hence, to maintain stability and certainty for stakeholders, we propose to continue using our current value of gamma of 0.25.

We will continue to monitor developments in this area, and will consider whether we should change our approach to gamma at our next WACC review.

#### **Final Decision**

38 Continue to use 0.25 as the value for gamma.

<sup>&</sup>lt;sup>177</sup> Ibid, pp 158-159.

<sup>&</sup>lt;sup>178</sup> Frontier Economics, p 51.

<sup>&</sup>lt;sup>179</sup> Frontier Economics, Updated dividend drop-off estimate of theta: Report for the Energy Networks Association, June 2013.

<sup>&</sup>lt;sup>180</sup> Forthcoming paper by Damien Cannavan and Stephen Gray, *Dividend drop-off estimates of the value of dividend imputation tax credits*, 2017.

84 | IPART Review of our WACC method

Appendices

# A Comparison of other regulators' approaches to WACC

#### Table A.1 Comparison of IPART, AER, ACCC and ESC Victoria's recent approaches<sup>181</sup>

	IPART <sup>a</sup>	AER <sup>b</sup>	ACCC <sup>c</sup>	ESCd
Date updated	Feb 2018	Dec 2013	Apr 2017 (rail)	Oct 2016 (water)
Application				
Type of WACC	Real post-tax	Nominal vanilla post-tax	Real pre-tax WACC	Real post-tax
Definition of benchmark entity	"A benchmark firm operating in a competitive market and facing similar risks to the regulated business".	"A pure play, regulated energy network business operating within Australia".	-	-
Point estimate or range	Default is midpoint of estimate range for each parameter derived from long and current market data.	Point estimate	Point estimate	Point estimate based on weighting of 60:40 return on debt to return on equity. However, while a benchmark cost of debt applies, return on equity is determined over a range of values linked to tangible outcomes to customers according to 'PREMO' framework.
Adjustment mechanism	Uncertainty index constructed from four proxies for economic uncertainty in Australia. If UI outside one standard deviation from mean, we will consider	There are multiple reasonableness checks and adjustments before finalising cost of debt and equity components.	-	WACCs are adjusted based on level of ambition proposed by the business.

<sup>&</sup>lt;sup>181</sup> This comparison table is compiled from a combination of WACC statements of approach (where published) and recent regulatory decisions. It may not reflect the methodology that applies to all industries. We have noted the approach is specific to one industry.

	IPART <sup>a</sup>	AER <sup>b</sup>	ACCCc	ESCd
	moving from the midpoint.			
Fixed for period or intra-period adjustment	Trailing average cost of debt, passed through either through annual price changes, or true-up at end of regulatory period.	Trailing average cost of debt	Fixed for period	Trailing average cost of debt
Cost of debt	10-year trailing average for historic component, and short- term trailing average (equal to length of regulatory period) for current component. Use a 40-day observation window each year, to recalculate the interest rate for that tranche of debt.	Start with an on-the-day rate for the first regulatory year using 10 or more consecutive business days averaging period as close as practicable to start of regulatory year. Gradually transition to a trailing average approach over 10 years, using benchmark with 10- year term to maturity and applying historic rates to new capex borrowings.	Sum of risk-free rate, debt margin and debt issuance (raising) cost.	10-year trailing average to estimate the benchmark cost of debt for water businesses, as it considers this better aligns actual cost of debt for an efficient business to regulated benchmark.
Risk-free rate	End of month estimates of AGS bond yields.	10-year AGS yield, 20 consecutive business days averaging period as close as practicably possible to the commencement of the regulatory period.	10-year Australian AGS and 20 day averaging period commencing as close as possible to the start of the period.	(Set out in each price review. Eg, for Melbourne Water 2016, cost of debt calculated as simple average of 10-year historic debt costs (risk-free rate plus debt premium) from RBA <sup>e</sup>
Debt margin	Measure monthly credit spreads of sample of Australian corporate bonds with term to maturity of 10 years from RBA.	Published yields from independent provider using benchmark credit rating and term to maturity of 10 years (extrapolated if shorter). Annualised if necessary. Confidential averaging period between 10 days to 12 months.	Takes an average of RBA and Bloomberg yield estimates. Adopts a BBB rated bond with a 10 year target tenor as the benchmark bond. Is a 20 business day average. Converted to an effective annual rate.	(Set out in each price review)
Credit rating	BBB (RBA BBB-/BBB/BBB+)	Closest approximate for BBB+	BBB (to represent BBB+)	BBB
Debt raising costs	12.5 basis points	Included in operating costs, based on efficient debt raising costs for benchmark firm.	9.5 basis points	15 basis points
Cost of equity				Each business's return on

	<b>IPART</b> <sup>a</sup>	AER <sup>b</sup>	ACCCc	ESCd	
Market risk premium	Midpoint of current and historic arithmetic average of excess market returns over risk-free rate. Current: two-thirds weight of median of five DGM parameter estimates and one-third weight of market indicator estimate.	Choose a point estimate (not necessarily the midpoint) from a range derived from theoretical and empirical evidence including historical excess returns, DGMs, survey evidence and conditioning variables.	Point estimate, taking into account historic estimates, market surveys and previous regulatory decisions. Most reliance placed on historic estimates.	equity is linked to tangible outcomes for customers. It varies according to level of ambition in price submission. A more ambitious submission will propose targeted services and outcomes at lower prices. This	
Equity beta	Reviewed at start of each price review process using proxy analysis, and updated if necessary.	Choose a point estimate from a range derived from empirical analysis of comparable firms. May be adjusted by international empirical analysis and theoretical principles.	Point estimate using the Monkhouse formula (eg, asset beta of 0.45 for ARTC). Analysis of comparable firms, adjusted for systematic risk mitigating factors. Takes into account previous betas and other regulatory decisions.	is achieved through better customer engagement, efficient management practices and rigorous self-examination. Ambition is assessed against five elements of PREMO – performance, risk, engagement, management and outcomes. 'Basic' submissions set at level where businesses recover interest costs of funding capital investment. 'Advanced' or 'Leading' price submissions would receive a higher return on	
Imputation credits	0.25	0.4	0.4 (within range of 0.3–0.5)	0.5	
Gearing	Reviewed at start of each price review process using proxy analysis, and updated if necessary.	0.6 based on historic precedent.	0.52 based on historic precedent and other regulatory decisions.	0.6	
Inflation	Geometric average of the 1-year ahead RBA forecast and the midpoint of the RBA's target band of inflation (i.e. 2.5%) for the remaining years in the regulatory period.	Geometric average of 1-year and 2-year ahead forecasts based on quarterly data from RBA's SMP; and, middle of RBA's target for years three to 10 (2.5%).	Weighted geometric average of RBA forecasts and mid-band inflation target over a 10-year period.	Latest market forecasts based on the Consumer Price Index – All Groups, Australia.	

a IPART, Review of WACC Method – Final Report, February 2018.

**b** AER, Better Regulation, Rate of Return Guideline, December 2013; Federal Court of Australia, Australian Energy Regulator v Australian Competition Tribunal (No 2), 24 May 2017.

c ACCC, Draft Decision – Australian Rail Track Corporation's 2017 Hunter Valley Access Undertaking, 20 April 2017.

d Essential Services Commission, Water Pricing Framework and Approach, Implementing PREMO from 2018, October 2016; Essential Services Commission, Melbourne Water 2016 Price Review – Guidance Paper, April 2015.

	QCAa	ERAWAb	ESCOSAc	NZCCd
Date updated	Aug 2014 (equity) Apr 2015 (debt)	Oct 2017 (rail)	Mar 2015 (water)	Dec 2016
Application				
Type of WACC	Nominal vanilla post-tax	Real pre-tax	Real post-tax	Vanilla post-tax
Definition of benchmark entity	Pure play, regulated, standalone.	-	"The regulatory return should be based on the expected behaviour of a benchmark efficient entity"	-
Point estimate or range	Point estimate	Point estimate	Point estimate	Percentile along a distribution, which is industry-specific.
Adjustment mechanism	-	-	-	Standard errors for asset beta, debt premium and MRP combined to determine WACC standard error. Based on industry, either midpoint or point along the distribution selected. Additional reasonableness checks apply to ensure WACC realistic in light of financial market conditions.
Fixed or intra- period adjustment	Fixed over period - rejected trailing average debt in 2015	Fixed over period	Trailing average cost of debt	Fixed over period - rejected trailing average debt in 2016
Cost of debt	'On the day' approach using benchmark cost of debt estimated just prior to start of regulatory cycle.	'On the day' observed rate for the next 10 years.	Weighted 10-year average approach – cost of debt updated each year of regulatory period.	Averages risk-free rate and debt premium over three calendar months just prior to start of regulatory period.
Risk-free rate	Based on Australian Government bond yields over 20-day averaging period and	Observed yield of 10-year Australian Government Securities (AGS) from Treasury	Observed yields from 10-year Commonwealth Government Bonds averaged over 20	Government bond rates as using yield to maturity as an approximation of spot rates.

Table A.2	Comparison of QCA	, ERAWA, ESCOSA	and NZCC's recent	t approaches
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	QCA <sup>a</sup>	ERAWA <sup>b</sup>	ESCOSA <sup>c</sup>	NZCC <sup>d</sup>
	RBA data. Benchmark debt term of 10 years.	Indexed Bond markets, used as a proxy.	business days. Observations taken close as possible to determination.	Maturity term of risk-free rate five years.
Debt margin	Econometric approach that measures the linear relationship between debt margin and term to maturity using 20-day averaging period.	5-year yield premiums (10-year rail) estimated from a sample of Australian and international bonds.	Weighted 10-year average approach, estimated directly from bond yields published by the RBA.	Maturity yields for pool of corporate bonds issued by similar companies. Estimate debt premium for term to maturity equal to regulatory period. Term credit spread differential allowance to compensate for additional debt premium and the interest rate swap execution costs from issuing longer term debt.
Credit rating	BBB+	BBB- to A (entity-specific)	BBB	BBB+(for electricity networks, A- for airports)
Debt raising costs	10.8 basis points	12.5 basis points	12.5 basis points	20 basis points
Inflation	-	Annually updated estimate implied from Treasury Bonds and Treasury Indexed Bonds using the Fisher equation.	Geometric mean of inflation over 10-year period using RBA inflation forecast for first and midpoint of RBA inflation target band for other years.	-
Cost of equity				
Market risk premium	Equally weighted average of four estimates (two historic and two current) (lbbotson, Siegel, Cornell DGM, survey evidence), and conditional information and rounding to the nearest whole percentage point.	Calculated using Ibbotson, Wright and DGM methods - Wright estimate given most weight, Ibbotson estimate given less weight. The Authority then accounts for DGM estimate of MRP. In the 2017 rail determination the Authority established a range of 6.9 to 7.2%, and selected an estimate of 7.2% at the upper end of the range in	MRP of 6 per cent consistent with majority of regulatory decisions over the past 10 years, market surveys of academics and market practitioners and sits within the range provided by historic estimates.	Studies of historic returns on shares relative to risk-free rate leading to an MRP of 7%.

	QCA <sup>a</sup>	ERAWA <sup>b</sup>	ESCOSA <sup>c</sup>	NZCC <sup>d</sup>
		light of the increase in the risk- free rate and other qualitative considerations.		
Imputation credits	0.47	0.4	Allowance made in operating expenditure on an entity-specific basis.	0
Gearing	Analysis of benchmark capital structure using comparable firms.	0.2 to 0.5 based on business historic precedent.	60% based on Australian regulatory decisions.	Uses the average leverage of asset beta comparator samples.
Equity beta	Empirical analysis of equity returns of publicly listed 'comparator' companies.	Empirical analysis including a standard Ordinary Least Squares (OLS) approach and other robustness approaches such as the Least Absolute Deviations (LAD); maximum likelihood robust methodology (MM); and Theil Sen approaches.	0.7 based on recent empirical research and regulatory precedent.	Identify comparator sample and estimate equity beta for each firm. De-lever each equity beta to estimate asset beta for each firm. Calculate average asset beta for sample. Adjust for regulatory or systematic risk differences to average asset beta. Re-lever average asset beta for sample to equity beta estimate using notional leverage.

a Queensland Competition Authority, Final decision, Trailing average cost of debt, April 2015; Queensland Competition Authority, Cost of capital: market parameters, August 2014.

**b** Economic Regulation Authority, Determination on the 2017 Weighted Average Cost of Capital for the Freight and Urban Railway Networks, and for the Pilbara railways, October 2017.

c Essential Services Commission of South Australia, SA Water Regulatory Rate of Return 2016 – 2020, Final Report to the Treasurer, March 2015.

d Commerce Commission New Zealand, Input methodologies review decisions: Topic paper 4: Cost of capital issues, 20 December 2016.

# B How we will update the cost of debt measurements

Under our 2013 WACC method, we set the cost of debt as a midpoint of a current and a historic estimate. We set the cost of debt for the duration of the regulatory period and do not update it until the next period.

As part of the consultation on our review of the WACC method, stakeholders proposed that we change our approach to estimating the cost of debt to update the cost of debt every year of the regulatory period.

We have decided to update the cost of debt annually, and maintain a midpoint of current and historic costs.

- For the historic estimate, we will estimate the cost of debt as a 10-year trailing average by splitting the historic debt into 10 equal parts, or 'tranches', with staggered dates of commencement and maturity.
- For the current estimate, we will split the current debt into tranches equalling the number of years in the regulatory period. The commencement and maturity dates for each tranche would be staggered so that one tranche would be refinanced the beginning of each year, effectively forming a short-term trailing average.

We will also decide whether the updated cost of debt should feed through to prices on an annual basis (annual update) or in the subsequent regulatory period (true-up). This appendix provides the formulae for calculating the annual update and the true-up.

The notation we use in the formulae below is explained in Box B.1.

Box B.1	Nomenclature for the formulae below
у	A year index where $y=0$ for the beginning of the first regulatory period of the new method.
Т	The tenor of debt.
n	The number of years in the regulatory period.
R(y,T)	The prevailing interest rate in year $y$ for a bond of tenor $T$ , measured over the 40-day observation window.
Debt	The average value of the firm's debt over the regulatory period, estimated by applying the benchmark gearing ratio we decided for the firm.
WACC	The WACC we set at the beginning of the current regulatory period.
F	The time value of money discount factor = 1 + WACC
ΤU	the true-up in dollars on the first day of the next regulatory period

# B.1 Formulae for annual update

Table B.1 provides the formulae for adjusting the cost of debt with an annual update for both the current and historic debt estimates.

At the beginning of the first regulatory period (y=0), the cost of debt is initially set as an average over the past 10 years for the historic estimate and as a 40-day average for the current estimate, ie:

- $\sum_{k=0}^{9} R(-k, 10)/10$  for the historic estimate, and
- R(0,10) for the current estimate.

The subsequent rows in Table B.1 outline how we will change the cost of debt in future years with updated interest rate data.

What	When	Add	Remove
Historic cost of debt	Start of first period (y=0)	Average of annual interest rates (40 working day observation window) $\sum_{k=1}^{9} R(-k, 10)/10$	N/A (No adjustment)
	During first period	R(y,10)/10	R(y-10,10)/10
	Start of subsequent periods	R(y,10)/10	R(y-10,10)/10
	During subsequent periods	R(y,10)/10	R(y-10,10)/10
	Start of first period (y=0)	Prevailing cost of debt (40 day observation window) R(0,10)	N/A (No adjustment)
Current cost of debt	During first period	R(y,10)/n	R(0,10)/n
	Start of subsequent periods	R(y,10)/n	R(y-n,10)/n
	During subsequent periods	R(y,10)/n	R(y-n,10)/n

 Table B.1
 Adjustment formulae for the annual update

# B.2 Formulae for true-up

If we decide to update the cost of debt in the subsequent regulatory period, we would need to account for the time value of money in order to make these changes NPV neutral. In Section 4.7 we outline why we will use the WACC that we set at the beginning of each regulatory period, as the discount factor.

Because there is no transition period for implementing a 10-year trailing average to estimate the historic cost of debt, we will calculate the true-up (TU) using equation 1 at the end of each period:

(11) 
$$TU = \frac{Debt}{20} \sum_{y=1}^{n-1} (n-y) (R(y,10) - R(y-10,10)) F^{\frac{n-y}{2}}$$

Equation 11 takes the change in the interest rate in each year of the regulatory period, for the 2nd year to the final year of an n year regulatory period, and then discounts these differences by the WACC to account for time value of money.

Because we will transition to the short-term trailing average over the first regulatory period, the true-up for the current cost of debt will be different for this period, as shown in equation 12:

(12) 
$$TU = \frac{Debt}{2 \times n} \sum_{y=1}^{n-1} (n-y) (R(y,10) - R(0,10)) F^{\frac{n-y}{2}}$$

The true-up for the current cost of debt in subsequent periods is shown in equation 13:

(13) 
$$TU = \frac{Debt}{2 \times n} \sum_{y=1}^{n-1} (n-y) (R(y,10) - R(y-n,10)) F^{\frac{n-y}{2}}$$

# C Our analysis on the appropriate CAPM model

### C.1 We consider the Black CAPM would produce similar results to SL-CAPM with adjustments for bias in the equity beta estimation

Both the SL-CAPM and Black CAPM predict the expected return of an asset is a function of its covariance with systematic (undiversifiable) risk. The main difference between these models is the interpretation of the intercept term. The SL-CAPM uses the contemporaneous risk-free rate of return, while the Black CAPM adopts the return of the minimum-variance zero-beta portfolio of assets. The return of the zero-beta portfolio is greater than the risk-free rate, but lower than the return of the market portfolio.<sup>182</sup>

In an abridged form, the expected return of an asset under the SL-CAPM (S) and Black CAPM (B) are:

(14) (S) 
$$r_i = r_f + \beta (r_M - r_f)$$

(15) (*B*)  $r_i = r_Z + \beta (r_M - r_Z)$ 

where  $r_i$  is the return on asset *i*,  $r_f$  is the risk-free rate of return,  $r_M$  is the return on the market portfolio, and  $r_Z$  is the return on the zero-beta portfolio. In essence, the SL-CAPM predicts a lower intercept (as  $r_f < r_Z$ ) and a higher slope ( $\beta$ ) than the Black CAPM.

The observed relationship between the equity beta and subsequent return is much 'flatter' under the Black CAPM than predicted by the SL-CAPM.<sup>183</sup> For stocks with estimated equity betas below (above) one, realised returns tend to be higher (lower) than predicted under the Black CAPM. Figure C.1 demonstrates that observed results more closely reflect the estimates of the Black CAPM than the SL CAPM, with a lower slope parameter and a higher intercept.

<sup>&</sup>lt;sup>182</sup> Sharpe, W, Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk, The Journal of Finance, Vol 19, No. 3, September 1964, pp 425-442; Lintner, J, The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets, The Review of Economics and Statistics, Vol. 47, No. 1, February 1965, pp 13-37; Black, F, Capital Market Equilibrium with Restricted Borrowing, The Journal of Business, Vol. 45, No. 3, July 1972, pp 444-455.

<sup>&</sup>lt;sup>183</sup> Fama, E, and K French, The capital asset pricing model: Theory and evidence, Journal of Economic Perspectives, Vol. 18(3), 2004, p 32.

Figure C.1 Average annualised monthly return versus equity beta, 1928 to 2003



**Note:** Data points represent the annualised average value-weighted monthly returns of US equity portfolios decile-sorted on prior-year beta. The furthest left observation therefore represents the average return on the lowest-decile beta stocks, with the furthest right observation representing returns for the highest-decile beta stocks. **Data source:** Fama, E, and K French, *The capital asset pricing model: Theory and evidence, Journal of Economic Perspectives*, Vol 18(3), 2004, p 33.

At face value, the evidence suggests that the Black CAPM addresses the downward bias of the SL-CAPM. This is especially relevant for regulated entities, as they typically exhibit equity betas of less than one.

However, our current approach implements an adjustment to our estimated equity betas to correct this potential bias. Empirical evidence suggests that equity betas obtained from ordinary least squares (OLS) estimation are likely to be subject to a high degree of estimation bias due to sampling error. To correct for this bias, we implement the Vasicek adjustment.<sup>184</sup> This adjusts OLS equity beta estimates towards the best prior equity beta estimate, with the degree of adjustment based on estimated standard errors. In essence, the Vasicek adjustment gives a higher weight to more precisely estimated equity betas, and a lower weight to estimated equity betas with higher standard errors.

Although the Vasicek adjustment is not explicitly designed to address the downward bias of the SL-CAPM, in practice, it can partly compensate for this bias. This is because very low or very high beta estimates are relatively more likely to be to be affected by estimation error.<sup>185</sup> For example, using a recent sample of proxy firms,<sup>186</sup> we compared estimated OLS equity betas to the change in equity beta due to the Vasicek adjustment. As Figure C.2 shows, the Vasicek adjustment increases the estimates of low-beta firms, and decreases the estimates of high-beta firms.

<sup>&</sup>lt;sup>184</sup> Vasicek, O, A Note on Using Cross-Sectional Information in Bayesian Estimation of Security Betas, The Journal of Finance, Vol. 28, No. 5, December 1973, pp 1233-1239.

<sup>&</sup>lt;sup>185</sup> Gray, S and J Hall, SFG Consulting and Diamond, N and R Brooks, Monash University, *The Vasicek adjustment to beta estimates in the Capital Asset Pricing Model*, June 2013, p 4.

<sup>&</sup>lt;sup>186</sup> Airport proxy firms as cited in: IPART, Maximum fees and charges for cruise ships Sydney Harbour – Final Report, November 2016, p 99.

Cost of equity estimates under the Black CAPM may still be higher than under our adjusted SL-CAPM due to the use of  $r_Z$  as the intercept. However, in our view, the adjusted equity beta estimates sufficiently account for the known downward bias of the SL-CAPM.



Figure C.2 OLS versus Vasicek-adjusted equity beta estimates, IPART airport proxy firms

**Note:** Difference is defined as Vasicek beta minus OLS beta. Positive differences indicate the Vasicek adjustment increased the OLS estimate, while negative differences indicate the adjustment lowered the OLS estimate. The adjusted R<sup>2</sup> value is 0.7 **Data source:** Airport proxy firms as cited in: IPART, *Maximum fees and charges for cruise ships Sydney Harbour – Final Report*, November 2016, p 99.

# C.2 We will monitor results produced by the Fama-French Model over the next five years

The Fama-French three-factor model<sup>187</sup> (FFM) follows empirical evidence that factors in addition to systematic and firm risks affect stock returns. In addition to a systematic (market) risk factor, the FFM also calculates a firm's expected return as a function of pricing factors that proxy firm size and book-to-market effects. The expected return of an asset under the FFM is:

(16) 
$$R_i - R_f = \beta_{mkt}(R_M - R_f) + \beta_{size}SMB + \beta_{value}HML$$

<sup>&</sup>lt;sup>187</sup> Fama, E and K French, Common Risk Factors in the Returns on Stocks and Bonds, Journal of Financial Economics, Volume 33, No. 1, February1993, pp 3-56.

where  $r_i$  is the return on asset *i*,  $r_f$  is the risk-free rate of return,  $r_M$  is the return on the market portfolio, *SMB* and *HML* are factors capturing the excess return of small and high book-to-market ratios (B/M-ratio) firms respectively, and  $\beta$  are factor sensitivities.

Both Australian<sup>188</sup> and international<sup>189</sup> evidence suggests that small firms earn higher excess returns on average than their larger counterparts, while high B/M-ratio firms earn higher excess returns on average than low B/M-ratio firms. This is why the FFM results in greater explanatory power in the cross-section of equity returns when compared to other versions of the CAPM.

A potential shortcoming of the FFM is that the model relies on ex-post statistical power that does not necessarily relate to ex-ante rational risk.<sup>190</sup> That said, the additional pricing factors in the FFM may not be an undiversifiable risk, but rather, factors which contribute to an underlying multidimensional risk framework.<sup>191</sup>

Some regulated firms contend that the FFM should be included in cost of equity estimations, stating that the increased explanatory power sufficiently outweighs any theoretical concerns or costs of implementation.<sup>192</sup>

In our view, this argument is sufficient to warrant estimation and comparison of FFM estimates, but is not sufficient reason to replace the SL-CAPM as our model at this stage. The FFM may provide a better statistical fit to historic returns data, but this statistical power varies significantly over time. In particular, there is empirical evidence that the impact of firm size on equity returns is not stable over time in Australia.<sup>193</sup>

In addition, the FFM would require estimates of size and B/M ratios for regulated entities. A government-owned regulated firm would have an undefined market value, since its equity is not traded. This would leave the B/M ratio undefined for such a firm. Potentially, we could estimate the FFM using the B/M ratio for a proxy firm, but doing so would introduce a greater subjectivity.

We intend to monitor the FFM over the next five years to examine how it would perform if we adopted it instead of the SL CAPM in our WACC method.

<sup>&</sup>lt;sup>188</sup> Tim Brailsford, Clive Gaunt and Michael O'Brien, *Size and book-to-market factors in Australia* Australian Journal of Management, Volume 37, issue 2, April 2012, pp 261-281.

<sup>&</sup>lt;sup>189</sup> Eugene F. Fama and Kenneth R. French, *Size, value, and momentum in international stock returns*, Journal of Financial Economics, Volume105, May 2012, pp 457-472.

<sup>&</sup>lt;sup>190</sup> Josef Lakonishok, Andrei Shleifer and Robert Vishny, Contrarian Investment, Extrapolation, and Risk, The Journal of Finance, Volume 49, Issues 5, December 1994, pp 1541-1578.

<sup>&</sup>lt;sup>191</sup> Eugene F. Fama and Kenneth R. French, *Multifactor Explanations of Asset Pricing Anomalies*, Journal of Finance, Volume 51, Issue 1, March 1996, pp 55-84.

<sup>&</sup>lt;sup>192</sup> See SFG Consulting, *The Fama-French model*: Report for Jemena Gas Networks, ActewAGL, Ergon, Transend, TransGrid, and SA PowerNetworks, May 2014.

<sup>&</sup>lt;sup>193</sup> Tim Brailsford, Clive Gaunt and Michael O'Brien, op cit.

# D IPART's uncertainty index model

We publish our uncertainty index model and a guide to using the model on our website.<sup>194</sup> Stakeholders can use this to replicate our uncertainty index, which is used as a basis for determining an appropriate WACC in our various price reviews.

The rest of this appendix is structured as follows:

- Section D.1 explains IPART's uncertainty index
- Section D.2 provides a list of input data and data sources, and explains how we manipulate the input data in Excel to create necessary variables for the uncertainty index, and
- Section D.3 describes steps we use to run a principal component analysis (PCA) in SPSS to obtain the uncertainty index.

## D.1 What is IPART's uncertainty index?

As part of our 2013 review, we developed a WACC decision-making framework to improve the transparency and predictability of our WACC decisions.<sup>195</sup> As part of this framework, we construct a monthly uncertainty index, which measures the level of economic uncertainty, and use it as a basis for determining an appropriate WACC in our price reviews. Our WACC decision making rule is that:

- ▼ If the uncertainty index is at, or within one standard deviation of, the long- term average of 0, we would select the midpoint WACC.
- If the uncertainty index is more than one standard deviation from the long- term average of 0, we would consider moving away from the midpoint WACC.

Our method for constructing the uncertainty index closely follows the approach taken by the Bank of England in its study of macroeconomic uncertainty.<sup>196</sup>

### D.2 Creating proxy variables for economic uncertainty

Constructing the uncertainty index is a two-stage process. In the first stage, we download data and create variables in Excel. We then export these variables to SPSS, a software package used for statistical analysis, to run a PCA.

We use the following four variables, which are a proxy for economic uncertainty in Australia:

implied volatility

<sup>&</sup>lt;sup>194</sup> IPART, *Fact Sheet: Guide to IPART's Uncertainty Index Model*, February 2016.

<sup>&</sup>lt;sup>195</sup> IPART, *Review of WACC Methodology - Final Report*, December 2013, pp 23-24.

<sup>&</sup>lt;sup>196</sup> Bank of England, 2013, pp 100-109

- dispersion in analysts' forecast
- credit spreads, and
- bills-overnight index swap (OIS) spread.

Table D.1 provides a full list of raw data and data sources.<sup>197</sup>

Proxy variable	Raw data	Data source	Series/Datatype
Implied volatility	S&P/ASX200 Volatility Index (post January 2008	Datastream	AXVIVOL/PI
	S&P/ASX 200 Index Total Return (prior to January 2008)	Datastream	ASX2001/RI
Dispersion in Analysts' forecast	Weighted average standard deviation of EPS forecasts for calendarised FY1 fiscal period	Datastream	@:AUSP200/ AF1SDC
Credit spread	UBS Credit Yield	Datastream (prior to September 2015)	ACBALLM/RY
	AusBond Credit Index Yield	Bloomberg (post September 2015	BACR0 Index/ YLD_YTM_MID
	UBS Treasury Yield	Datastream (prior to September 2015)*	AGBALLM/RY
	AusBond Treasury Index Yield	Bloomberg (post September 2015)	BATY0 Index/ YLD_YTM_MID
Bills-OIS spread	90-day Bank Accepted Bills	Datastream	AUBAB90D
	Australian 3-month Overnight Indexed Swaps	Datastream	AUGBILL3

Table D.1 List of raw data and data sources

### D.2.1 Volatility Index

The S&P/ASX 200 VIX is a volatility index that reflects the market's expected volatility in the S&P/ASX 200. The level of the volatility index implies the market's expectations of volatility in the S&P/ASX 200 over the next 30 days. The index value is similar to rate of return volatility with the volatility index reported as an annualised standard deviation percentage.<sup>198</sup>

The variable, *Volatility Index*, is created in the '*IVOL*' tab in the Excel spreadsheet on a monthly basis. We download daily S&P/ASX 200 VIX from Datastream. The S&P/ASX 200 VIX is available only from January 2008. Prior to this period, we use the Total Return

 <sup>&</sup>lt;sup>197</sup> Proprietary data from Thomson Reuters Datastream (Datastream) and Bloomberg has been removed and replaced with dummy data. Users need to source the data independently.
 <sup>198</sup> Proprietary data independently.

<sup>&</sup>lt;sup>198</sup> http://www.asx.com.au/products/sp-asx200-vix-index.htm accessed 23 June 2017.

Index (*TRI*) of the S&P/ASX 200 Index from Datastream and calculate the annualised standard deviation of daily returns over 90 days, where a daily return on day t, r, is calculated as:

(17) 
$$r_t = \ln(\frac{TRI_t}{TRI_{t-1}})$$

We then calculate the standard deviation of the returns over the last 90 days and annualise it by multiplying it by the square root of 252.199

To obtain a monthly implied volatility value, we average daily volatility index values in each month.

## D.2.2 Dispersion in Analysts' Forecast

The variable, *Dispersion in Analysts' Forecast*, is created in the '*DISP*' tab in the Excel spreadsheet. We download monthly dispersion in analysts' earnings forecasts for the companies in the S&P/ASX Index from Datastream. The dispersion in analysts' forecast is used as a proxy for the uncertainty about future earnings or the degree of consensus among analysts or market participants.

## D.2.3 Credit Spread

The variable, *Credit Spread*, is created in the '*CS*' tab in the Excel spreadsheet on a monthly basis. Credit spreads refer to a difference in yields between different securities due to different credit quality. We calculate daily credit spreads as the difference between daily *Credit yield* and daily *Treasury yield*.

Previously, we used the daily UBS Australian all maturities credit yields and UBS Australian Treasury all maturities yield as *Credit yield* and *Treasury yield*, respectively, sourced from Datastream. However, since Thomson Reuters has ceased publishing these data series in September 2015, we have been using the AusBond Credit Index Yield and AusBond Treasury Index Yield. We note that data values from Datastream and Bloomberg are identical except that Bloomberg publishes weekend values.

To obtain a monthly credit spread, we average daily credit spreads in each month.

# D.2.4 Bills-OIS Spread

The variable, *Bills-OIS Spread*, is created in '*BOS*' in the Excel spreadsheet. We download monthly 90-day bank bill swap rates and 3-month overnight indexed swaps (OIS) from Datastream, and calculate the Bills-OIS spread as the difference between these two data series.

<sup>&</sup>lt;sup>199</sup> The annualisation assumes 252 trading days.

# D.3 Running a Principal Component Analysis

A PCA is a way of identifying patterns in data and expressing the data in a way which highlights their similarities and differences.<sup>200</sup> Using this method, we can combine the four variables, which we identified as proxies for economic uncertainty, and extract a single variable, called a principal component, which explains most of the variation in the original set of the four proxy variables.

To replicate our PCA for the uncertainty index, users should download the MS Excel spreadsheet *IPART uncertainty index - Creating proxy variables - Public.xls* and accompanying Fact Sheet from our website.

<sup>&</sup>lt;sup>200</sup> For more information on principal component analysis including derivation of principal components, see Jolliffe, I.T., *Principal Component Analysis Second Edition*, 2002.

# E Our analysis on using breakeven inflation (BEI)

# E.1 Economic theory would suggest the BEI method is superior

In theory, the BEI method is superior to a geometric average approach, because it is the expected inflation rate that would make an investor indifferent between an inflation-linked bond and a nominal bond of the same maturity.

There is less reason to expect that the geometric average of RBA's 1-year ahead inflation forecast, and the midpoint of its inflation target, would be the best inflation forecast. The RBA's stated inflation target:

...seeks to keep consumer price inflation in the economy to 2–3 per cent, on average, over the medium term.

While the RBA has found that its short-term forecasts of inflation have "substantial explanatory power", the RBA's inflation target is a range over the medium term.<sup>201</sup> It does not imply that an inflation forecast should be 2.5% after the first year of a specific regulatory period.

The BEI method may be affected by risk premia. Two potential risk premia are liquidity risk and inflation risk.

**Liquidity risk** reflects any additional yield investors require to hold an illiquid investment, over a more liquid investment. The size and depth of the nominal bond market is many times larger than the inflation-linked bond market in Australia. The yield on inflation-linked bonds may be upwardly biased relative to the yield on a nominal bond of the same maturity, reflecting the additional compensation investors require to hold inflation-linked bonds. Therefore, liquidity risk would tend to result in a downwards bias to the estimate of inflation under the BEI method.

**Inflation risk** is the compensation that investors require for bearing the risk of lower- or higher-than-expected inflation. This affects the yield of a nominal bond, as its real return is affected by inflation. In general, inflation risk would increase as uncertainty about future inflation increases, although recent evidence also suggests that the risk of deflation can result in a negative inflation risk premium (as nominal bonds perform relatively well in a deflationary environment).<sup>202</sup>

A number of studies have found that inflation risk can vary over time, including research by the RBA,<sup>203</sup> updated in 2016,<sup>204</sup> which suggests inflation estimates using the BEI method

<sup>&</sup>lt;sup>201</sup> Peter Tulip and Stephanie Wallace, *Estimates of Uncertainty around the RBA's Forecasts*, RBA Research Discussion Paper, November 2012, p 2.

<sup>&</sup>lt;sup>202</sup> See, for example, Gonzalo Camba-Mendez and Thomas Werner, *The inflation risk premium in the post-Lehman period*, ECB Working Paper Series no. 2033, March 2017.

<sup>&</sup>lt;sup>203</sup> Richard Finlay and Sebastian Wende, Estimating Inflation Expectations with a Limited Number of Inflationindexed Bonds, RBA Research Discussion Paper, March 2011.

Angus Moore, *Measures of Inflation Expectations in Australia*, RBA Bulletin, December Quarter 2016, pp 23-32.

may be affected by inflation risk. That said, the authors of the RBA research also emphasised caution over the results due to data limitations and model complexity.

The accuracy of the BEI method would be negatively affected to the extent that the risk premium embedded in the BEI method varies at different points in the economic cycle. In its ongoing review of inflation, the AER provided a full list of the risk premia that the BEI method may potentially be affected by.<sup>205</sup>

# E.2 Current concerns about reliability of market data due to bond liquidity do not appear to be acute

Illiquidity in the inflation-linked bond market was a factor in our 2009 decision to move away from the BEI method. Illiquidity implies that market prices are not reliable. Our analysis for this review suggests that inflation-linked bond liquidity is currently lower than liquidity in the nominal bond market. However, we consider that bond market liquidity is currently:

- sufficient, if judgement is applied, to produce an estimate of inflation using the BEI method for 3-5 year regulatory period, and
- not appropriate for shorter regulatory windows.

Figure E.1 suggests that although inflation-linked bond turnover has increased, it is around 5% of nominal bond turnover. This suggests that the BEI method may still be affected by liquidity premium, which all else equal, would mean the BEI method underestimates expected inflation.



Figure E.1 Annual turnover in Australian Government Bonds (\$b)

While inflation-linked bond issuance has increased significantly, from around \$6 billion in June 2009 to \$30 billion as at June 2016, Figure E.2 shows that the maturity dates of inflation-linked bonds are more sporadic than for nominal bonds. The AOFM has issued bonds so that a nominal bond matures in each year to 2029, and an inflation linked bond matures every 2-3 years.

Data source: Austraclear

<sup>&</sup>lt;sup>205</sup> AER, *Regulatory treatment of inflation, Preliminary position*, October 2017, Table 6, pp 59-60.
Figure E.2 Australian government bond maturities (A\$b)



Data source: Australian Office of Financial Management, data as at 25 August 2017

Because inflation-linked bond issuance is more sporadic, the maturity date of an inflationlinked bond maturity will not always align with the end of the regulatory period. When these dates do not align, we would need to interpolate an expected inflation rate consistent with the regulatory period. This increases the complexity of our approach.

Figure E.3 plots the real interest rates for the various inflation linked bond securities, which we would be used to estimate inflation using the BEI method. It shows:

- The real interest rates for the inflation-linked bonds maturing in 2020 and 2022 indicate a reasonably liquid market (the right-hand panel of the figure). This suggests we could use these bonds to estimate inflation rates for 3- to 5-year periods.
- Real interest rates for the 2010 and 2015 bonds increased substantially in the 6 to 12 months before they matured (left-hand panel), likely reflecting bond illiquidity. For short regulatory periods, if we converted the real interest rate into an expected inflation rate using the Fisher equation, we could get an artificially low expected inflation rate using the BEI method.
- During periods in 2015 and 2017, real interest rates were occasionally negative. That is, investors were willing to buy and sell bonds with a negative real interest rate.

Figure E.3 Real interest rates for inflation-linked bond securities (%)



Data source: Bloomberg

## E.3 Historic forecasts suggest the BEI method may be affected by changes in risk premia over time

We compared what our inflation estimates would have been over 2010-2017 using the BEI method, and the geometric average method, for 3- and 5-year regulatory periods (Figure E.4):

- For the BEI method, where the maturity date of inflation-linked bonds did not align with the regulatory period, we used linear interpolation to estimate expected inflation.
- For the geometric average method, we calculated the geometric average according to the length of the regulatory period, as opposed to a 10-year average, in line with our draft decision.



Figure E.4 Estimated annual inflation using the two methods (%)

**Note:** A positive number on the right-hand panel indicates that the model over-estimated inflation. **Data source:** Bloomberg; IPART analysis

The comparison suggests that:

- The forecasts using the geometric average would have only fallen slightly over the 2010-2017 period (the grey lines). Inflation rates using this approach would have been between 2.3-2.4% in recent years.
- Expected inflation using the BEI method is currently around 1.7-1.8% for this period (the blue lines).
- The BEI method produced expected inflation rates in the middle of 2016 of around 1.0%. This reflects that real interest rates were around 0.4% in this period, and nominal interest rates were about 1.4%.

Figure E.5 charts the difference between actual CPI inflation and the inflation estimates produce by each method over the period 2010 to 2017. A positive number indicates that the method would have over-estimated inflation:

- The data for 2010-2012 suggests neither the geometric average and the BEI method initially predicted the low inflation environment that we subsequently entered into, and therefore over-estimated inflation.
- Over a 3-year period (left-hand panel), the BEI method would have produced slightly smaller forecast errors than a geometric average method.
- Over a 5-year period (right-hand panel), there is less evidence the BEI method is more accurate than a geometric average method.



Figure E.5 Realised forecast errors using the two methods (%)

**Note:** A positive number on the right-hand panel indicates that the model over-estimated inflation. **Data source:** Bloomberg; IPART analysis

Based on the analysis summarised in Figure E.1 to Figure E.5, our overall conclusion is that:

The geometric average approach would over-estimate inflation in the current low inflation environment. However, to the extent that future inflation is uncertain, our method should gravitate towards an average expected inflation rate over the longer term. As outlined in our Issues Paper, our view is that long-term inflation expectations are anchored around the midpoint of the RBA's inflation target band (2.5%).<sup>206</sup> Therefore, we consider a geometric average method approximates the average inflation rate over time.

<sup>&</sup>lt;sup>206</sup> IPART, *Review of WACC methodology*, Issues Paper, July 2017, p 44.

 The accuracy of the BEI method may be impacted over time to the extent that the risk premia affecting the yield on inflation-linked bonds, such as liquidity risk, vary at different points in the economic cycle.

## E.4 The geometric average method is simpler, more transparent and replicable

The geometric average approach uses data that is publicly available and directly observable. The RBA currently produces semi-annual inflation forecasts in its quarterly SMP. The only drawback with this approach is that there is not an inflation forecast that is exactly 1-year ahead at all points in time. For example, stakeholders may be unclear whether we used a 9-month ahead, or 15-month ahead inflation forecast. Our final decision would define our 1-year ahead inflation forecast more precisely.

The smaller amount of inflation-linked bond issuance results in data limitations. As a consequence, more judgement would be required to estimate inflation using the BEI method. To estimate inflation with the BEI method, we would need to:

- 1. Determine what time period we collect bond market data to estimate inflation.
- 2. Ascertain whether there is an inflation-linked bond with a maturity equal to the regulatory period.
- 3. If there is, calculate expected inflation directly using the fisher equation.
- 4. If not, interpolate an expected inflation rate consistent with the regulatory period, using inflation linked bonds of similar maturity. This would involve:
  - deciding a method we would use to interpolate an expected inflation rate, and
  - potentially ignoring data from inflation linked bonds with a short maturity, which may be affected by illiquidity.

The bond yield data used to calculate inflation using the BEI method is publicly available through the RBA website. However, as judgement is required to estimate inflation using this method, we consider that the BEI method would be more difficult for stakeholders to replicate.