IPART

Independent Pricing and Regulatory Tribunal
New South Wales

Review of our WACC method

Issues Paper
Research

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Invitation for submissions

IPART invites written comment on this document and encourages all interested parties to provide submissions addressing the matters discussed.

Submissions are due by 5pm on 18 August 2017

We would prefer to receive them electronically via our online submission form <www.ipart.nsw.gov.au/Home/Consumer_Information/Lodge_a_submission>.

You can also send comments by mail to:

Review of our WACC method
Independent Pricing and Regulatory Tribunal
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Late submissions may not be accepted at the discretion of the Tribunal. Our normal practice is to make submissions publicly available on our website <www.ipart.nsw.gov.au> as soon as possible after the closing date for submissions. If you wish to view copies of submissions but do not have access to the website, you can make alternative arrangements by telephoning one of the staff members listed on the previous page.

We may choose not to publish a submission—for example, if it contains confidential or commercially sensitive information. If your submission contains information that you do not wish to be publicly disclosed, please indicate this clearly at the time of making the submission. IPART will then make every effort to protect that information, but it could be disclosed under the *Government Information (Public Access) Act 2009* (NSW) or the *Independent Pricing and Regulatory Tribunal Act 1992* (NSW), or where otherwise required by law.

If you would like further information on making a submission, IPART's submission policy is available on our website.

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1 Introduction

The Independent Pricing and Regulatory Tribunal of NSW (IPART) is reviewing the standard method we use to decide on the weighted average cost of capital (WACC) as part of our price regulation process. The WACC is the efficient cost of a hypothetical benchmark business's debt and equity, weighted to take account of the relative share of debt and equity in its capital structure. Our WACC decision is a key input for calculating the allowance for a return on assets, as part of the building block approach we use to determine the revenue requirement of the businesses we regulate.

This paper explains the context and purpose of the review, outlines our proposed approach, and discusses key issues on which we seek stakeholder comment.

1.1 Why are we conducting this review?

We last reviewed and updated our WACC method in December 2013.[1] Since then we have published further refinements to some elements of this method – including our approaches for estimating the debt margin, adjusting for inflation, and implementing the WACC decision rule.[2]

In our view, the current WACC method is working well. Stakeholders can replicate our calculations and the method has increased the stability of the regulatory regime for our regulated businesses.

Nevertheless, it is good practice to review the method periodically to make sure it is functioning as intended. We will consider whether there are opportunities to make incremental improvements to the method to better reflect the efficient financing costs of the benchmark firm. We will make improvements where we consider it feasible and there are material benefits from doing so.

1.2 Who does this review 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:

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

1 IPART, *Review of WACC Methodology – Final Report*, December 2013.

2 IPART, *Fact Sheet - IPART's New Approach to Estimating the Cost of Debt*; April 2014; IPART, *Fact Sheet - New approach to forecasting the WACC inflation adjustment*, March 2015; IPART, *Fact Sheet - Guide to IPART's Uncertainty Index Model*, February 2016.

Other affected businesses include those we review under section 9 of the IPART Act, such as the Port Authority of NSW, for which we recently recommended port site occupation charges.

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 strongly affects the prices these businesses can charge.

1.3 What is the scope of the review?

This review will focus on how we measure and estimate the parameters we use to calculate the WACC. We propose to consider:

- 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 do not propose to consider broader policy issues related to how we apply the WACC in this review. 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) are outside the scope of the review.

We are satisfied that our current approach of applying a post-tax WACC more closely estimates tax 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. Moving away from a real post-tax WACC would add considerably to uncertainty and the potential for large price changes.

1.4 How will we conduct the review?

Like our price reviews, we propose to conduct public consultation as well as research and analysis. This Issues Paper is the first step in our review process. It sets out the key issues for the review and our preliminary views, and seeks comments from stakeholders.

We will hold a public hearing to discuss this Issues Paper on **Tuesday, 15 August 2017**. Further information about the public hearing will be published on our website in due course. We also invite interested parties to make written submissions in response to this paper by **18 August 2017**. Information on how to make a submission can be found on page iii at the front of this paper.

We will continue to consult with stakeholders throughout the review and propose to:

- release a Draft Report that explains our draft decisions and invites stakeholder submissions

- hold a public hearing where stakeholders can provide further evidence and feedback on our draft decisions, and
- consider all stakeholder feedback and undertake further analysis before making our final decisions.

Table 1.1 provides an indicative timetable for our review.

Table 1.1 Indicative review timetable

Date	Actions proposed
4 July 2017	Issues Paper released and review formally started
15 August 2017	Hold Public hearing
18 August 2017	Submissions due to Issues Paper
October 2017	Release Draft Report
December 2017	Submissions due to Draft Report
February 2018	Release Final Report

1.5 When will our new WACC method take effect?

Our new WACC method will apply to pricing decisions that take effect **on or after 1 July 2018**.

The new WACC method **will not apply** to any of the following decisions:

- the 2017 determinations of prices for the Sydney Desalination Plant and WaterNSW rural bulk water services, which apply from 1 July 2017
- the 2017 determinations of Sydney Water and Hunter Water's system-wide wholesale prices, which apply from 1 January 2018
- fares for private ferries, which apply from 1 January 2018, and
- rural and regional bus fares, which apply from 1 January 2018.

1.6 How is this paper structured?

The rest of this paper discusses the review in more detail:

- Chapter 2 outlines our proposed approach to this review
- Chapters 3 focuses on how we measure WACC inputs, including the definition of the benchmark firm and the timing of market observations
- Chapters 4 and 5 discuss how we calculate the cost of debt and the cost of equity
- Chapter 6 discusses how we combine debt and equity measurements to derive a point estimate of the WACC, including how we implement our WACC decision rule, and
- Chapter 7 focuses on how we estimate inflation and gamma.

Each chapter outlines our current approach, the changes we propose to consider, our preliminary views (where we have them), and the questions we particularly seek stakeholder comments on. Where we have a preliminary view, the chapter also sets out why

we have formed that view. This will allow stakeholders to engage with us on our reasoning and facilitate more detailed engagement where stakeholders have an alternative view. Whether or not we have a preliminary view, we will consider the merits of the arguments put to us in forming a decision.

1.7 List of preliminary views and questions in this paper

For convenience, a complete list of our preliminary views and questions for stakeholders is provided below.

1.7.1 Preliminary views

1.7.2 Questions on which we seek comment

Our proposed approach

How we measure WACC inputs

Cost of debt

Cost of equity

2 Our proposed approach

As Chapter 1 discussed, we consider our current WACC method is working well. We are generally satisfied that it 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.

Therefore, our objective for this review is to identify whether there are opportunities to make incremental improvements to the method to reflect the efficient financing costs. We propose to make such improvements where we find this to be feasible and there are likely to be substantial benefits from doing so.

We have developed a proposed approach for meeting this objective, including a set of principles to guide our decision making.

2.1 Proposed principles for this review

We consider that in making our decisions for this review, we should aim to balance the following three principles:

1. The WACC method should be relatively stable over time to give stakeholders certainty.
2. The WACC method should be predictable and able to be replicated by stakeholders to provide transparency and reduce resources required in each review.
3. We should make incremental improvements where there is compelling 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 Independent Pricing and Regulatory Tribunal Act 1992 (IPART Act) (see Box 2.1).

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

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.

2.1.1 The WACC method should be stable over time to provide stakeholder certainty

Having a stable WACC method within and between regulatory periods provides certainty to our 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'.[3]

Following the implementation of our current 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 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.[4]

Similarly, Moody's March 2015 rating report for Hunter Water stated that IPART has "a stable and mature regulatory framework…"[5] and "we believe that IPART will continue to

3 Moody's Investor Service, *Rating Methodology – Regulated Water Utilities*, December 2015, p 6.
4 Moody's Investor Service, *Rating Action: Moody's upgrades Sydney Water's rating to Aa3; outlook stable*, March 2015, p 1.
5 Moody's Investor Service, *Rating Action: Moody's assigns first-time A1 issuer rating to Hunter Water Corporation; Outlook Stable,* March 2015, p 1.

exhibit consistency in its decision translating into increased stability in revenue outcomes for Hunter Water."[6]

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.[7]

We do not propose to make major changes to our WACC method in this review. Our default position will be to maintain our current approach, unless there are compelling reasons for change to increase accuracy, or enhance stability and certainty.

2.1.2 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.[8] 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 in section 2.1.1 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.[9] It stated that:

> 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.[10]

We propose to ensure that any changes to our method maintain or improve our current transparency, predictability and replicability.

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6 Ibid.

7 Moody's Investor Service, *Rating Action: Moody's changes outlook for Sydney Water Corp's Aa3 rating to Stable*, October 2016, p 1.

8 IPART, *Review of WACC Methodology – Final Report*, December 2013, p 29.

9 Moody's Investor Service, *Moody's revises Sydney Water's rating outlook to positive from stable*, December 2014, p 1

10 Ibid.

2.1.3 We will make incremental improvements where there are compelling reasons

While our WACC method has generally performed well over time, we consider that there are some areas where we can improve it incrementally. The benefits of these improvements will be considered against the first two principles of providing stability and predictability over time.

There are many differences between the approaches individual Australian and New Zealand 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 will consider recent changes that other regulators have made to their WACC approach, and the evidence and reasons for these changes.

Appendix A compares selected Australian and New Zealand regulators' approaches to WACC in their recent decisions or standard method.

IPART seeks comments on the following

1 Do you agree with our guiding principles? Are there any other principles we should consider?

2 What are the benefits of having a common position across regulators? For which parameters is this consistency most important and why?

2.2 Proposed approach for this review

In line with the scope of this review (see section 1.3), we propose to consider four broad elements of our current WACC method:

- 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 have conducted a preliminary review of our WACC measurement process and identified some potential changes to our current approach within each of the above elements.

We propose to examine the pros and cons of each of these changes versus our current approach, taking account of other regulators' current practice, stakeholders' comments, and each of the principles for the review. We will also examine other potential changes stakeholders propose and make them where they make a convincing case that these changes best meet our guiding principles for the review. As noted above, in making our decisions, we will aim to achieve a balance between the three principles.

2.2.1 Our basis for measurement

This includes our definition of the benchmark firm, and our approach to sampling dates for market observations.

Definition of benchmark firm

In setting prices for a regulated utility, we consider how much revenue would be required by an efficient 'benchmark' firm, rather than the actual firm. Our definition of the benchmark firm is important in determining the appropriate gearing and equity beta. We will consider whether our current definition of the benchmark firm – 'a firm operating in a competitive market and facing similar risks to the regulated business' – remains appropriate or can be improved.

Sampling and measurement

We use both current market data and historic averages to estimate the costs of debt and equity. We generally estimate current market parameters over an average of 40 days and historic parameters over 10 years.[11] We will consider whether we should change how we sample parameters to improve our WACC method's alignment with financial markets.

2.2.2 How we calculate the cost of debt and the cost of equity

Based on our benchmark firm and approach to sampling and measurement, we will consider how we measure each of the parameters that we use to calculate the costs of debt and equity, and decide whether any adjustments should be made to increase the accuracy of our estimates. The potential changes we will consider include:

- updating our decision on the cost of debt during the regulatory period
- using a different mix of current market data and historic averages
- making adjustments to account for how the bond yield data underlying our estimates is calculated
- adjusting our approach for estimating the current MRP, including the mix of measures we use and how we select a single value, and
- adjusting our approach for estimating the equity beta, including whether we should re-estimate this value at each price review, and whether we should adjust our beta estimate to account for estimation bias.

2.2.3 How we combine these measurements to derive the WACC

We currently bring together our estimated debt and equity parameters to derive a single point estimate of the WACC using our 'WACC decision rule'.[12] This rule selects the midpoint of the current and historic estimates, as long as the uncertainty index is at or within one standard deviation of its historical (2001 to 2017) average of zero. We will consider how our decision rule has performed since implementation and whether it remains appropriate in its current form. We will consider whether we require a more structured approach to guide our decisions when the uncertainty index is outside its range of one standard deviation from zero.

11 With the exception of the historic MRP, which is measured over a much longer period of 100+ years, and CPI, which is measured over 10 years in the short and long-term.

12 IPART, *Review of WACC Methodology – Final Report*, December 2013, p 4.

2.2.4 How we measure and index for inflation

We will consider how we measure inflation and apply it in our real post-tax WACC framework.

3 How we measure 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.

In this review, we propose to consider:

1. our definition of the benchmark entity, particularly whether it operates in a competitive or regulated market, and
2. our approach for 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.

3.1 Definition of the benchmark entity

Our current approach is to determine the WACC for a benchmark entity, which may differ from the cost of capital for the actual regulated business. This is consistent with our price setting objective, which is to attempt to replicate the disciplines of a competitive market. The 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 to be consistent with our general price setting objective.

Our current definition of the benchmark efficient entity is **"a benchmark firm operating in a competitive market and facing similar risks to the regulated business"**.[13] 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.

In some other Australian jurisdictions, regulators adopt a different benchmark entity. 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".**[14]

The AER's reasoning for defining the benchmark entity as a regulated business is that:

13 IPART, *Review of WACC Methodology – Final Report*, December 2013, p 1.
14 AER, *Better Regulation, Explanatory Statement - Rate of Return Guideline*, December 2013, p 32.

- demand risk is mitigated by the regulatory regime through revenue or price setting mechanisms under a revenue cap
- energy network businesses can used fixed charges to offset demand volatility under a price cap
- energy network businesses have the ability to propose the form of control they employ (eg, revenue cap, price cap, etc), and
- by virtue of being regulated, these businesses effectively face a very limited increase in risk due to competition.[15]

Our preliminary view is that our current approach of defining the benchmark entity as a firm operating in a competitive market is appropriate for our regulated businesses for three 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. A regulated firm has the option to change its financing strategy in response to how the regulator sets the WACC. Therefore, it may not be possible to directly observe the efficient financing strategy for a regulated business.
3. 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 comparator firms. This is because:

- our price setting objective aims to replicate the outcomes of a competitive market and therefore firms should be compensated for that level of risk
- other regulators also aim to replicate the outcomes of a competitive market, potentially making those regulated firms appropriate comparators. For businesses that are not regulated under this objective, they would be less suitable comparators, and
- for some industries, there are few comparator firms. Therefore some regulated firms must be considered as a practical necessity.

IPART preliminary view

1 That we should maintain our current definition of the benchmark entity.

IPART seeks comments on the following

3 Do you agree with our preliminary view that we should continue to define our benchmark entity as a firm operating in a competitive market facing similar risks to the regulated business?

15 Ibid, p 33.

3.2 Should the sampling dates for the market-based parameters be synchronised?

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. Because of volatility, sampling at different times will 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).

We currently use the latest available method.[16] 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). This method ensures we use the most recent information available for all parameters. But 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.

If we used the synchronised method, we would use the latest month's data for most parameters 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 at different dates. However, it would also mean that the risk-free rate sample would normally not be the most recent available, unless the WACC calculation is done very close to the beginning of a month.

Our preliminary view is that moving to the synchronised method would improve 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 below.

First, there is a negative correlation between the risk-free rate and the MRP - when one of these parameters changes, the other changes in the opposite direction. This is because in times of economic uncertainty, investors would move away from riskier assets in preference for safer assets like government bonds. This would push up the price of these bonds and decrease the yield – a phenomenon known as a 'flight to quality'[17].

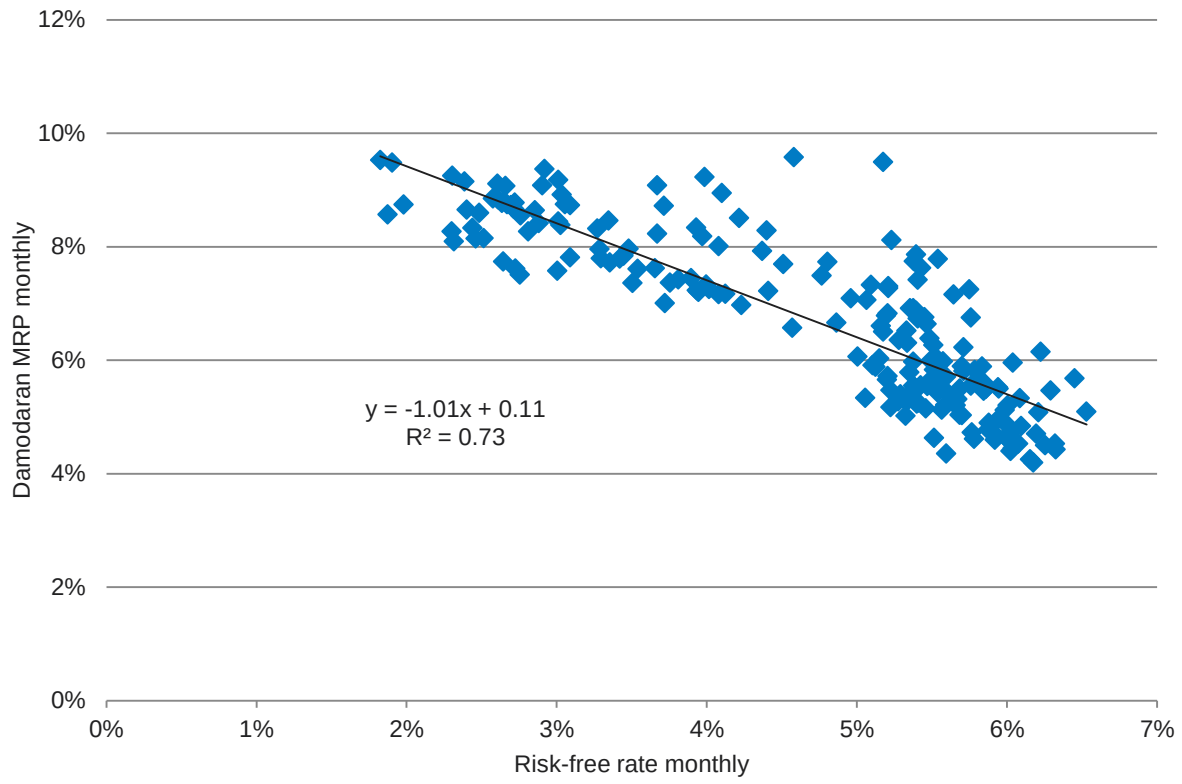
Figure 3.1 shows this inverse relationship between the risk-free rate and the MRP estimated using the Damodaran model. Very similar correlations are also found for the other MRP methods, including the two Bank of England models and the SFG analyst implied method. In particular, the figure shows if the risk-free rate increases by 1%, the MRP decreases by approximately 1% - substantially offsetting the effect on the WACC of the increase in the

16 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.

17 SFG, *Testing the reasonableness of the regulatory allowance for the return on equity*, *Report for Aurizon Network*, March 2013, p 33.

risk-free rate. If we don't sample the data on the same day, we may not capture this offsetting effect, making the overall WACC result less accurate than if we did.

Figure 3.1 Correlation between short-term MRP and short-term risk-free rate



Data source: IPART analysis of monthly market data from Nov 2000 to May 2017 using Damodaran MRP.

Second, we estimate the MRP by subtracting the risk-free rate from an estimate of the market returns to equity. If the risk-free rate used for this subtraction is sampled on a different date from the risk-free rate used for the cost of debt, then it could introduce a systematic bias.

Third, the debt margin is also volatile. Over the period August 2008 to May 2017, the mean absolute monthly deviation for the debt margin is 0.27%, compared with 0.20% for the risk-free rate and 0.40% for the MRP. Unlike the MRP, movements in the debt margin are not well correlated with the risk-free rate. Nevertheless, this volatility implies that the cost of debt estimated using risk-free rate and debt margin observations from different dates could miss some correlation. A synchronised estimate of the cost of debt would reflect the true cost of debt at the end of the previous month. In contrast, the latest available data method estimate would less accurately reflect the cost of debt at any date.

However, moving to a synchronised approach may not entirely eliminate any potential bias in the estimates that may result from a mismatch in our sampling periods. We currently use end-of-month values for the MRP and debt margin calculations, but use a 40-day average of daily values to calculate the risk-free rate estimate. To improve accuracy, we may wish to consider adopting a similar sampling period across all market parameters.

IPART preliminary view

2 That we should synchronise the dates that we sample parameters.

IPART seeks comments on the following

4 Do you agree with our preliminary view that we should synchronise sampling across all current parameters to take account of relationships between parameters and minimise systematic bias?

3.3 Should we give businesses advanced notice of sampling dates?

In recent years, we have provided regulated businesses with advanced notice of the sampling period we will use to measure the current market-based parameters. However, we do not publish this information until our price determination has been finalised.

Our preliminary view is that we should continue our current practice. Providing businesses with advanced notice of the sampling dates allows them 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 them to hedge their debt portfolios in line with our decision on the cost of debt.

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

Another option would be to allow businesses to propose their own dates, to further minimise their hedging and financing risk. However, this would reduce our scope to synchronise sampling dates for different parameters. It also conflicts with our internal policy of using the same sampling dates for all determinations starting on the same date, while using the latest available data that achieves synchronisation. Further, there is little scope for businesses to influence dates, because some parameters rely on data produced on a monthly frequency.

IPART preliminary view

3 That we will continue to choose and advise regulated businesses of our sampling dates in advance and on a confidential basis.

IPART seeks comments on the following

5 Do you agree with our preliminary view that we will choose and advise businesses of our sampling dates in advance? Should we disclose our sampling dates to other stakeholders?

4 Cost of debt

Currently, we determine a value for the cost of debt at the start of the regulatory period and apply this value for the whole period. To determine this value:

- We add estimates of the **risk-free rate** and the **risk premium.**[18] The risk-free rate is measured by the 10-year Australian Government Bond (AGS) yield, and the risk premium is measured by the spread between BBB rated corporate bond yields and 10-year AGS yields.[19]
- We calculate a **current estimate** and a **historical estimate** of the risk-free rate and the risk premium. The current estimate uses 10-year bond yields averaged over a 40-day period, and the historical estimate is the average of these yields over the past 10 years.
- We take the midpoint of the current and historical estimates to determine the cost of debt.

In this review, we propose to consider four potential refinements to this approach:

1. updating our decision on the cost of debt during the regulatory period
2. using a different mix of current market data and historical averages
3. the measurement of the debt margin, and
4. making adjustments to account for how the aggregated bond yield data underlying our estimates is calculated.

Each of these issues and our preliminary analysis is discussed below.

4.1 Should we update the cost of debt within period?

Setting one value for the cost of debt that applies for the whole regulatory period has benefits and risks for customers and regulated businesses. If the cost of debt moves materially after we set a WACC – as it did during the global financial crisis (Figure 4.1) – this approach provides greater price certainty for customers during the period.

However, it can lead to larger price changes at the start of the next regulatory period. In addition, it exposes regulated businesses to refinancing risks if they need to raise debt over the period. A firm can hedge some, but not all, of this refinancing risk:

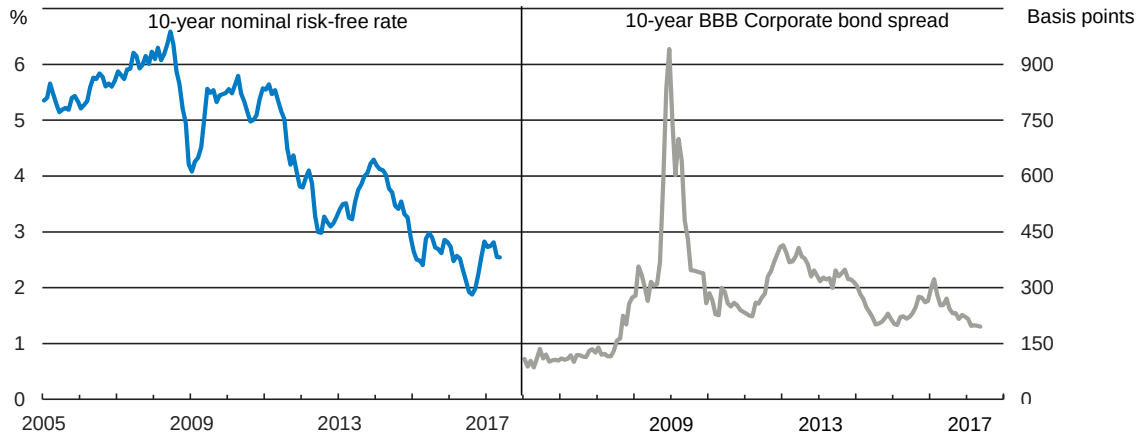
- **Changes in the risk-free rate** can be partly offset by using interest rate swaps, but cannot be eliminated if new debt is issued during the regulatory period.

18 There is also small allowance (12.5 basis points) for debt raising costs added to both the current and historical estimates.

19 We use the RBA's aggregate measure of the debt margin, not actual yields on corporate debt.

- **Changes in risk premium** can theoretically be offset by purchasing credit default swaps (CDS).[20] But in practice, this is unlikely to perfectly hedge this risk, because the CDS market may not be sufficiently liquid to match changes in the firm's risk premium.[21]

Figure 4.1 Changes in cost of debt, 2005 to 2017



Data source: Bloomberg; RBA.

Other regulators have adopted one of two approaches:

1. The QCA, ERAWA and NZCC set one value for the cost of debt that applies for the whole regulatory period, like IPART.[22]
2. The AER, ESC and ESCOSA set a value for the cost of debt at the start of the period and adjust it (and the resulting prices) each year to reflect changes in the market.[23]

A third approach would be to estimate one value for the cost of debt that applies for the regulatory period but adjust it to take account of expected changes in debt costs over this period using forward interest rates.

A forward interest rate measures the expected interest rate of a specific maturity in the future, and can be estimated from current interest rate data.[24] For example, the expected 10-year risk-free rate in one year's time can be derived by comparing the yield on the 1-year risk-free rate and the 11-year risk-free rate. This assumes that total return on investing for 11 years is equal to two components:

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20 A CDS is a form of insurance, which compensates the holder if a 'credit event' (eg, default) occurs. The value of these contracts rises (falls) as the risk of the firm rises (falls). A firm could buy CDS contracts when the WACC is set, and sell these contracts when issuing debt. This hedges a firm against increases in risk premium, because the value of holding a CDS contract will increase as the risk spread rises, offsetting the higher borrowing costs for the firm.

21 Fabbro, *The Australian Credit Default Swap Market*, RBA Bulletin article, December Quarter, 2011.

22 Queensland Competition Authority, *Final decision, Trailing average cost of debt*, April 2015; Economic Regulation Authority, *Determination of the 2016 Weighted Average Cost of Capital for the Freight and Urban Railway Networks, and for the Pilbara railways*, October 2016; Commerce Commission New Zealand, *Input methodologies review decisions: Topic paper 4: Cost of capital issues*, December 2016.

23 AER, Better Regulation, *Explanatory Statement - Rate of Return Guideline*, December 2013; Essential Services Commission, *Melbourne Water 2016 Price Review – Guidance Paper*, April 2015; Essential Services Commission of South Australia, *SA Water Regulatory Rate of Return 2016 – 2020, Final Report to the Treasurer*, March 2015.

24 Forward interest rates are typically from zero coupon bond yield data (see section 4.4 for more details). Daily 10-year forward interest rates are available from Bloomberg.

- the return on investing for a 1-year period today (the 1-year risk-free rate), and
- the return on re-investing the proceeds in one year's time for 10 years (the forward rate).

In theory, forward rates could be used to allow the WACC to capture expected changes in the cost of debt during a regulatory period. Over a three year regulatory period, a mix of 1-, 2- and 3-year expectations for 10-year yields could be used to consider the market's current forecast of future long-term borrowing costs. Our preliminary analysis suggests that using forward interest rates could better align our estimate of the cost of debt to the efficient cost of borrowing for a benchmark firm (see Box 4.1). However, adjusting the cost of debt for expected changes would increase complexity of this calculation, reducing certainty for regulated businesses.

Overall, this suggests there are benefits and risks to all three approaches. In addition, if we decided to update the cost of debt within the regulatory period, it may also be appropriate to update our cost of equity estimates on a consistent basis, recognising the potential co-relationships between WACC parameters (as discussed in section 3.2).

Box 4.1 Comparing the accuracy of risk-free rate estimates

To analyse the accuracy of different methods of estimating the risk-free rate, we conducted a back-testing exercise for a hypothetical benchmark firm over the period 2001 to 2014, using:

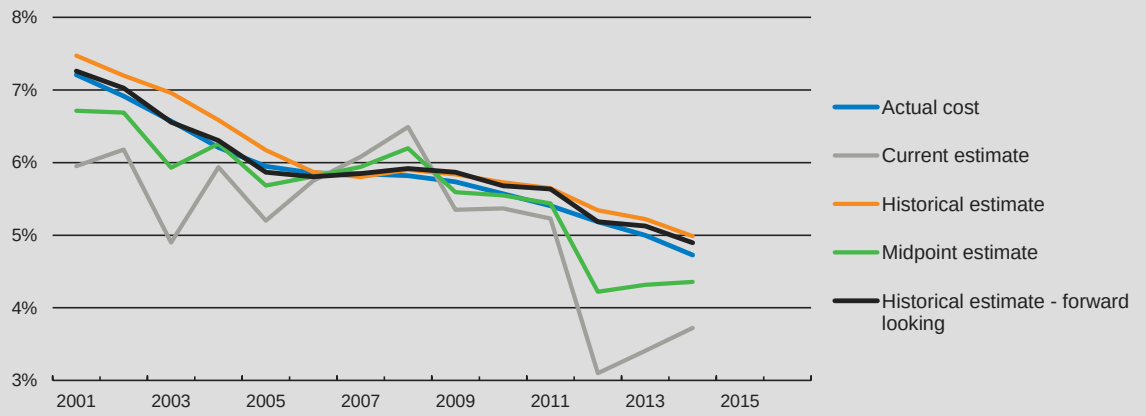
- current market data (**current estimate**) and 10-year averages (**historical estimate**)
- the midpoint of these estimates (**midpoint estimate**)**,** in line with our current approach, and
- historical averages adjusted for expected changes during the regulatory period using forward interest rates (**historical estimate - forward looking**).

We estimated the firm's cost of funding (**actual cost**) over this period (Figure 1) assuming:

- we set the WACC at 1 July each year for 3-year regulatory periods
- the firm did not hedge interest rate risk, and
- the firm had a staggered maturity profile (ie, it issued a 10-year bond to finance 10% of its debt portfolio on 1 July each year).

For example, the realised cost of funding on 1 July 2006 was the firm's average risk-free rate from 1 July 2006 to 30 June 2009.

Figure 4.2 Risk-free rate: actual costs vs costs estimated using different approaches over a 3-year regulatory period[a]



a Firm is assumed not to hedge interest rate risk.
Data source: IPART analysis

This analysis indicates that, over the period 2001 to 2014, current market data tended to underestimate the risk-free rate, while historical data tended to overestimate it, reflecting a downward trend in risk-free rates over the past 20 years. The simple average of forecast errors over the period was lowered by taking the midpoint of these approaches, while the method that considered interest rate expectations using forward interest rates most closely matched the realised cost of funding.

Overall, to the extent that a firm cannot hedge changes in the cost of borrowing, as in this basic scenario, its actual cost of borrowing would be more closely matched by an approach that:

- incorporated a forward-looking measure of interest rates, or
- periodically adjusted the cost of debt during the regulatory period.

However, by issuing variable rate debt and using interest rate swaps, a firm can more closely align the cost of borrowing to the cost of debt over the regulatory period.

IPART seeks comments on the following

6 Should we continue to set a single cost of debt for the regulatory period, or should this cost be updated during the period? If we set a single cost of debt, should it be adjusted to reflect future interest rate expectations using forward interest rates?

4.2 What mix of current market data and historical averages should we use?

As outlined above, IPART currently sets the value of the cost of debt using a combination of current market data and historical averages. That is, we estimate the current cost of debt (using approximated 40-day averages) and the historical cost of debt (approximated using 10-year averages) and select the midpoint value in normal situations (ie, if the uncertainty index is within one standard deviation from the long-term average).

There is merit in both the current and historical approaches:

- The current cost of debt reflects the marginal cost of raising debt for a firm at the start of the regulatory period. Setting the value of the cost of debt in line with this cost could provide an efficient price signal to a firm when it is deciding whether to expand capacity or make other investment decisions. As the AER has noted, it is "likely to more closely imitate the outcomes of a competitive market near the start of the regulatory period"[25] (than an approach using historical averages).
- However, the historical cost of raising debt could more accurately reflect the benchmark firm's outstanding cost of debt. This is because firms tend to stagger the maturity of their loans and bonds to reduce refinancing risk (see Box 4.2), and may be unlikely, or unable, to fully hedge the interest rate risk on this debt so that it aligns with a current cost of debt at the start of a regulatory period. Setting the cost of debt based on historical averages could promote prudent debt risk management by creating a stronger incentive for firms to issue historical debt.

Using a combination of these approaches takes appropriate account of their different merits. However, other regulators use only one or the other approach:

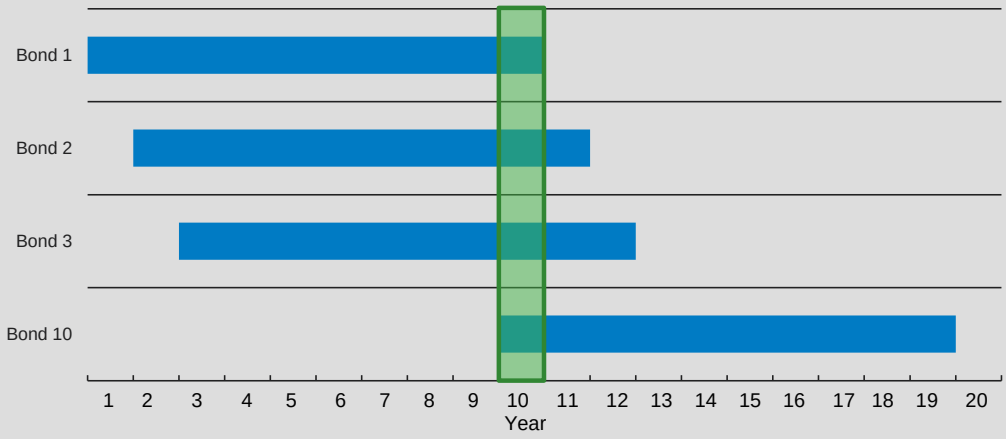
- The AER, QCA, ERAWA and NZCC estimate the cost of debt using current market data only.[26]
- The ESC and ESCOSA estimate the cost of debt using the historical average only.[27]

25 AER, *Final Decision: Jemena distribution determination 2016 to 2020, Attachment 3 – Rate of return*, May 2016.
26 AER, 2013; QCA, 2015; ERAWA, 2016; NZCC, 2016.
27 ESC, 2015; ESCOSA, 2015.

Box 4.2 Firms tend to stagger their debt maturities

Firms tend to stagger the maturity of their loans and bonds so that only a small portion of their total debt becomes due at any time. This allows a firm to manage the risk that it is unable to refinance a large proportion of its debt at a given time at a reasonable cost. For example, a firm might refinance 10% of its debt each year by issuing a 10-year fixed rate bond (Figure 4.3).

Figure 4.3 A staggered debt maturity profile



In this case, at the beginning of Year 10, the average cost of debt for the firm is the average of the interest rates from Year 1 to Year 10 in nominal terms.

If we set the WACC for this firm at the beginning of Year 10, a historical average approach would replicate its average cost of debt. To replicate our current approach, a firm would need to:

- refinance one-half of its debt for a 10-year period, at the beginning of Year 10, or
- issue one-half of its debt on a floating rate basis, and at the beginning of Year 10, enter into interest rate swaps to hedge the interest rate risk of this debt.

IPART preliminary view

4 That we should continue to use a combination of current market data and historical averages to estimate the cost of debt because this promotes both efficient investment decisions and reflects prudent debt risk management by firms.

IPART seeks comments on the following

7 Do you agree with our preliminary view that we should continue to use a combination of current market data and historical averages to estimate the cost of debt? If so, do you think we should place more weight on either of the two approaches?

4.3 How should the debt margin be measured?

To estimate the debt margin, we use estimates published by the RBA of the spread between the yield of BBB rated bonds issued by Australian non-financial corporations to Australian

Government Bond yields.[28] It is 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.[29]

Other regulators adopt a variety of approaches. ESCOSA also uses the BBB rated corporate bond spreads data published by the RBA, while the AER uses individual bond yield data, from third party data providers, to estimate the risk premium for 10-year BBB+ rated corporate bonds.[30] In contrast, the NZCC uses the BBB+ credit rating to estimate the debt margin for electricity networks, and an A- rating for airports.[31]

In our view, the BBB credit rating is the most appropriate measure of the debt margin for a benchmark firm operating in a competitive market, even if the credit rating of the firms we regulate might not be BBB rated. The estimates published by the RBA are our preferred measure of the debt margin, because they are publicly available through the RBA's website and therefore increase the transparency of our WACC determination process

IPART preliminary view

5 That we should continue to use the 10-year corporate bond spread data published by the RBA, and that the BBB credit rating is the most appropriate proxy for measuring the debt margin.

IPART seeks comments on the following

8 Do you agree with our preliminary view that we should continue to use the 10-year BBB rated corporate bond spread data published by the RBA?

4.4 Should we adjust bond market data?

Regulated firms tend to operate assets with long lives, and would be exposed to refinancing risk if they did not issue long-term debt. In line with the efficient practices of a firm operating in a competitive market facing similar risks, we estimate the cost of debt to reflect long-term borrowing costs. This is a transparent and relatively simple approach to accurately reflect long-term borrowing costs. However, this published data does not precisely replicate a firm's 10-year borrowing cost.

4.4.1 Annual rates with semi-annual compounding

In Australia, government and corporate bond yields are typically derived from semi-annual rates of return.[32] 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.

28 For further information, see: IPART, *Fact Sheet: New Approach to Estimating the Cost of Debt: Use of the RBA's Corporate Credit Spreads*, February 2014.

29 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.

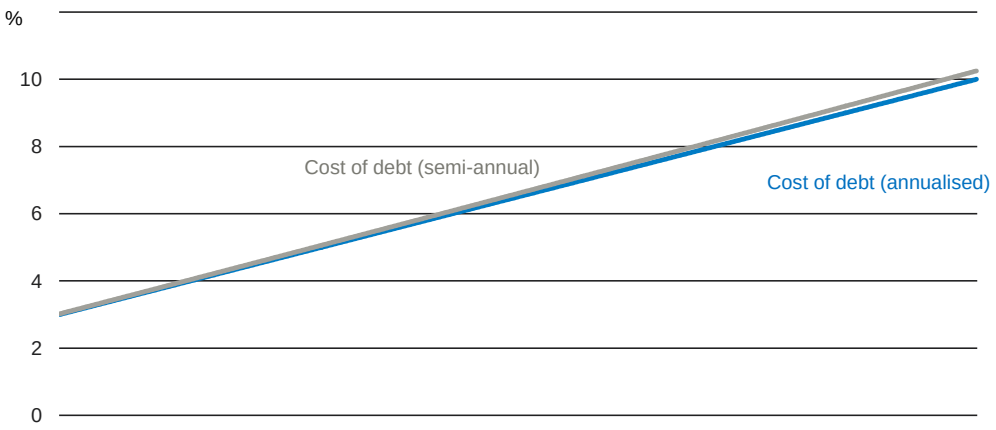
30 ESCOSA, 2015; AER, 2013.

31 Commerce Commission New Zealand, *Input methodologies review decisions: Topic paper 4: Cost of capital issues*, December 2016, p 57.

32 Quoting the yield to maturity based on semi-annual rates of return is standard bond market convention in Australia. This is because Australian government bonds typically pay interest every six months. For more details, see AFMA, *Long Term Government Debt Securities Conventions*, January 2017, p 4.

However, this ignores the impact of compounding on investment returns. Figure 4.4 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 4.4 Effect of converting semi-annual yields to annualised yields



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:

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

Risk-free rates are based on semi-annual rates of return, and we assume that the RBA data on the debt margin is also based on semi-annual rates of return. As the impact of compounding on interest rates is non-linear, if an adjustment is warranted, we should calculate the annualised cost of debt by adjusting the sum of the risk-free rate and the debt margin.

A number of other regulators (the AER, ERAWA and QCA) convert published yields into an effective annual rate.[33]

IPART preliminary view

6 That we should convert semi-annual bond yields into an annualised yield that recognises the compounding effect.

IPART seeks comments on the following

9 Do you agree with our preliminary view that we should convert the published bond yield data into annualised yields?

4.4.2 Zero-coupon yields

Our current approach to estimating the risk-free rate of return is to use the yield of an Australian Government bond, maturing in approximately 10 years' time, that pays interest

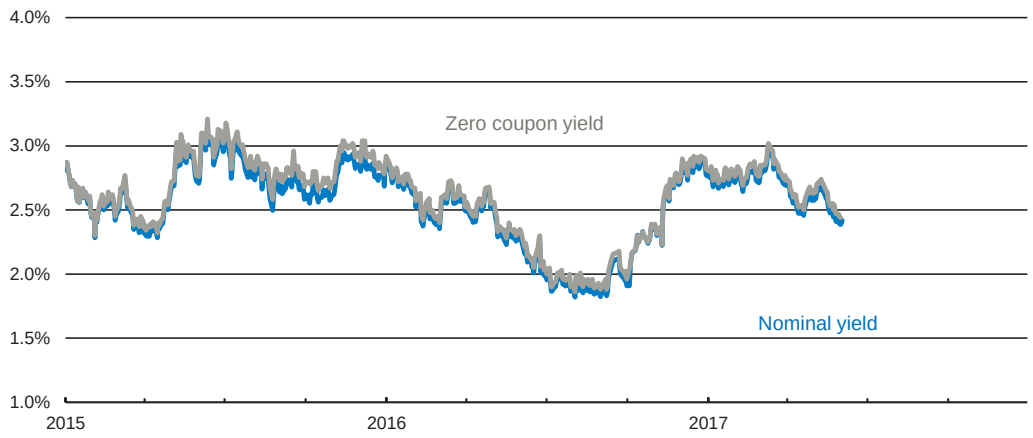
33 AER, 2013; ERAWA, 2016; QCA, 2014.

every six months (ie, semi-annual coupons). While this approximates the historical risk-free rate of return, 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. Thus 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, as well as the rates of return applying to the other coupons paid over the life of the bond.[34]

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.[35] The RBA publishes risk-free rates based on zero-coupon yields on a daily frequency on the second business day of each month. Figure 4.5 compares 10-year risk-free rates based on the standard 'nominal' yield, and the zero coupon yield. In recent times, this adjustment would add around 0.05% to the cost of debt.

Figure 4.5 10-year risk-free rates



Data source: Bloomberg; RBA.

In its December 2016 review, the NZCC said it would "have regard to" zero-coupon bond rates when determining the WACC.[36] In contrast, Australian regulators do not adjust yields for coupon payments, in line with our current approach.

It is important for our approach to be transparent, replicable and result in an accurate proxy of borrowing costs. Although we think that our current approach, which uses published coupon-paying bond yield data, meets these objectives, we may consider alternative approaches if there are clear benefits.

IPART preliminary view

7 That we should continue to use our current approach of using coupon-paying bond yield data to estimate the cost of debt.

34 RBA, *Extracting Information from Financial Market Instruments*, RBA Bulletin, March Quarter 2012.
35 Nominal yields for Australian Government Bonds are adjusted for coupon payments to derive their zero coupon yields. For more details, see RBA, *Extracting Information from Financial Market Instruments*, 2012.
36 NZCC, 2016, p 20.

IPART seeks comments on the following

10 Do you agree with our preliminary view that we should continue to use coupon-paying bond yield data in estimating the cost of debt?

5 Cost of equity

Currently, we use the 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 and the product of the MRP and equity beta. To apply the model, we:

- estimate a historical and a current risk-free rate (as discussed in Chapter 4)
- estimate a historical and a current MRP
- estimate the equity beta using a selection of proxy companies when we first estimate a benchmark WACC for a regulated industry, and review this value for subsequent reviews, and
- use the above values to estimate a historical and a current cost of equity, and then select a single value for the cost of equity within this range.

In this review, we propose to consider:

1. our approach for estimating the current MRP, including the mix of measures we use and how we select a single value, and
2. our approach for estimating the equity beta, including whether we should re-estimate this value at each price review, and whether we should adjust our beta estimate to account for estimation bias.

The sections below provide more information on the CAPM and why we estimate a historical and a current cost of equity, and then discuss each of these issues and our preliminary views.

5.1 Capital Asset Pricing Model

Like most regulators in Australia and overseas, we use the CAPM to calculate the cost of equity. This model distinguishes between systematic risk and firm-specific risk.

'Systematic risk' is the risk faced by all firms that they will be affected by events that cause movements in the whole market. This risk cannot be removed through a strategy of diversification, because every firm in the diversified portfolio will be similarly affected.

Risks faced by one firm alone because of its particular circumstances are firm-specific risks. This type of risk can usually be removed through diversification. Within the diversified portfolio, firm-specific ups and downs tend to cancel out.

According to the CAPM, it is only systematic risk that affects the expected return that the marginal equity investor would require. The marginal investor, who determines the price of equity, is assumed to hold a well-diversified portfolio of equities. Such an investor would not require compensation for firm-specific risks and therefore would require a lower expected return than another investor who doesn't hold a diversified portfolio.

The average cost of equity across the entire market comprises a risk-free rate (representing the rate that an investor would receive for a certain return) plus a premium that reflects the additional risk borne by the marginal equity investor (representing the average premium the investor is willing to accept for a less-than-certain return). This is called the MRP.

Not all firms are equally affected by movements in the stock market. 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 services. On the other hand, firms that make discretionary consumer products, especially luxury items, tend to be highly exposed to market dynamics.

This varying sensitivity to the state of the market is captured through a firm-specific parameter called the equity beta (β_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 CAPM states that:

(2) Expected rate of return on equity = Risk-free rate + MRP x βe

5.2 Why we estimate a historical and a current cost of equity

As outlined above, we estimate both a historical and a current cost of equity. We think this is appropriate because, like the risk-free rate (discussed in Chapter 4), investors take into consideration both long- and short-term values when making their investment decisions. Over long time periods (eg, many decades) the average MRP value is fairly steady at about 6%. However, over shorter periods (eg, several months) MRP observations can vary by several percentage points (see Figure 5.1).

Other regulators, notably the AER and ACCC, use only a historical 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 historical average were short-lived and mean-reverting. If that were so, the historical 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 would be weaker.

In the past decade, deviations from the historical average MRP have been persistent. As Figure 5.1 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 historical and a current MRP.

We use a range with a midpoint of 6% as the historical MRP, in line with the historical average. We estimate the current MRP using the approach discussed in section 5.3 below. Then we:

- calculate a current cost of equity by using a current MRP and a current risk-free rate
- calculate a historical cost of equity by using a historical MRP and a historical risk-free rate, and
- select a single value for the cost of equity by giving equal weight to the current and historical estimates, unless the uncertainty index is greater than one standard deviation from zero (We discuss how to weight current and historical estimates when the uncertainty index is outside these bounds in Chapter 6).

In our view, it would be invalid to combine a current risk-free rate with a historical MRP, because the result of that calculation would not represent the state of the equity market at any point of time.

IPART preliminary view

8 That we should continue to:

- use a range with a midpoint of 6% as our historical estimate of the MRP
- calculate a historical cost of equity by using a historical MRP and a historical risk-free rate
- calculate a current cost of equity by using a current MRP and a current risk-free rate, and
- give equal weight to the current and historical costs of equity, unless the uncertainty index is greater than one standard deviation from zero.

IPART seeks comments on the following

11 Do you agree with our preliminary views on how to calculate the cost of equity?

5.3 What measures should we use to estimate the current MRP?

The current MRP is difficult to measure reliably. Typically, such estimates rely on dividend growth models (DGMs) or dividend discount models (DDMs), which 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.

Currently, we use six different MRP forecasts to determine a single point estimate for the current MRP:

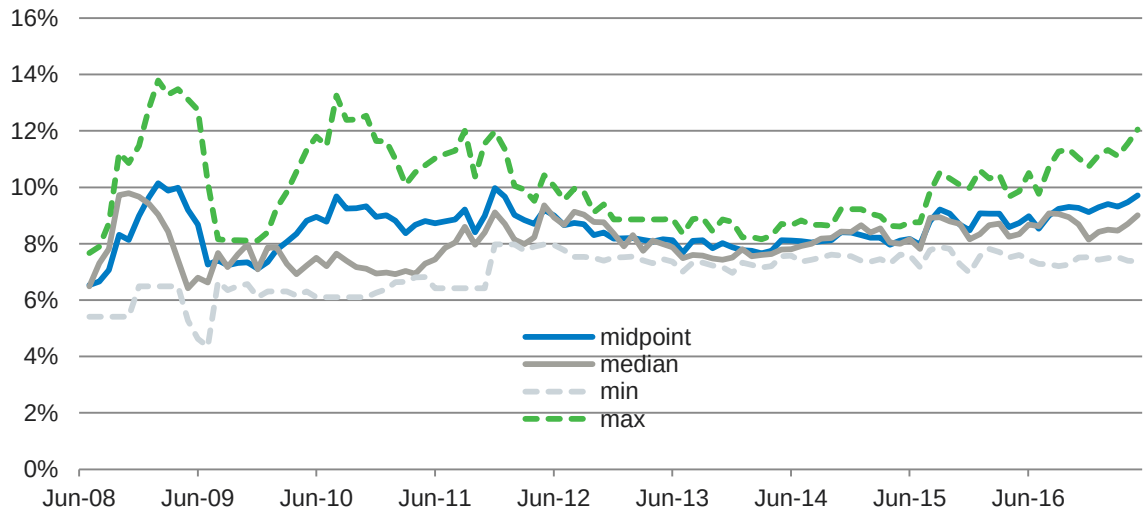
- Damodaran 2013 method
- Bank of England 2002 method
- Bank of England 2010 method
- Bloomberg method
- SFG market indicator method

- SFG analysts forecast method.

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

Figure 5.1 below shows the variation in each forecast since June 2008.

Figure 5.1 Comparison of MRP estimates 2008 to 2016 (%)



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

Our MRP estimates using the Damodaran, Bank of England and Bloomberg methods are based on the ASX 200 share price index and consensus earnings per share (EPS) forecasts.

It is also possible to calculate these four estimates using analyst **price targets** rather than **share prices** in performing the DDM computations. Price targets are higher than market prices, on average, so they will lead to lower cost of capital estimates.

A reason for using price targets is the possibility that analyst earnings forecasts are optimistic. If we use price targets an analyst's optimism in relation to earnings better matches the analyst's optimism in relation to the value of the stock. This price target approach helps to mitigate the risk of a mismatch in the optimism between analysts making earnings forecasts and investors trading shares.

A further possible change to the MRP calculation could be to use individual analyst EPS forecasts in our analysis, and aggregate these to a market-based EPS forecast ourselves, rather than using the consensus EPS forecast, which is already aggregated using a particular method. The consensus EPS forecasts contain more out-of-date EPS forecasts than the individual analyst forecasts. In addition, we can 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 on 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 will 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.

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

Compared to our current method of estimating 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.

5.3.1 Effect of gamma on MRP

The observed equity returns that we use to estimate MRP are taken after corporate tax. 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 standard WACC method. We discuss the derivation of this gamma in Chapter 7.

IPART preliminary view

9 That we should continue to use our existing six measures of current MRP.

IPART seeks comments on the following

12 Do you agree with our preliminary view that we should continue to use the existing six methods to calculate the current MRP? Or should other MRP methods be included?

13 Should we change our approach to DDM estimates on analyst price targets and individual analyst EPS forecasts?

5.4 Should we use a midpoint or median approach to determine our point estimate for the current MRP?

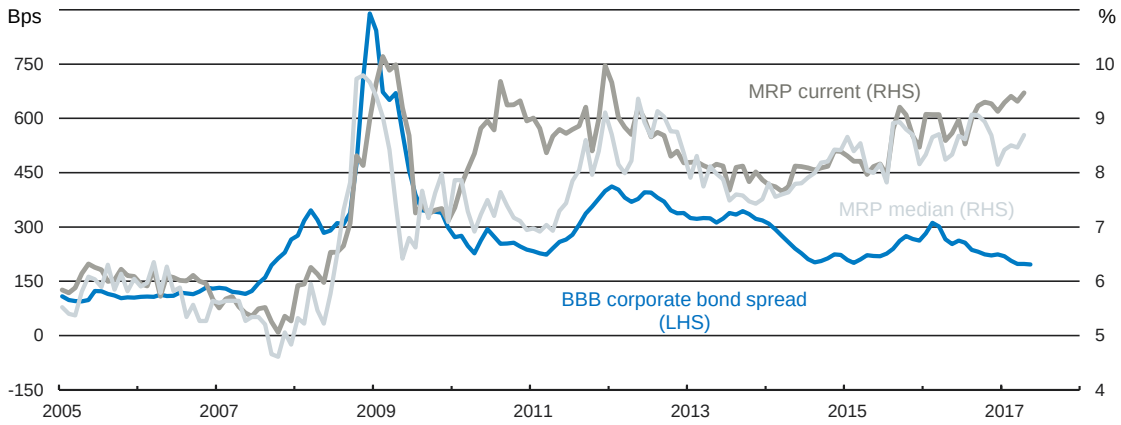
To select a single value for the current MRP from the six estimates discussed above, we currently use the midpoint of the highest and lowest current MRP estimate in each month. However, an alternative approach would be to use the median of the six indicators.

For most of the years shown in Figure 5.1 in section 5.3 above, these two approaches would have resulted in a similar result. 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 extremely high values in the Bloomberg indicator.

To consider which approach is preferable, we have assessed how well each of them tracks the BBB corporate bond spread, which measures another type of risk premium that is related to the MRP. Figure 5.2 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 co-move more closely with changes in the corporate bond spread than the midpoint measure. Given that the corporate bond spread and the MRP are both measures of firm risk, one might expect the two measures to co-move. This provides some evidence that the median approach might be less affected by outliers than the midpoint approach.

Figure 5.2 MRP estimates and debt margin



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 preliminary view is that we should change our method of combining the six MRP estimates from the midpoint rule to a median rule.

IPART preliminary view

10 That we should use the median of the current MRP indicators rather than our existing midpoint approach.

IPART seeks comments on the following

14 Do you agree with our preliminary view that we should use the median approach to determine the point estimate of the current MRP? Should we exclude outliers in our calculation?

5.5 Should we re-estimate equity betas at each price review?

For a listed firm, it is possible to measure the equity beta directly calculating the historical 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 with similar characteristics 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 re-lever 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.

IPART preliminary view

11 That we should re-estimate equity betas at each price review.

IPART seeks comments on the following

15 Do you agree with our preliminary view that we should re-estimate equity betas at each price review?

5.6 Can we improve our selection of proxy companies?

One of the main weaknesses of our current approach is that the selected proxy companies may not represent a benchmark firm well, leading to an inaccurate estimate of the equity beta. Often, the type of regulated industry will dictate the range of available proxy firms. The more unique the regulated activity, the greater the difficulty in finding suitable proxies.

Several statistical issues also need to be considered. To get valid estimates of beta, we need to have a sufficient number of market observations. The number of observations can be increased either by including a larger number of proxy firms, or by examining a smaller number of firms over a longer period of time. Each approach has drawbacks:

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

The main data sources used in Australia for beta estimation are Bloomberg and Thomson Reuters. These sources provide raw data (stock prices and indices) that can be used for the regression analysis, and published beta estimates. The published beta estimates reflect analyst-specific methodology choices, and so they 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.

There are some further nuances to the empirical estimation of beta. Unless using daily data, it is necessary to select weekly or monthly returns, which means a reference day must be chosen (eg, Monday for weekly returns or the first day of the month). It can make a material difference to the estimate which reference day is chosen, so care must be taken.

IPART seeks comments on the following

16 How formal should the process of selecting proxy companies for beta analysis be?

17 How often should beta estimates be refreshed with new econometric analysis?

5.7 Should we adjust our beta estimate to account for 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, the Blume (1975) and Vasicek (1973) methods are commonly used to adjust estimates.

- The Blume technique adjusts for bias in individual securities by placing two-thirds of weight to the OLS beta and a third to a beta of one.[37]
- Vasicek adjusts the OLS betas towards the best prior beta estimate with the degree of adjustment based on the standard error of the OLS estimates. Where the OLS estimates have lower (higher) standard errors, it is given more (less) weight.[38]

In some, but not all, recent decisions we have made a judgement about the appropriate beta considering the OLS beta with no adjustments, the Blume-adjusted and Vasicek-adjusted betas. Our preliminary view is that we should consider all three methods. If we consider these estimates, we need to decide how to weight them. If all estimates are close, we could weight each estimate equally. If estimates are more dispersed, we could place more weight on some estimates.

IPART preliminary view

12 That we should decide on the appropriate beta having regard to betas calculated using:
   - the OLS method with no adjustment
   - the OLS method with the Blume adjustment, and
   - the OLS method with the Vasicek adjustment.

IPART seeks comments on the following

18 Do you agree with our preliminary view that we should decide on the appropriate beta having regard to the OLS methods with and without adjustments? What adjustments, if any, should be made to estimated betas?

37 Blume, M, *Betas and Their Regression Tendencies*, Journal of Finance, Vol. 30, No. 2, June 1972, pp 785-795.

38 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.

6 How we combine 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 that we combine to derive the WACC – our estimates of the:

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

Our approach is first to calculate a single cost of debt by combining the current and historical costs and then do the same for equity. We then combine our debt costs and our equity costs according to the gearing ratio of the benchmark entity.

In this review, we propose to consider how we weight the current and historic costs in calculating a single cost of debt and a single cost of equity. Our current approach and the specific issues we propose to consider are outlined below.

6.1 Weighting current and historical measurements

In normal market circumstances, our current approach is to take a simple average of the current and historical 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 uncertainty index is at or within these specified bounds, our decision rule is to apply the midpoint approach.
- When the uncertainty index is outside these bounds, we use our discretion to decide how these data are combined.

In this review, we will consider how we construct the uncertainty index, how we decide when market circumstances are normal, and whether we should have an explicit decision rule when the market is not normal rather than having full discretion.

6.1.1 How should we construct the uncertainty index?

We have designed our uncertainty index 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.[39] 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 historical average over time. (See Appendix B for more information.)

IPART seeks comments on the following

19 Should we consider any changes to how we calculate our uncertainty index?

6.1.2 What market circumstances are considered normal?

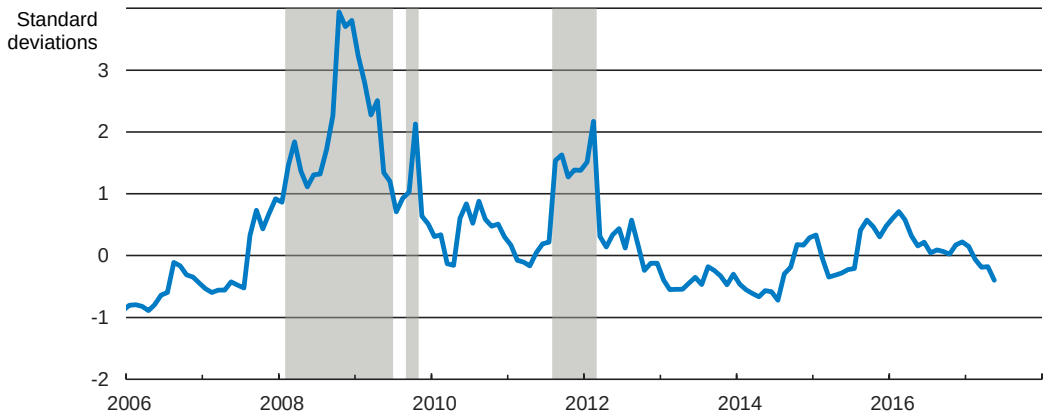
We currently consider that market circumstances are normal when our uncertainty index is at or within one standard deviation of its historical (since mid-2001) average of zero. We have identified two potential issues with this approach:

1. Whether our current one standard deviation threshold is appropriate. For example, if we applied a threshold tighter than the one standard deviation rule, we would deviate from the midpoint more often.
2. Whether the decision rule should be applied to a fixed period of time – such as the last 10 years of uncertainty index data. We currently apply the decision rule to the average of the uncertainty index since mid-2001. 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 reduces the amount of information used to apply the decision rule.

Figure 6.1 plots the uncertainty index, and highlights periods where the economic uncertainty is estimated to have been more than one standard deviation from its historical average. These periods include most of 2008-09 corresponding to the Global Financial Crisis, as well as a seven month period beginning in late-2011, corresponding to the Eurozone crisis.

39 Bank of England, *Macroeconomic uncertainty: what is it, how can we measure it and why does it matter?*, Quarterly Bulletin, February 2013, vol. 53, issue 2, pp 100-109.

Figure 6.1 IPART Uncertainty Index with data to 31 May 2017



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

Note: The grey shaded areas indicate periods where the uncertainty index was more than ± one standard deviation away from its long-term average.

While it is difficult to determine what periods are normal, Figure 6.1 indicates that our current one standard deviation threshold appears to have identified periods of heightened economic uncertainty.

IPART preliminary view

13 That the sensitivity of our decision rule is appropriate, the uncertainty index is operating as intended and that we have not unnecessarily deviated from the midpoint.

IPART seeks comments on the following

20 Do you agree with our preliminary view that we should only consider deviating from our standard approach if the uncertainty index is more than one standard deviation from its historical average since mid-2001?

6.1.3 Should we have an explicit decision rule when the market is not normal?

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

While we have not had reason to exercise this discretion to date, it may be useful to provide more specific guidance to all parties on how we would use it in the event.

During periods of high market volatility, such as during the Global Financial Crisis, important variables like the risk-free rate, the debt margin and the MRP were far from

historical 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 are changing rapidly, there is also a risk that current estimates are more unreliable than historical average estimates. That consideration suggests giving greater weight to the historical measurements in volatile periods.

Given these conflicting possibilities, our preliminary view is that we should retain the discretion to modify the decision rule in light of a suite of market information. Therefore we consider that a specific decision rule should not be made for these abnormal conditions.

IPART preliminary view

14 That we should retain discretion to determine the weighting of current and historical average market data when the uncertainty index is outside the range of one standard deviation from its historical average of zero.

IPART seeks comments on the following

21 Do you agree with our preliminary view that we should retain discretion to determine the weighting or current and historical market data when the uncertainty index is outside the range of one standard deviation from its historical average of zero? Should we adopt a specific decision rule for abnormal market conditions? If so, what should the rule be?

6.2 How we weight debt and equity costs

The WACC is a weighted average of the cost of debt and equity. These weights must sum to one because a firm's capital is either equity or debt. We determine the debt and equity weights having regard to the capital structure that a benchmark entity would have, which may differ from the gearing ratio of the actual firm.

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 historical 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. This raises the question of whether we should review how we set the gearing ratio over time.

Overall, we think 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.

IPART preliminary view

15 That we should review the gearing of the benchmark entity at each price review.

IPART seeks comments on the following

22 Do you agree with our preliminary view that we should review the gearing at each price review?

7 How we measure inflation and gamma

As Chapter 6 discussed, we derive the WACC by combining four measurements: the current and historical cost of debt, and the current and historical cost of equity. These measurements are 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.

Our current approach is to apply a single, forward-looking inflation forecast to both the current and historical costs. This forecast is the expected rate of inflation over the next 10 years, which we calculate as the geometric average of:

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

In this review, we propose to consider three issues related to this approach, including:

1. whether the approach remains appropriate given that current inflation is lower than 2.5%
2. whether it is appropriate to apply a single, forward-looking inflation forecast to all four costs, and
3. whether we should change our approach for calculating the geometric average.

The sections below outline our rationale for setting and applying a real post-tax WACC, and then discuss each these issues. One aspect of the impact of taxation on the WACC is the imputation credit factor gamma. We discuss that in section 7.1.3.

7.1 We will continue to set a real post-tax WACC

As Chapter 1 noted, we don't propose to consider broader policy issues related to how we apply the WACC in this review. In particular, we will continue to set and apply a real post-tax WACC.

7.1.1 Applying a real WACC

We will continue to apply a real WACC to a regulatory asset base (RAB) that we index for inflation. This ensures that inflation is accounted for once and only once.

We note that 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.

7.1.2 Applying a post-tax WACC

We will continue to apply our current approach of using a post-tax revenue model. The post-tax framework avoids overcompensating firms who, in practice, will 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.

7.1.3 Gamma

Our current WACC methodology assumes a value of 0.25 for the imputation credit factor (gamma). 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.

Other regulators adopt different values for gamma (see Appendix A). At times the selection of gamma has been controversial. Unfortunately, it is a characteristic of financial markets and investors that is extremely difficult to establish empirically.

We have used a 0.25 value for gamma since our December 2011 pricing decision for the Sydney Desalination Plant.[40] That decision took account of a dividend drop-off study by then SFG Consulting (SFG) that was done for the Australian Competition Tribunal.[41] This value was reconfirmed by a follow-up report by SFG that was done for Jemena Gas Networks in 2015.[42]

SFG based its estimate primarily on implied market valuation methods, such as dividend drop-off studies.[43] 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 takes into account valuation information obtained from analysis of equity ownership and of Australian Taxation Office (ATO) taxation statistics.[44] 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.

40 IPART, *Review of water prices for Sydney Desalination Plant Pty Limited*, December 2011, p 81.
41 SFG, *Dividend drop-off estimate of theta, Final Report*, March 2011.
42 SFG, *The required return on equity for the benchmark efficient entity*, February 2015, p 33.
43 SFG, 2011.
44 SFG, *Estimating gamma for regulatory purposes*, February 2015.

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.

After considering the difficulty in estimating gamma and based on SFG's analysis, we use a value of gamma of 0.25 in our WACC decisions. In line with the objectives for this review we would only change our standard gamma method if compelling new evidence indicated that 0.25 was an incorrect value. We would consider any submissions on that point.

Our preliminary view

16 That we should continue to use 0.25 as the value for gamma.

IPART seeks comments on the following

23 Do you agree with our preliminary view that we should continue to use 0.25 as the value for gamma? If not, what evidence can you provide that supports a different value?

7.2 Is our approach appropriate given that inflation is currently below 2.5%?

Our method gives an inflation estimate that is very close to 2.5%, which is the midpoint of the RBA's inflation target band for inflation. However, actual inflation is currently lower than 2.5%. If this low level of inflation persists in coming years, there is a risk that our current approach will over-estimate actual inflation.

7.2.1 Other regulators are considering how they forecast inflation

The AER uses a similar approach to ours, forecasting inflation as the geometric average of:

- one-year and two-year forecasts based on quarterly data from the RBA's Statement of Monetary Policy, and
- the middle of the RBA's target (2.5%) for Years 3 to 10.[45]

However, it is currently reviewing this approach as part of a broader review of the way it treats inflation.[46] The AER is considering four methods of estimating inflation expectations:

1. its current approach
2. implied inflation rates using the difference in prices of nominal and inflation-indexed bonds
3. implied inflation rates using inflation swaps, and
4. surveys of inflation expectations.

45 AER, *Regulatory treatment of inflation*, *Discussion paper*, April 2017, p 20.
46 Ibid.

The AER's discussion paper notes that its current approach produces the best estimates of expected inflation as it is a simple, transparent, replicable approach and likely to be unbiased.[47]

Until recently, the Economic Regulation Authority of Western Australia (ERAWA) used a fixed 2.5% inflation rate.[48] In an October 2016 determination, it moved away from this approach as it would have resulted in a negative real risk-free rate. Instead, the ERAWA used the 10-year inflation rate implied from bond market data to forecast inflation (method number 3 in the list above), with the inflation rate updated annually.[49]

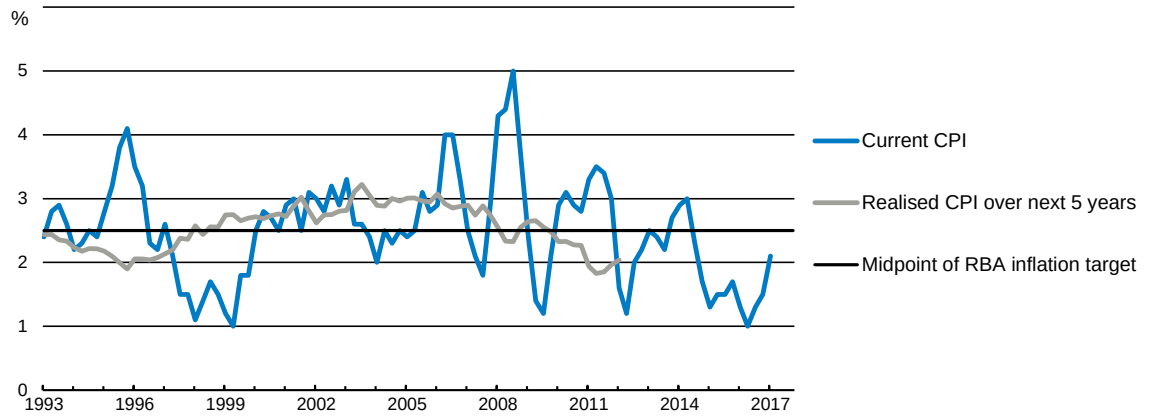
7.2.2 We consider our current approach remains appropriate

While we recognise there is a risk that our current approach will over-estimate actual inflation in the current environment, our view is that long-term inflation expectations are anchored around the midpoint of the RBA's inflation target band (2.5%). This view is based on:

- Previous research suggesting that long-term inflation expectations are relatively well anchored around the midpoint of the RBA's target band for inflation. The RBA found that, since 1998, long-term inflation expectations have not deviated by more than 0.2 percentage points from 2.5%,[50] consistent with previous research.[51]
- Our analysis suggesting that over the medium-term, there is no clear relationship between current and future inflation rates. Figure 7.1 compares the relationship between current CPI and the realised geometric average CPI over the next five years. The realised CPI has remained close to 2.5%. It shows that inflation is stable over the medium-term, and that low current rates of inflation have not historically been associated with low future rates of inflation. For example, when CPI was below 2% in the late 1990s, average inflation over the next five years was slightly above 2.5%.
- Research undertaken by the RBA in 2012 analysing the accuracy of its inflation forecasts. It found that its forecasts have "substantial explanatory power for inflation over the first forecast year".[52] However, it suggests that forecasts beyond the next year lack explanatory power – "…at longer horizons deviations in underlying inflation from the RBA's target seem to be unpredictable".[53]

47 ACCC, *Best estimates of expected inflation: a comparative assessment of four methods,* ACCC/AER Working Paper Series No. 11, February 2017, p 18.
48 ERA, *Determination on the 2016 Weighted Average Cost of Capital for the Freight and Urban Railway Networks, and for Pilbara Railways*, October 2016, p 24.
49 ibid.
50 RBA, *Inflation Targeting: A Victim of Its Own Success?'*, RBA Research Discussion Paper 2015-09, August 2015, p 9.
51 ACCC, *Best estimates of expected inflation: a comparative assessment of four methods,* ACCC/AER Working Paper Series No. 11, February 2017, pp 16-18.
52 RBA, *Estimates of Uncertainty around the RBA's Forecasts*, November 2012, p 30.
53 Ibid, p 15.

Figure 7.1 Annual Consumer Price Inflation (%)



Data source: IPART analysis of RBA data.

Note: Headline CPI with RBA adjustments for interest changes and GST introduction.

Overall, we consider that the way that we currently estimate inflation is an accurate, simple and transparent estimate of long-term inflation expectations.

IPART preliminary view

17 That we should continue to forecast inflation as the geometric average of the RBA's 1-year ahead inflation forecast and the midpoint of the RBA's target inflation band, as this accurately reflects long-term inflation expectations, and is simple to estimate, transparent and replicable by stakeholders.

IPART seeks comments on the following

24 Do you agree with our preliminary view that we should continue to forecast inflation 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?

7.2.3 Is it appropriate to apply a single, forward-looking inflation forecast to all cost of debt and equity measurements?

As noted above, to derive a real WACC, we adjust our current and historical cost of debt and equity measurements by a single inflation forecast. For the historical cost of debt measurement, this means we deflate the average of the cost of debt of the past 10 years by a single forward-looking forecast. This raises the question of whether it is appropriate to use an inflation **forecast** to deflate **historical** debt costs.

Our analysis suggests that a current, forward looking, inflation forecast is an appropriate measure to deflate the nominal WACC. This is because the WACC should reflect an efficient firm's expected cost of capital over a regulatory period. In nominal terms, this expected cost might be a mix of current and historical debt and equity costs, in part, reflecting the firm's expected mix of debt issuance and maturities over that period. However, the rate of inflation that we should apply to calculate the real cost of capital is a forward-looking measure that captures the expected inflation rate over the regulatory period.

Our current approach sets a single WACC estimate which applies for a regulatory period. If we instead decided to update the WACC over the period, for example, on an annual basis, this might affect how we estimate inflation during the period. One potential approach could be to update our current method on an annual basis.

Our preliminary view

18 That we should continue to use a forward-looking inflation estimate to deflate our nominal WACC estimates, as a real WACC estimate should capture expected inflation over the regulatory period.

IPART seeks comment

25 Do you agree with our preliminary view that our forward-looking inflation forecast is the best method to deflate the nominal WACC?

7.2.4 Should we change our approach for calculating the geometric average?

We currently calculate expected inflation as the geometric average of the inflation rate. This approach is expressed in equation (3) below:

$$(3) \qquad \pi_0^e = \sqrt[10]{(\pi_1^{RBA}) \times (\pi_2^{MP}) \times \ldots \times (\pi_{10}^{MP})}$$

where:

- π_0^e is the expected inflation rate
- π_1^{RBA} is the RBA's one-year ahead inflation forecast, which applies in Year 1, and
- $\pi_2^{MP} \ldots \pi_{10}^{MP}$ are the midpoint of the RBA's target inflation band, which applies in Years two through 10.

However, expected inflation could also be measured using the geometric average of the change in the level of prices, with this average converted into an inflation rate separately. This alternative is expressed in equation (4):

$$(4) \qquad \pi_0^e = \sqrt[10]{(1+\pi_1^{RBA}) \times (1+\pi_2^{MP}) \times \ldots \times (1+\pi_{10}^{MP})} - 1$$

Our preliminary view is that we should change the way that we calculate inflation expectations to consider the change in the level of prices – that is, use equation (4). 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.[54] In addition, our current approach would not work in the (unlikely) event that the one-year inflation forecast is negative.

IPART preliminary view

19 That we should change the way that we calculate expected inflation to consider the geometric average of the change in the level of prices.

54 ACCC, *Best estimates of expected inflation: a comparative assessment of four methods*, ACCC/AER Working Paper Series No. 11, February 2017, p 109.

IPART seeks comments on the following

26 Do you agree with our preliminary view that we should change the way that we calculate expected inflation to consider the geometric average of the change in the level of prices?

Appendices

A Comparison of other regulators' approaches to WACC

Table A.1 Comparison of IPART, AER, ACCC and ESC Victoria's recent approaches[55]

	IPART[a]	AER[b]	ACCC[c]	ESC[d]
Date updated	Dec 2013	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 moving from the midpoint.	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.
Fixed for period or intra-period adjustment	Fixed for period	Trailing average cost of debt	Fixed for period	Trailing average cost of debt
Cost of debt	Default is midpoint of short (40-day) and historical (10 year)	Start with an on-the-day rate for the first regulatory year using 10	Sum of risk-free rate, debt margin and debt issuance (raising) cost.	10-year trailing average to estimate the benchmark cost of

55 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[a]	AER[b]	ACCC[c]	ESC[d]
	average yields.	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 historical rates to new capex borrowings.		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 historical debt costs (risk-free rate plus debt premium) from RBA[e]
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 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
Market risk premium	Default position is midpoint of short and historical averages of historical arithmetic average of excess market returns over risk-free rate. Current: average of six model parameter estimates (five	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	Point estimate, taking into account historical estimates, market surveys and previous regulatory decisions. Most reliance placed on historical estimates.	

	IPART[a]	AER[b]	ACCC[c]	ESC[d]
	based on DGMs)	variables.		outcomes at lower prices. This 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 equity.
Imputation credits	0.25	0.4	0.4 (within range of 0.3–0.5)	
Equity beta	Determined as part of price determinations using proxy analysis.	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.	
Gearing	Determined as part of price determinations using proxy analysis.	0.6 based on historical precedent.	0.52 based on historical precedent and other regulatory decisions.	0.6
Inflation	Geometric mean of the one-year RBA forecast and the middle of the RBA's target band of inflation (i.e. 2.5%) for the remaining nine years.	Geometric average of one-year and two-year ahead forecasts based on quarterly data from RBA's Statement of Monetary Policy; 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 Methodology – Final Report*, December 2013.

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.

e Essential Services Commission, *Melbourne Water 2016 Price Review – Guidance Paper*, April 2015.

Table A.2 Comparison of QCA, ERAWA, ESCOSA and NZCC's recent approaches

	QCA[a]	ERAWA[b]	ESCOSA[c]	NZCC[d]
Date updated	Aug 2014 (equity) Apr 2015 (debt)	Oct 2016 (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 RBA data. Benchmark debt term of 10 years.	Observed yield of 10-year Australian Government Securities (AGS) from Treasury Indexed Bond markets, used as a proxy.	Observed yields from 10-year Commonwealth Government Bonds averaged over 20 business days. Observations taken close as possible to determination.	Government bond rates as using yield to maturity as an approximation of spot rates. Maturity term of risk-free rate five years.

	QCA[a]	ERAWA[b]	ESCOSA[c]	NZCC[d]
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 historical and two current) (Ibbotson, 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 2015 rail determination the Authority placed more weight on lower half of range of externally observed DGM estimates than upper half, in recognition of DGM estimates' inherent upward bias. The Authority determined a final MRP closer to	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 historical estimates.	Studies of historic returns on shares relative to risk-free rate leading to an MRP of 7%.

	QCA[a]	ERAWA[b]	ESCOSA[c]	NZCC[d]
		historic lower bound.		
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 historical 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 2016 Weighted Average Cost of Capital for the Freight and Urban Railway Networks, and for the Pilbara railways*, October 2016.

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 IPART's uncertainty index model

We publish our uncertainty index model and a guide to using the model on our website.[56] 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 B.1 explains IPART's uncertainty index
- Section B.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 B.3 describes steps we use to run a principal component analysis (PCA) in SPSS to obtain the uncertainty index.

B.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.[57] 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 from the long- term average of 0, we will select the midpoint WACC.
- If the uncertainty index is more than one standard deviation from the long- term average of 0, we will consider moving away from the midpoint WACC.

Our methodology for constructing the uncertainty index closely follows the approach taken by the Bank of England in its study of macroeconomic uncertainty.[58]

B.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

56 IPART, *Fact Sheet: Guide to IPART's Uncertainty Index Model*, February 2016.
57 IPART, *Review of WACC Methodology - Final Report*, December 2013, pp 23-24.
58 Bank of England, 2013, pp 100-109

- dispersion in analysts' forecast
- credit spreads, and
- bills–overnight index swap (OIS) spread.

Table B.2 provides a full list of raw data and data sources.[59]

Table B.1 List of raw data and data sources

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	ASX200I/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

B.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.[60]

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

59 Proprietary data from Thomson Reuters Datastream (Datastream) and Bloomberg has been removed and replaced with dummy data. Users need to source the data independently.

60 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:

$$r_t = \ln(\frac{TRI_t}{TRI_{t-1}})$$

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.[61]

To obtain a monthly implied volatility value, we average daily volatility index values in each month.

B.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.

B.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.

B.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.

61 The annualisation assumes 252 trading days.

B.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.[62] 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.

62 For more information on principal component analysis including derivation of principal components, see Jolliffe, I.T., *Principal Component Analysis Second Edition*, 2002.