Review of WACC Methodology

Research — Final Report
December 2013
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1 Executive summary

Over the past 12 months, IPART has reviewed the methodology we use to determine the weighted average cost of capital (WACC) for a regulated business. Our main objective is to improve the robustness of our methodology under changing market conditions. Other objectives are to improve the transparency and predictability of our decisions on the WACC.

In conducting the review, we have consulted with stakeholders and undertaken research and analysis. In October 2013, we released a draft report that set out draft decisions and invited stakeholders to make submissions.¹

We have now considered those submissions and made final decisions on our WACC methodology. This report sets out these final decisions, and explains how they differ from the draft decisions. It also summarises stakeholders’ comments on the draft report, and our consideration and analysis in response to those comments.

We thank stakeholders for their helpful contributions to this review. We will start using our WACC methodology from the publication date of this final report.

1.1 Overview of our decision

In line with the scope of this review, we made final decisions on our objective in determining the WACC, and the process we will use to determine the WACC. We also made final decisions on some of the approaches and frameworks we will use within the first 2 stages of this process, including:

- the approach for estimating the cost of debt
- the approach for estimating the cost of equity, focusing on the market risk premium (MRP) and equity beta
- the approach for estimating inflation expectation
- the decision rule for choosing the WACC point estimate.

Finally, we made final decisions on the information we will publish to increase the transparency and predictability of our decisions on the WACC.

1.1.1 Objective in determining the WACC

Our objective in determining the WACC for a regulated business will be to set a WACC that reflects the efficient cost of capital for a benchmark firm operating in a competitive market and facing similar risks to the regulated business. This is consistent with our draft decision.

1.1.2 Process for determining the WACC

To determine the WACC, we will use the following 3-stage process:

1. Establish a WACC range and midpoint by estimating a feasible range based on long-term averages and a feasible range based on current market data; using the midpoints of these 2 feasible ranges as the upper and lower bounds of the WACC range; and using the average of these midpoints as the midpoint of the WACC range.

2. Choose a WACC point estimate within the WACC range based on our WACC decision rule.

3. Specify our point estimates for the cost of debt and the cost of equity, and the evidence we considered in choosing the WACC point estimate.

This process is largely consistent with the one we outlined in our draft report, but we have reworded the final decision to provide greater clarity. We have also made more detailed decisions on our WACC decision-making framework, which are summarised below.

1.1.3 Cost of debt estimation

We will set the cost of debt at the start of the regulatory period and will not make annual adjustments. To estimate the cost of debt, we will use both current market data and long-term averages. These decisions are the same as our draft decisions. However, we have also decided that we will:

- use a target term-to-maturity (TTM) of 10 years (rather than 5 years) for all industries
- reduce the allowance for debt raising costs from 20 basis points (bps) to 12.5 bps, reflecting the longer target TTM.

The decision to use a TTM of 10 years reflects our consideration of stakeholder comments on the draft decision and new analysis. The decision to allow 12.5 bps for debt raising costs is a consequence of using a 10-year TTM. Given evidence that debt raising costs for 5- and 10-year debts are similar, our decision on the debt raising costs accounts for the longer period over which these costs are amortised when the TTM is increased from 5 to 10 years.

1.1.4 Cost of equity estimation

To estimate the MRP, we will use both long-term averages and current market data. For the MRP using long-term averages, which we will use to estimate the cost of equity using long-term averages, we will use a range of 5.5% to 6.5% with a midpoint of 6% based on the historical arithmetic average of the excess market returns over risk-free rates. For the MRP using current market data, which we will use to estimate the cost of equity using current market data, we will
construct an implied MRP range and midpoint using the following methodologies: Damodaran’s 2013 method (Damodaran (2013)), Bank of England’s 2002 method (BoE (2002)), Bank of England’s 2010 method (BoE (2010)), SFG’s method based on economic indicators, SFG’s method based on analysts’ forecasts, and Bloomberg’s method. This is consistent with our draft decision.

However, we have also decided that in constructing the implied MRP range, we will:

- account for the effect of imputation credits
- use the end-of-month dividend yield and risk-free rate to estimate the implied MRPs based on Damodaran (2013), BoE (2002) and BoE (2010).

The decision to account for the effect of imputation credits reflects our consideration of stakeholder comments on the draft decision, and new evidence provided by NERA on behalf of Sydney Water Corporation. The decision to use the end-of-month values for the dividend yield and risk-free rate also reflects stakeholder comments, and our view that the 3 versions of the DDM (ie, Damodaran (2013), BoE (2002) and BoE (2010)) we use within the WACC methodology should be internally consistent. That is, if we use an end-of-month value for 1 parameter in the model, we should use it for all parameters.

1.1.5 Inflation expectation estimation

Consistent with our draft decisions, we will:

- Use swap market data to estimate the inflation expectation for the WACC using current market data with an averaging period of 40 days.
- Use a hybrid approach to estimate the inflation expectation for the WACC using long-term averages with an averaging period of 10 years. This will involve using swap market implied inflations from 1 January 2009 and breakeven inflation (BEI) for the period prior to 31 December 2008. We will substitute swap market inflation for BEI as it becomes available.

1.1.6 Equity beta

Consistent with our draft decision, we will use a single beta to estimate the cost of equity using both long-term averages and current market data. We will review and determine the value of industry equity betas as part of our price determination process.
1.1.7 WACC decision-making framework

Consistent with our draft decisions, in choosing a WACC point estimate from within the WACC range, our default position will be to choose the midpoint of this range. We will consider whether it is appropriate to choose a point other than the midpoint having regard to the level of economic uncertainty.

However, we have now developed a more detailed decision-making framework to improve the transparency and predictability of our WACC decisions. Specifically, we have made decisions to:

- Construct a monthly uncertainty index using the S&P/ASX 200 VIX Index, the dispersion in analysts’ forecasts for companies in the S&P/ASX 200, credit spread and Bills-OIS spread from July 2001.

- Establish a WACC decision rule:
  - If the uncertainty index is within or at 1 standard deviation from the long-term average of 0, we will select the midpoint WACC.
  - If the uncertainty index is more than 1 standard deviation from the long-term average of 0, we will consider moving away from the midpoint WACC. In deciding whether and by how much the WACC point estimate should deviate from the midpoint, we will have regard to the value of the uncertainty index and additional financial market information, including debt and equity transaction data, interest rate swap curves, equity analyst reports and independent expert reports.

1.1.8 Information to be published to increase transparency and predictability

We have decided to publish biannual updates on financial market conditions and how these conditions affect the WACC in February and August, consistent with our draft decision.

1.2 Structure of this report

The next section of this report provides information on the context of our review of the WACC methodology, including the review scope and process, and an overview of stakeholder comments on our draft decisions. The remaining sections discuss our final decisions in more detail, focusing mainly on where these differ from our draft decisions:

- Section 3 discusses our decision on our objective in determining the WACC.

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2 For a full understanding of our decisions and the analysis that underpins them, please also see our draft report http://www.ipart.nsw.gov.au/Home/Industries/Research/Reviews/WACC/Review_of_method_for_determining_the_WACC.
Sections 4 to 7 discuss our decisions on the approaches we will use to estimate the cost of debt, the implied MRPs, the inflation expectation and the equity beta we will use in estimating the cost of equity.

Section 8 covers our decision-making framework for choosing the WACC point estimate, including our decisions on the uncertainty index, the WACC decision rule.

Section 9 discusses our decision to publish biannual market updates.

Appendix A summarises Damodaran (2013), BoE (2002) and BoE (2010), and Appendix B includes SFG’s report which explains their methods based on economic indicators and analysts’ forecasts and Bloomberg’s method. Appendix C outlines the method we will use to construct the uncertainty index. Appendix D provides a sample biannual market update.

2 Context for this review

The WACC for a business is the expected cost of its debt and equity, weighted to take account of the relative share of debt and equity in its capital structure. Determining this cost for a regulated business is a critical step in our price setting approach. This decision has a major influence on the prices the business can charge for its regulated services over the regulatory period, and on its incentives to invest in the assets it uses to provide these services.

If we set the WACC value too low, it could result in prices that are below efficient costs and discourage prudent and efficient investment. Conversely, if we set the WACC too high, it could result in prices that are too high and encourage over-investment. Clearly, getting this decision ‘right’ is in the interests of both the utilities we regulate and their customers.

While we are generally satisfied that our previous methodology for determining the WACC (see Box 2.1) has resulted in reasonable decisions in the past, in recent years we have become concerned that the methodology may not produce the ‘best’ decision in all market conditions. In particular, we considered that it may underestimate the efficient benchmark cost of capital due to changes in financial market conditions since the global financial crisis (GFC). This was mainly due to historically low yields on Commonwealth Government Securities (CGS), which resulted in much lower costs of debt and equity than their historical averages.

The SFG’s report was in Appendix A of our interim report on the review of WACC methodology.
As a temporary measure, we have addressed these issues in recent determinations by selecting a WACC point estimate above the midpoint within the range, having regard to the long-term averages for the costs of debt and equity. However, we also decided to conduct this review with the aim of improving the robustness of our methodology in a range of financial market conditions and industry circumstances.

2.1 Scope of the review

Our review of WACC methodology was limited to the following main issues:

- **The expected cost of debt** – should we use current or long-term data to estimate the risk-free rate and the debt margin, or both? If we continue to use current data, should we maintain the current 20-day averaging period or increase this period?

- **The expected cost of equity** – should we use long-term historical data or current data to estimate the market risk premium (MRP) and risk-free rate?

- **The feasible WACC range** – what combination of cost of debt and cost of equity methods should we use to establish the WACC range?

- **The appropriate WACC value** – what factors, information, models, processes and reference points should we use to choose the WACC point estimate?

### Box 2.1  Our previous WACC methodology

Our previous methodology aimed to determine a WACC for an efficient benchmark utility, which faces similar risks to the regulated businesses and is a new entrant. It involved the following 3 steps:

1. Estimating a range for the expected cost of debt using current market data with a 20-day averaging period for the risk-free rate and the debt margin.

2. Estimating a range for the expected cost of equity based on the Capital Asset Pricing Model (CAPM). We used a MRP range of 5.5% to 6.5% with a midpoint of 6% based on the historical arithmetic average of the excess market returns over risk-free rate and current market data with a 20-day averaging period for the risk-free rate.

3. Establishing a feasible range for the WACC using the ranges for the cost of equity and the cost of debt given a chosen level of gearing.

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2.2 Review process

In conducting the review, we have consulted with stakeholders and conducted research and analysis. We released a discussion paper in December 2012 which explained the main issues in the scope of the review, set out our preliminary views and invited stakeholders to make submissions. We received 6 submissions in response to this paper and held a workshop to discuss the issues and way forward for the review of the WACC methodology. After the workshop, we received 3 additional submissions.

We released an interim report in June 2013 which set out the approach we proposed to use to determine the WACC for price determinations released prior to the completion of this review. We received 5 submissions to this report.

We released a draft report in September 2013 and received 4 submissions from stakeholders. Overall, these stakeholders welcomed the draft decisions on the review of WACC methodology. However, they also argued that certain components of the methodology could be improved, or should be reconsidered. (Their views are summarised in Box 2.2 and discussed in more detail in the sections that follow.)

We considered these views carefully, and conducted new analysis where necessary to assist us in making our final decisions. These decisions will be incorporated into our methodology for determining the WACC from the publication date of this report.
Box 2.2 Overview of stakeholder responses to the draft report

We received 4 submissions in response to our draft report – from Hunter Water Corporation, Sydney Catchment Authority, Sydney Desalination Plant, and Sydney Water Corporation.

Overall, these stakeholders supported our draft decisions on the WACC methodology. However, they also submitted that:

- In estimating the cost of debt, we should increase the target TTM from 5 years to 10 years.
- In estimating the implied MRPs, we should incorporate the benefits of imputation credits, and use the end-of-month dividend yield instead of daily dividend yields averaged over a month.
- In relation to inflation expectation, we should not use a long-term inflation expectation, but use a best estimate of the expected inflation over the regulatory period.
- In relation to the equity beta, we should review the methodology we use to estimate this parameter.
- In choosing a WACC point estimate from within the range, we should determine the weights to allocate to the WACC using current market data and long-term averages based on market conditions.
- We should make the data we use to construct the uncertainty index publicly available.

2.3 Matters we are required to consider

Under Section 15 of the Independent Pricing and Regulatory Tribunal Act (IPART Act) 1992, we must have regard to a range of factors. Some key factors relevant for this review are:

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
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.

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5 Not all of IPART’s determinations are made under the IPART Act. For example, bus determinations are done under the Passenger Transport Act 1990. However, the requirements that affect the determination of the rate of return are similar.
The cost of capital is a component of the costs of providing the services and must be considered under (1) above. The requirement to consider efficiency under (4) draws our attention to the efficient cost of capital rather than the actual debt and equity costs of the regulated business. Setting the WACC too high is arguably inconsistent with (2) and (4), while setting it too low may conflict with (3) and (5).

3 Objectives for setting the WACC

Final decision

1 Our objective in determining the WACC is to establish a value that reflects the efficient cost of capital for a benchmark entity. The benchmark entity is a firm that operates in a competitive market and faces similar risks to the regulated business that is subject to our decision.

This final decision is the same as our draft decision on our objective in determining the WACC. Having regard to market practice of how investors form their expectations, we consider that the efficient cost of capital for the benchmark entity is likely to reflect a mix of current market rates and long-term averages. We will approximate current market rates using 40-day averages and long-term averages using 10-year averages.

3.1 Stakeholder’s comments

Overall, stakeholders supported the objective for setting the WACC. However:

- Sydney Catchment Authority (SCA) noted that utilities’ preferred or actual financing strategies should not be discounted if these strategies reflect efficient financing practices.

- Sydney Water Corporation (SWC) expressed the view that despite the stated objective, the overall regulatory framework remains prescriptive, has weak incentives and does not support the ability of the businesses to earn commercial rates of return in excess of the estimated WACC.

3.2 Our analysis

After considering stakeholders’ comments, we maintain our view that our objective in setting the WACC should be to reflect the efficient cost of capital for a benchmark entity that operates in a competitive market and faces similar risks to the regulated business subject to our decision.
Our final decision represents a change from the objective for our previous WACC methodology, in which the benchmark entity was a new entrant in a competitive market. In line with this objective, we previously set the WACC with reference to the current costs of debt and equity, since a new entrant would be financed at prevailing rates. However, because new entry is rare in practice, it was difficult to infer the efficient financing strategy for a new entrant from observed behaviour.

We consider that setting the WACC to reflect the efficient cost of capital for a benchmark firm that operates in a competitive market and faces similar risks to the regulated business is a more appropriate objective. It allows us to take account of how an efficient firm, in practice, would finance its operations in a competitive product market. Further, the cost of capital for such a benchmark firm is more readily observable and independent of any specific form of regulation chosen by the regulator.

We also consider that our final decision is consistent with the matters we must consider in making pricing decisions, as set out under section 15 of the IPART Act. It is also consistent with the long-term interests of consumers, as we consider that these interests are best served through efficient investment and the commercially sustainable provision of efficient services.

We disagree with SCA’s view that utilities’ preferred or actual financing strategies should not be discounted if they are efficient. We consider that if our objective in setting the WACC is to reflect the efficient cost of capital for a benchmark entity, the WACC need not reflect the actual financing decisions for a business under its existing structure and ownership.

We also disagree with SWC’s view that the objective for determining the WACC does not support the ability of the businesses to earn commercial rates of return in excess of the estimated WACC. We note that incentive regulation does not prevent a regulated business from earning higher returns on capital than the allowed return on capital. For example, the business could earn higher rates of return than the estimated WACC, if they improved their capital efficiency.

4 Cost of debt estimation

Final decision

2 We will:

- set the cost of debt at the start of the regulatory period and will not make annual adjustments

- use both current market data (approximated using 40-day averages) and long-term averages (approximated using 10-year averages) to estimate the cost of debt
– use a TTM of 10 years for all industries to estimate the cost of debt
– reduce the allowance for debt raising costs from 20 bps to 12.5 bps in estimating the cost of debt.

The decisions to set the cost of debt at the start of the regulatory period, not to make annual adjustments and to use both current market data and long-term averages in estimating the cost of debt are the same as our draft decisions. However, the decision to use a 10-year TTM for all industries is a change from our draft decision. The decision to reduce the allowance for debt raising costs from 20 bps to 12.5 bps is a consequence of adopting the 10-year target TTM.

4.1 Stakeholder’s comments

While stakeholders agreed with our draft decision to use both current market data and long-term averages in estimating the cost of debt, they submitted that we should change the assumed TTM from 5 years to 10 years for all industries. In particular, they argued that:

▼ The 5-year TTM assumption is inconsistent with efficient financing practice of firms with long-lived assets. HWC, SCA, SDP and SWC all submitted that a 5-year TTM is inconsistent with the efficient financing practice employed by infrastructure service providers with long-lived assets, such as water utilities. Investment and financing horizons for utilities are often longer than 5 years with debt issued for approximately 10 years. The real asset is the underlying physical assets, which generate the cash flow over their expected economic lives, not the future cash flow resulting from each price reset. Investors seeking to invest in a utility, whether regulated or unregulated, would value the business based on the expected cash flow that would be generated by the business over the expected life of its assets.

SCA added that our financeability test ensures a utility’s short-term financial viability. It argued that, for long-term financial viability, we should ensure that the benchmark cost of debt reflects the efficient debt management practice of firms in an unregulated market, which is to raise long-term debts.

▼ The 5-year TTM assumption exposes utilities to a greater refinancing risk
HWC and SWC submitted that the use of 5-year TTM implies that utilities may need to renegotiate the terms of their debt at the start of each regulatory period. This is likely to increase refinancing risk, resulting in a higher cost of debt in the subsequent regulatory periods. SWC pointed out that Professor Kevin Davis and Associate Professor Martin Lally’s analysis,6 which supported the use of the 5-year TTM, did not consider that the use of the 5-year TTM would expose utilities to a greater refinancing risk. It also noted that utilities cannot use swaps to manage refinancing risk arising from the use

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6 Professor Kevin Davis, Determining debt costs in access pricing, December 2010. This report can be found at Appendix A of IPART, Developing the approach to estimating the debt margin – Draft Decision, February 2011; Lally, M., Regulation and the choice of the risk free rate, December 2004.
of the 5-year TTM, because swaps can only be used to manage utilities’ exposure to risk-free rate movement (for those issuing floating rate debt).

- **Our main reason for adopting a 5-year TTM for water utilities no longer holds under our new WACC methodology.** In our draft report, we indicated that we adopted a 5-year TTM for the cost of capital estimation in April 2011 based on advice from Professor Kevin Davis\(^7\) that matching the TTM to the regulatory period is consistent with the NPV neutrality of regulated cash flows under a building block model.\(^8\) SDP submitted that the relevance of this reason is weakened or lost under the draft WACC methodology, as we include long-term averages in the overall WACC calculation.

- **Irrespective of their industries, firms with long-lived assets would raise capital in the same financial markets and adopt a similar approach to debt financing.** Our draft report also indicated that we would use a longer TTM for electricity, gas and coal mining reviews, since NPV neutrality is not an issue for these sectors as they are not regulated under a building block model. SCA and SDP argued that the assumed TTM should not be contingent on the regulatory model employed by the regulator. SCA noted that this could increase regulatory pricing risk.

- **Using the 10-year TTM would not over-compensate a benchmark efficient utility operating in our regulatory model, which resets the debt allowance every 5 years.** SWC submitted that the yield on the 10-year debt sampled every 5 years should in the long-term be equivalent to the long-term average yield on the 10-year debt. The difference between the actual cost of debt and the regulatory cost of debt would decrease as the averaging period used to set the regulatory cost of debt increases.

### 4.2 Our analysis

We considered these comments carefully, and examined further evidence on the debt raising practices of firms with long-lived assets. We decided to increase the TTM to 10 years for all industries, in line with stakeholder views. We also examined the implications this decision for the methodology we use to calculate the debt margin, and the allowance we set for debt raising costs.

#### 4.2.1 Rationale for decision to increase TTM to 10 years

We agree with stakeholder views that increasing the TTM from 5 years to 10 years for all industries is more consistent with our objective for setting a WACC that reflects the efficient financing costs of a benchmark entity operating in a competitive market.

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\(^7\) Professor Kevin Davis, *Determining debt costs in access pricing*, December 2010.

Evidence indicates that asset-intensive firms with long-lived assets operating in a competitive market seek to raise debt with a maturity of 10 years or longer. A recent survey by Brotherson et al (2013) on firms’ practice in estimating the cost of capital shows that firms and financial advisors unanimously responded that they use bond maturities of 10 years or longer.9 Further, investors seeking to invest in utilities, whether regulated or unregulated, have investment and financing horizons longer than 10 years.

We also agree with SDP that the NPV neutrality argument is less likely to support retaining a 5-year TTM assumption under our new WACC methodology. Previously, our objective for setting the WACC was to reflect the financing costs of a new entrant. Consistent with this objective, we estimated the WACC using current market rates only, based on the assumption that utilities would refinance their entire debt portfolio at each regulatory reset. Based on advice provided by Kevin Davis,10 we adopted a 5-year TTM to achieve the NPV neutrality of our regulatory model. However, under our new WACC model, which uses a mix of current and long-term historical rates, the NPV neutrality principle is less likely to hold.

4.2.2 Implications for our debt margin calculation

We currently estimate the cost of debt based on our own sample of Australian corporate bonds issued in Australia and US. But the debt margin estimate based on our sample may not achieve a 10-year TTM, since the sample was designed to target our 5-year TTM assumption. Moving to the 10-year TTM would entail methodological changes in our debt margin calculation. To achieve a 10-year TTM, we may consider one of the following approaches.

- Extrapolation methodology: We could continue to use our bond sample to estimate the debt margin, but add a premium to account for an increase in debt margin associated with a 10-year maturity. To extrapolate this premium, we could apply a bond pair analysis currently used by the Australian Energy Regulator (AER).

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10 Professor Kevin Davis, Determining debt costs in access pricing, December 2010.
The Bloomberg BBB fair value curve (FVC) is produced for TTM of up to 7 years. To use the Bloomberg BBB 7-year FVC as a 10-year benchmark, the AER currently extrapolates it to 10 years. For example, in its recent final decision for the Victorian gas businesses, the AER conducted bond pair analysis based on 2 sets of bonds issued by Stockland and Sydney Airport to extrapolate the Bloomberg BBB Fair value curve from 7 years to 10 years. The estimated premium of 14.12 bps was then added to the debt margin of the Bloomberg BBB 7-year FVC.\(^{11}\) We could adopt a similar approach by assessing the increase in debt margin per year of maturity for bonds issued by the same company that have approximately 5 and 10 years maturity, respectively.

\* The RBA’s series of credit spreads: At the time of writing this report, we are aware that the RBA expects to start publishing monthly credit spreads of Australian non-financial corporations (NFC) across maturities ranging from 1 to 10 years from December 2013. Its sample will consist of bullet bonds and bonds with embedded options,\(^{12}\) which are issued by Australian NFCs and denominated in Australian dollars and foreign currencies. The aggregate credit spreads are estimated as a weighted average of observed spreads of outstanding bonds issued by Australian NFCs, with the weights determined by the distance between the bonds’ residual maturities and the target tenor of the estimated spread.

Our preference would be to use the RBA’s series of credit spreads as it will be based on a transparent and robust methodology developed by an independent and reputable third party. Further, its sample selection methodology is very similar to our current approach except that bonds with embedded options are also included. Once the RBA publishes its methodology and estimates, we would consult with stakeholders regarding the adoption of the RBA’s series.

4.2.3 Implications for allowance for debt raising costs

Prior to April 2011, we used a TTM of 10 years and included an allowance of 12.5 bps for debt raising costs. When we decided to reduce the TTM to 5 years, we increased the allowance for debt raising costs to 20 bps.\(^{13}\) This decision was based on evidence that the transaction costs for raising 5-year debt are similar to those for raising 10-year debt. Therefore, the debt raising costs should be amortised over 5 years instead of 10 years if we assumed a 5-year TTM.


\(^{12}\) Bullet bonds are redeemable only at maturity, while bonds with embedded options may be exercised by the issuer before the maturity date.

\(^{13}\) IPART, *Developing the approach to estimating the debt margin – Final Decision*, April 2011, p 27.
For the same reasons, we consider that our current decision to revert to a TTM of 10 years means that we should also revert to an allowance for debt raising costs of 12.5 bps. This allowance is consistent with an assumed amortisation period of 10 years.

5 Cost of equity estimation

Final decision

3 In estimating the market risk premium (MRP), we will use both long-term averages and current market data:

- For the MRP using long-term averages, which we will use to estimate the cost of equity using long-term averages, we will use a range of 5.5% to 6.5%, with a midpoint of 6% based on the historical arithmetic average of the excess market returns over risk-free rates.

- For the MRP using current market data, which we will use to estimate the cost of equity using current market data, we will construct an implied MRP range using the maximum and minimum of the implied MRPs estimated using the following MRP methodologies: Damodaran (2013), BoE (2002), BoE (2010), SFG’s method based on economic indicators, SFG’s method based on analysts’ forecasts, and Bloomberg’s method. We will establish the midpoint of the implied MRP range by averaging the upper and lower bound of this range.

- In estimating the implied MRPs, we will account for the effect of imputation credits.

- In estimating the implied MRPs based on Damodaran (2013), BoE (2002), BoE (2010), we will use the end-of-month dividend yield and risk-free rate instead of daily dividend yields and risk-free rates averaged over a month.

This decision is consistent with the overall approach for estimating the MRP set out in our draft report. However, it includes refinements to the approach for estimating the implied MRPs in response to comments from stakeholders and our further consideration.

We will continue to monitor the use of other models to estimate the implied MRPs for the cost of equity using current market data. However, we will consult with stakeholders before changing the set of models specified in our final decision or their specifications.
5.1 Stakeholder’s comments

Only 2 stakeholders commented on our draft decisions on estimating the implied MRPs – HWC and SWC. Both generally supported the overall approach. For example, SWC put the view that is a positive development. However:

- SWC also suggested the approach for estimating the implied MRP would be improved by:
  - Taking into account the benefits of imputation credits. It provided a report that NERA undertook on its behalf, which argued that since investors derive value from imputation tax credits, this value should be reflected in the expected MRP.
  - Using an end-of-month dividend yield rather than daily dividend yields averaged over a month in estimating the implied MRPs based on Damodaran (2013), BoE (2002) and BoE (2010).

- Both HWC and SWC suggested that the same TTM of the risk-free rate should be used in estimating the implied MRPs and in estimating the cost of equity.

In addition, Deloitte, on behalf of HWC, stated that while it considers that an appropriate MRP is 7%, it currently uses an MRP of 7.5%, of which an extra risk premium of 0.5% reflects short-term market risks.

5.2 Our analysis

We considered stakeholders comments, and examined the evidence provided in NERA’s report. We decided to take account of the benefits of imputation credits in estimating the implied MRP, and considered how we will do this, and the implications for our post-WACC revenue model. We also decided to use an end-of-month dividend yield in estimating the implied MRP based on Damodaran (2013), BoE (2002), BoE (2010), and considered the implications for consistency within the DDM and the resulting implied MRP estimates. Our final decision to use a TTM of 10 years in estimating the cost of debt addresses the issue that HWC and SWC raised regarding the use of the same risk-free rates in estimating the implied MRP and in estimating the cost of equity.

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5.2.1 Rationale for decision to take account of the benefits of imputation credits

We note that the historical MRP range of 5.5% to 6.5%, which we will use to estimate the cost of equity using long-term averages, includes the benefits of imputation credits. In our 2009 review of the WACC, we found that imputation credits do have an impact on the MRP and that this impact is likely to be reflected in the MRP range of 5.5% to 6.5%. We put the view that the value of imputation tax credits has been included in historical estimates of the MRP since their introduction into the Australian tax system.

In contrast, our estimates of the implied MRPs based on the 6 MRP methodologies do not include the benefits of imputation credits. We currently make a downward adjustment to the estimated cost of corporate taxes, which forms part of the allowed revenues of regulated businesses, to take into account the value that equity investors place on the franking credits.

However, after considering the new evidence provided in NERA’s report on behalf of SWC, we agree that since imputation credits have value to equity owners and this value is reflected in our revenue determination process, it should be also accounted for in estimating the implied MRPs.

We also note that since providing us with advice on the implied MRP range, SFG has provided a submission to the AER on behalf of the Energy Networks Association (ENA) in which it argued for the inclusion of imputation tax credits in estimating implied MRPs.

5.2.2 Methodology for taking account of the benefits of imputation credits

Given our decision to take account of the benefits of imputation credits in estimating implied MRPs, we have considered how we should implement this decision. We propose to use the approach that SFG recommended to the AER in its recent submission on behalf of ENA. This approach was supported by NERA in its submission to this review on behalf of SWC.

This approach uses the following equation, which shows the relationship between the return on equity including and excluding the benefits of imputation credits given our assumed tax rate ($\tau$) and gamma ($\gamma$):

$$\text{Return incl. imp benefits} = \text{Return excl. imp benefits} + \frac{1 - \tau}{1 - \tau(1 - \gamma)}$$

15 IPART, *IPART’s cost of capital after the AER’s WACC review – Lessons from the GFC*, November 2009, p 38.
17 Ibid.
Return excl. imp benefits = \frac{1 - 30\%}{1 - 30\%(1 - 0.25)}

= Return excl. imp benefits \div 0.9032

For example, if we assume a risk-free rate of 5.0\% and that the expected return on a market portfolio excluding imputation benefits is 11.0\%, the implied MRP excluding imputation benefits is 6.0\% (11.0\% - 5.0\% = 6.0\%). If we assume an equity beta of 0.8, the cost of equity using current market data, which is estimated using the implied MRP excluding imputation benefits, is 9.8\%.

To calculate the implied MRP including imputation benefits, we:

- First, calculate the expected return on the market portfolio including imputation benefits. Using the equation and assumptions above, this would be 12.2\% (11.0\% \div 0.9032 = 12.2\%). This implies that investors holding the market portfolio are assumed to receive 11.0\% from the allowed revenue stream and a further 1.2\% from the assumed value of imputation credits.

- Second, subtract the risk-free rate of 5.0\% from this expected return on the market portfolio. This results in an implied MRP including imputation benefits of 7.2\% (12.2\% - 5.0\% = 7.2\%).

Based on the equity beta of 0.8, the cost of equity using current market data, which is estimated using the implied MRP including imputation benefits, is 10.7\%.\(^{18}\)

5.2.3 Implication for our post-tax WACC revenue model

An increase in the cost of equity using current market data, through an increase in the implied MRP as a result of accounting for imputation benefits, will increase the revenue requirement. The extent of the increase will depend on:

- the weights we give to current market data and long-term averages in choosing the WACC point estimate (discussed in Section 8 below)

- the gearing ratio we use, and

- the equity beta we use.

\(^{18}\) Alternatively, NERA, in its submission to this review on behalf of SWC, suggests that we could scale up directly the expected dividends in a DDM to account for the value of imputation credits in estimating the implied MRPs. The AER has decided to adopt this approach in its draft decision. However, we have not considered adopting this method as we cannot apply it to SFG’s methodology based on economic indicators and Bloomberg’s methodology. SFG’s MRP methodology based on economic indicators is not a DDM, so there are no dividends that can be adjusted for imputation benefits. While Bloomberg’s methodology is a DDM, we cannot adjust dividends used in its model as we only obtain the final MRP values calculated by Bloomberg.
From the example set out in section 5.2.2 above, we observe that the increase in the cost of equity using current market data as a result of including imputation credits is 0.9% (10.7%−9.8% = 0.9%).

If we choose the midpoint WACC (ie, give equal weight to the current market data and long-term averages) and use a gearing of 60% (ie, proportion of equity in total value being 40%), the revenue will increase by 50%×40% of the imputation adjustment reflected in the cost of equity using current market data. That is, the revenue requirement will increase by 0.9%×50%×40%=0.2% in our example.

5.2.4 Rationale for decision to use end-of-month dividend yields and risk-free rates

In the draft report, we used daily dividend yields and risk-free rates averaged over a month, and the end-of-month index price to estimate the implied MRPs based on Damodaran (2013), BoE (2002) and BoE (2010). We used the daily dividend yields and risk-free rates averaged over a month to be consistent with the methodology used by SFG in estimating the implied MRPs based on 4 economic indicators. However, we consider that using dividend yields averaged over a month and the end-of-month index price may be problematic, since the dividend yield is calculated as dividends per share divided by the share price.

We agree with NERA’s suggestion on behalf of SWC that this problem should be addressed by using the end-of-month value for dividend yields. However, we consider that if we do this, we should also use the end-of-month values for risk-free rates. This reflects our view that there should be consistency within a model, as it will mean that all input parameters to DDMs are as of the end of each month.

5.2.5 Considerations on using the same risk-free rate for estimating the implied MRP and the cost of equity

Under our draft decisions, we would use the 10-year CGS yield to estimate the implied MRPs, but the 5-year CGS yield to estimate the cost of equity for all industries other than electricity generation, electricity retail, coal mining and gas businesses.

We agree with SWC that the same risk-free rates should be used to estimate the implied MRPs and the cost of equity. We note that under our final decisions, this is the case. As Section 4 discussed, our final decision is to use a TTM of 10 years in estimating the cost of debt for all industry. This also means that we will use the 10-year risk-free rate to estimate the cost of equity.
6 Inflation expectation estimation

Final decision

4 To estimate the inflation expectation for the WACC using:
   – Current market data, we will use swap market implied inflation expectation with an averaging period of 40 days.
   – Long-term averages, we will use a hybrid approach with an averaging period of 10 years. This approach combines:
     o Swap market implied inflation expectation (for the period from 2 January 2009 to the date of the WACC decision).
     o Breakeven inflation (BEI) for the period over which the swap market implied inflation is not available (for the period prior to 2 January 2009). We will substitute swap market inflation for BEI as it becomes available.

This decision is the same as our draft decision.

6.1 Stakeholder’s comments

SWC submitted that using the long-term inflation expectation is inappropriate, and suggested that we should use a best estimate of the expected inflation over the regulatory period. It argued that using the long-term inflation expectation is problematic when the long-term average inflation expectations differ substantially from the forecast of inflation over the regulatory period. They provided the following example:

- the regulatory period is 4 years
- the nominal WACC determined is 8%
- the expected inflation for the regulatory period is 3.3%
- the long-term average inflation expectation is 2.7%.

In this scenario:
- the return on capital earned on the RAB is 5.3% during the regulatory period
- the expected indexation of the RAB during the regulatory period is 2.7%
- in total, the expected return from revenue and indexation is 8.6%, which is greater than the nominal WACC of 8%.

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19 The breakeven inflation is derived based on the Fisher equation where inflation rate = (1+nominal rate)/(1+real rate)-1. For this estimation, we used the 10-year Australian Government bond (Mnemonic: FCMYGBAG10D) and indexed bond (FCMYGBAGID), sourced from the RBA website: www.rba.gov.au/statistics/tables/xls/f02dhist.xls.
6.2 Our analysis

We have carefully considered SWC comments and example, and maintain our view that the best estimate of expected inflation over a regulatory period is likely to be derived from a combination of the current inflation expectation from swap market data and the long-term average inflation expectation from swap and bond market data.

In principle, businesses can use a mix of real and nominal debt to manage their inflation exposure. The decision of entering into inflation hedges or not, the size of the hedge (inflation exposure) and the inflation rate will be determined by the businesses’ expected inflation rate. We consider that the inflation expectation would be formed in a similar way to the expectation for other cost of capital parameters, which is based on a mix of current market data and long-term averages.

In our view, for the WACC based on long-term averages, the best estimate of investors’ inflation expectations is an average of historical inflation expectations equalling target TTM (ie, 10 years). For the WACC based on current market data, the best estimate of investors’ inflation expectations is current swap market implied inflation rate. In our proposed model, under normal market conditions (ie, an average level of economic uncertainty), each estimate of inflations would carry a 50% weight.20

7 Equity Beta

Final decision

5 We will use a single beta to estimate the cost of equity using both current market data and long-term averages. We will review and determine the value of the equity beta as part of our price determination process.

This decision is the same as our draft decision.

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20 For the purpose of our WACC decision, normal market conditions are defined as periods where our uncertainty index is within or at 1 standard deviation from the long-term average of our uncertainty index.
7.1 Stakeholder’s comments

SWC suggested:

▼ that we should place greater weight on those companies that are most comparable to the regulated entity

▼ account for the effect of known biases in the CAPM (such as the bias that the expected returns for stocks with equity beta less (greater) than 1 are underestimated (overestimated)), when interpreting the equity betas estimated using comparable firms

▼ have regard to equity betas adopted by US regulators that estimate the implied equity betas based on DDM.

7.2 Our analysis

We maintain our view that adopting a single beta value to estimate the cost of equity using both current market data and long-term averages is reasonable. Using 2 different averaging periods does not mean that we should use 2 equity betas to estimate the WACCs using current market data and long-term averages. This is because there is no short-term beta or long-term beta for a stock, but rather 1 beta estimate that accurately measures the covariance between stock and market returns.

We will review and determine the value of the equity beta for regulated businesses as part of each price review. In selecting a sample of comparable firms, we try to identify as many comparable firms as possible, subject to data availability, and exclude firms whose equity beta could not be reliably estimated. We used a similar approach estimate the equity betas for our review of regulated electricity retail prices from 2013 to 2016. In that review, we estimated equity betas adjusting for any potential bias using Blume and Vasicek adjustments, and taking into account up and down market conditions.

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8 WACC decision framework and decision rule

Final decision:

6 We will choose a point estimate WACC from within the WACC range using a decision-making framework comprising:

   – A monthly uncertainty index, which we will construct using the S&P/ASX 200 VIX Index, the dispersion in analysts’ forecasts for companies in the S&P/ASX 200, credit spread and Bills-OIS spread from July 2001.

   – A WACC decision rule:
     o If the uncertainty index is within or at 1 standard deviation from the long-term average of 0, we will select the midpoint of the WACC range.
     o If it is not, we will consider deviating from midpoint of the WACC range.
     o In deciding whether and by how much the WACC point estimate should deviate from the midpoint, we will have regard to the value of the uncertainty index and additional financial market information, including debt and equity transaction data, interest rate swap curves, equity analyst reports and independent expert reports.

This is similar to our draft decision. However, we have decided to include the Bills-OIS spread as an additional variable in constructing the uncertainty index. We have also established a clear WACC decision rule that provides more detail on when and how we will consider choosing a WACC point estimate other than the midpoint.

8.1 Stakeholder’s comments

In relation to the uncertainty index:

▼ SCA supported the use of this index, and consideration of additional information to supplement the index. It also requested that IPART makes available the data used to construct the index and additional financial market information.

▼ SWC submitted that to improve the uncertainty index, we should exclude periods of considerable financial instability (eg, the GFC since September 2008 and the European sovereign debt crisis in late 2009). It argued that including these periods would result in a downward bias in the extent to which the index captures the level of economic uncertainty.

22 The Bills-OIS spread is calculated as the difference between the 3-month Bank bills and the 3-month overnight index swap (OIS).
In relation to choosing the point estimate WACC, SCA submitted that placing equal weight on the WACCs estimated using current market data and long-term averages does not necessarily reflect the financing practice of a firm with long-lived assets. It recommended an adaptive approach, whereby current market data is given a greater weight in periods of an expansion and long-term averages are given a greater weight in periods of a stable market condition.

8.2 Our analysis

We considered stakeholders’ comments on the uncertainty index, and undertook further research and analysis on this issue. We decided not to adopt SWC’s suggestion to exclude periods of financial instability, and to include an additional variable, the Bills-OIS spread, in constructing the index. We noted SCA’s request that we make the data we use to construct the index publicly available. We are not able to meet this request due to restrictions imposed by our data service providers. However, stakeholders can obtain the data directly from the data providers to replicate the index.

We also gave further consideration to how we will take economic uncertainty into account in choosing the WACC point estimate, including SCA’s comment. We decided to develop a clear WACC decision rule to increase the transparency and predictability of our WACC decisions.

8.2.1 Rationale for not excluding periods of considerable financial instability

We disagree with SWC’s suggestion that to improve the uncertainty index, we should exclude periods of considerable financial instability. Given that the purpose of constructing the index is to identify an unusual level of economic uncertainty (shocks) in the market, we consider that excluding these shocks would significantly diminish its usefulness and validity.

We also consider that if we did exclude these shocks, the index would ‘overestimate’ the level of economic uncertainty. For example, the years 2007 and 2010 showed a much lower level of uncertainty than 2008 and 2009 (the GFC period) but a higher level of uncertainty than the early 2000s. If the GFC period was excluded from the index, 2007 and 2010 would be regarded as periods of very high economic uncertainty, when actual level of uncertainty was not unusually high. Thus, the index would falsely direct us to select a WACC above the midpoint.
8.2.2 Analysis on including Bills-OIS spread

In our draft report, we proposed constructing the uncertainty index using the S&P/ASX VIX Index, the dispersion in analysts’ forecasts for the companies in the S&P/ASX 200 Index and credit spread (ie, difference between the UBS Australian all maturities credit yield and UBS Australian Treasury all maturities yield).

Since the release of that report, we have identified another variable, the Bills-OIS spread, which can be added to the construction of the uncertainty index. The Bills-OIS spread is calculated as the difference between the 3-month Bank bills and the 3-month overnight index swap (OIS). It is the Australian equivalent of the TED spread,\(^{23}\) which is calculated as the difference between the 3-month London Interbank Offered Rate (LIBOR) and the 3-month T-bill interest rate.

We consider that the information content of the Bills-OIS spread is highly relevant to measuring economic uncertainty. Like the TED spread, the Bills-OIS spread reflects changing liquidity conditions or credit worthiness of the market. An increase in the Bills-OIS spread would signal worsening liquidity as banks are becoming less willing to lend. When credit constrains are binding, banks would increase their interbank lending rates and tighten other investors’ credit constraints over time. As such, the spread can be viewed as an indication of banks’ perception of the creditworthiness of other financial institutions and the general availability of funds for lending purposes.

Figure 8.1 shows Bills-OIS spreads from 2 July 2001 to 31 October 2013. Figure 8.2 shows the uncertainty index, which is constructed including the Bills-OIS spread and updated to October 2013. We note that the uncertainty index presented in the Draft Report started in November 2000. Since the Bills-OIS spread is available from July 2001, the uncertainty index including this spread starts in July 2001.

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\(^{23}\) TED is an acronym for T-Bill and ED, the ticker symbol for the Eurodollar futures contract. Initially, the TED spread was the difference between the interest rates for 3-month U.S. Treasuries contracts and the 3-month Eurodollars contract as represented by the London Interbank Offered Rate (LIBOR). However, since the Chicago Mercantile Exchange dropped T-bill futures after the 1987 crash, the TED spread is now calculated as the difference between the 3-month LIBOR and the 3-month T-bill interest rate.
For comparison, we show the uncertainty index in Figure 8.3, which is constructed excluding the Bills-OIS spread. This was the uncertainty index presented in the Draft Report.
There is little difference between the original uncertainty index and the index including the Bills-OIS spread. Both indicate similar patterns of economic uncertainty over time. Nevertheless, we have decided to include the Bills-OIS spread, because:

- this information is highly relevant to measuring economic uncertainty
- its inclusion as an additional variable from the debt market provides a good balance of information, since the original index consists of 2 variables from the equity market (ie, S&P/ASX VIX Index and dispersion in analysts’ forecasts for the companies in the S&P/ASX 200 Index) and 1 variable from the debt market (ie, credit spread).

Appendix C explains in detail how we construct the uncertainty index.

8.2.3 Rationale for establishing the WACC decision rule

Our draft decision was to choose the midpoint WACC if the level of economic uncertainty is neutral and to consider moving away from the midpoint if the level of economic uncertainty is unusually high or low. However, we did not specify what level of economic uncertainty would be considered sufficiently ‘unusually high or low’ to justify a move away from the default midpoint position in determining the WACC.
Since the release of the draft report, we have developed a clear decision rule that provides this greater level of specificity. As indicated at the beginning of Section 8, this rule states that:

- if the uncertainty index is within or at 1 standard deviation from the long-term average of 0, we will select the midpoint of the WACC range
- if it is not, we will consider deviating from midpoint of the WACC range
- in deciding whether and by how much the WACC point estimate should deviate from the midpoint, we will have regard to the value of the uncertainty index and additional financial market information.

We consider that this rule represents a good balance between the need to:

- provide a predictable and transparent decision-making framework
- ensure the WACC reflects current market condition
- support stability in the WACC.

The rule also specifies that the additional market information we will have regard to in deciding whether and by how much the WACC point estimate should deviate from the midpoint will include market data (debt and equity transaction data and interest rate swap curves), as well as equity analyst reports and independent expert reports.

Market data include equity and debt transaction data and interest rate swap curves. Interest rate swap rates reflect expectations for future interbank lending rates and the market’s perception of credit quality of AA-rated banks, so the interest rate swap curve is a good indicator of conditions in the fixed income markets. Actual transactions related to equity and debt issuance are our preferred source of financial market information, but its availability may vary between decisions. Hence, we decided to include secondary sources of information such as equity analyst reports and independent expert reports.

In deciding on these types of information, we also considered including further information, such as RBA and Treasury’s economic outlooks, corporate treasury views, and discussions with bankers. However, while this information would be useful:

- the information content of RBA and Treasury’s economic outlooks is likely to overlap with that of the uncertainty index
- corporate treasury views are mostly opinion-based, so the information may not be objective
- the information obtained from discussions with bankers may lack transparency.
We decided that their inclusion could increase the complexity of our WACC decision with no additional benefits. Based on objectivity, relevance and the incremental value of available information, we consider that debt and equity transaction data, interest rate swap curves, equity analyst reports and independent expert reports provide a balanced view of the financial market’s expectation of future rates of return for our WACC decision framework.

## 9 Biannual market update

**Final decision**

7 We will publish biannual updates on financial market conditions and how these conditions affect the WACC in February and August.

This is the same as our draft decision. Appendix D provides an illustrative example of a biannual update.

### 9.1 Stakeholder’s comments

SWC welcomed our draft decision to release biannual market updates, but suggested the following:

- We should provide sufficient information regarding how the uncertainty index is used to determine the WACC point estimate. Especially, we should provide information about:
  - how the uncertainty index is constructed
  - what level of uncertainty would warrant a deviation from the midpoint
  - how we will adjust WACC estimates or underlying parameters where the index indicates a certain level of market uncertainty.

- We should provide clear guidance on the internal consistency tests of the cost of equity and the cost of debt estimates. Especially, we should specify:
  - how close the cost of equity and cost of debt estimates would need to be before any adjustment is made
  - how adjustment will be made to each of the underlying parameters.

### 9.2 Our analysis

We consider we have addressed the first of SWC’s suggestions through the detailed information about the data and methodology we will use to construct the uncertainty index provided in the draft report and Appendix C of this final report, and through the WACC decision rule discussed in Section 8.
In relation to SWC’s second suggestion, we note that our internal consistency test assesses the relative difference between the cost of debt and the cost of equity. If the cost of debt happens to be higher than the cost of equity, we will investigate why and consider making possible adjustments in the context of applying the WACC decision-making framework discussed in Section 8. We will not make any generic adjustments to the cost of debt or the cost of equity outside this decision-making framework.
Appendices
A How we estimate implied MRPs

As Section 5 discussed, to establish the MRP using current market data, we will construct an implied MRP range using the maximum and minimum of the implied MRPs estimated using 6 MRP methodologies: Damodaran (2013), BoE (2002), BoE (2010), SFG’s method based on economic indicators, SFG’s method based on analysts’ forecasts, and Bloomberg’s method. The first 3 of these methodologies are described below. The remaining 3 methodologies are described in SFG’s report attached in Appendix B.

Damodaran (2013)\(^1\)

Professor Damodaran annually publishes implied MRP estimates for the US market using the S&P 500 Index. Following Damodaran (2013), we assume that:

- The expected dividends over the next 5 years are estimated using the geometric average of the expected growth rates over the next 5 years (ie, \(g_{GA} = \left[\prod_{t=1}^{5}(1 + g_t)\right]^{\frac{1}{5}}\), where \(g_t\) is an expected growth rate for \(t\)-year ahead.).

- In estimating \(g_{GA}\)
  - \(g_1\) and \(g_2\) are estimated using analysts’ earnings per share (EPS) forecasts for the companies in the index for 1 and 2 years ahead
  - \(g_3\) and \(g_4\) are estimated assuming a linear decrease (or increase) in the growth rate from a rate of \(g_2\) to the constant growth rate of \(g\) in the 5th year (ie, \(g_5 = g\)).

- After 5 years, the growth rate reverts to the long-term constant growth rate, \(g\).

The DDM of Damodaran (2013) is as follows. Our aim is to find MRP given other parameters.

\[
P_0 = \sum_{t=1}^{t=5} \frac{E(D_t)}{(1 + MRP + r_f)^t} + \frac{E(D_0)}{(MRP + r_f - g)} \frac{1}{(1 + MRP + r_f)^5}
\]

\(^1\) Damodaran, A., *Equity risk premiums (ERP): Determinants, estimation and implications – The 2013 edition*, 2013, pp 63-73. Damodaran is Professor of Finance at the Stern School of Business at New York University. He is best known as the author of several widely used academic and practitioner texts on valuation, corporate finance and investment management.
**Bank of England (BoE, 2002)**

The purpose of BoE (2002) was not to derive implied MRPs, but to value the FTSE 100 Index using a DDM. This methodology assumes that the FTSE 100 Index grows at a different rate from the long-term constant growth rate for the first 12 years. Its model consists of 3 phases:

1. In Phase 1, dividends are expected to grow at a constant rate given by analysts’ forecast for long-term growth ($g_{LTG}$) for the first 4 years.
2. During Phase 2, the dividend growth rate declines (or increases) in a linear fashion until year 12.
3. In Phase 3, from year 12 on, dividends are assumed to grow at a constant rate, $g$.

BoE (2002) applies the following simplified formula, which is given by Fuller and Hsia (1984).

$$P_0 = \frac{D_0}{(MWP + r_f) - g} [(1 + g) + 8(g_{LTG} - g)]$$

**Bank of England (BoE, 2010)**

In its quarterly bulletin in spring 2010, BoE extends its previous work on valuation. In the BoE (2010) methodology:

- $g_1$, $g_2$ and $g_3$ are estimated using analysts’ EPS forecasts on the index for 1-year, 2 years and 3 years ahead.
- $g_4$ is given by the analysts’ long-term growth rate forecast.
- After 4 years, the growth rate reverts to the long-run constant growth rate of $g$.

The DDM of BoE (2010) is similar to Damodaran (2013) in the sense that dividends grow for a certain number of years at a different rate to a long-term constant growth rate and then reach a constant growth stage.

$$P_0 = \sum_{t=1}^{4} \frac{E(D_t)}{(1 + MRP + r_f)^t} + \frac{E(D_5)}{(MWP + r_f - g)(1 + MRP + r_f)^4}$$

---

Assumption regarding the choice of the long-term constant growth rate, g

The choice of the long-term constant growth rate has a significant impact on the terminal value within a DDM. The impact becomes larger as the terminal growth rate approaches the required rate of return. In our MRP estimation, we assume that the long-term nominal constant growth rate of dividends is equal to the expected long-term nominal growth rate of the Australian economy, which is approximately 5.5%.

This assumption is based on Associate Professor Lally’s estimate of the average real GDP growth rate in Australia. Based on real GDP growth rates over 100 years, he estimated that the historical average of the real growth rates in Australia is 3%. Assuming the long-term inflation rate of 2.5%, we obtain the nominal GDP growth rate as follows.

\[ g = (1 + 0.03)(1 + 0.025) - 1 \approx 0.0566 \]

Implicit in our approach for choosing the long-term constant growth rate is that the constant dividend growth rate is directly related to the economy’s growth rate. This is based on Rozeff (1984), who assumed that the real growth rate of dividends is directly related to the economy’s real growth rate of output.

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6 For simplicity, we have used a constant growth rate of 5.5%.
B SFG report on the methods to estimate the MRP
Market risk premium

18 May 2013
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1. Introduction

1.1 The question

SFG Consulting has been engaged to advise the Independent Pricing and Regulatory Tribunal (“IPART” or “the Tribunal”) on methods for estimating the forward-looking market risk premium (“MRP”). This is an estimate of the difference in the expected return on the market portfolio of all risky assets and the risk free rate of interest. In almost all practical contexts, the market is considered to be the equity market because this is the type of liquid security for which market and accounting data is readily available. So for the purposes of this report we treat the market as the listed Australian equity market. The question of whether the market should be considered an international equity market or limited to Australian-listed securities does not form part of our analysis.

IPART estimates the regulated rate of return as the prevailing cost of funds at the time of each determination. It is an estimate of the return investors require at each point in time before they are prepared to commit capital. There are separate estimates for the cost of debt and equity capital, and those estimates are weighted by an estimate of the proportions of debt and equity finance used to finance the firm.

In recent years the estimate of the market risk premium has become contentious because regulators have almost uniformly maintained an estimate of 6%, despite historically low government bond yields. The figure of 6% is an approximation of the annual average difference between Australian equity market returns and government bond yields.1 At present, the yield on 10-year Australian government bonds is approximately 3.5% per year, which implies an equity return of 9.5%. Assuming a corporate tax rate of 30% and a value for gamma of 0.25 to account for the imputation value of corporate tax, as assumed by IPART, the implied return from dividends and capital gains is 8.6%.2 In July of 2012 the government bond yield fell to around 2.9%. Performing the same computation at this point implies a return to equity holders of 8.9% including just 8.0% from dividends and capital gains.

The combination of low government bond yields and a constant market risk premium estimate led to estimates of the required return to equity holders which seemed implausibly low, as they occurred during periods of above-average volatility in equity market returns and share prices which were low compared to earnings and dividends. These equity market signals suggest that the cost of equity capital is above average, while the regulatory estimate suggests that the cost of equity capital is below average. In Figure 1 we present average daily values for 10 year government bond yields every six months, along with a constant market risk premium assumption of 6%.

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1 There is not general agreement that the long run average equity market return relative to government bond yields is 6.0%. For example, the most recent estimate reported by the Queensland Rail Track Corporation (2013) is 6.21% but the QCA considers this estimate to potentially be overstated. The Australian Rail Track Corporation (2013) submitted that “studies over various time periods have consistently produced estimates in the range of 6% to 8%.” Brailsford, Handley and Maheswaran (2012) estimated the average equity market return relative to government bond yields at 6.1% over the 53 years from 1958 to 2010, and for the 128 years from 1883 to 2010. The reason for the two different start dates is that the authors question the reliability of data prior to 1958, which reiterates the concern they expressed in Brailsford, Handley and Maheswaran (2008). However, for the purposes of this paper we treat the figure of 6.0% as the market risk premium that would be assumed by the Tribunal if it relied exclusively on historical returns relative to government bond yields to make its estimate of the market risk premium.

2 In cases where the cost of equity under imputation is estimated using the equation from Officer (1994) we have:

\[
\text{Return from div & capital gains} = r_e \times \left[ \frac{1 - \tau_f}{1 - (1 - \tau_f)(1 - \gamma)} \right] = 0.095 \times \left[ \frac{1 - 0.30(1 - 0.25)}{1 - (1 - 0.095)(1 - 0.25)} \right] = 0.095 \times 0.903 = 0.086.
\]

This equation relies upon the assumption that expected cash flows are a level perpetuity, which is not generally the case in reality, but is an equation often adopted by regulators.
The reason for these contrasting signals relates to estimation error. The reason IPART and other regulators have maintained a constant estimate of the market risk premium of 6% is because in their view they have not had a reliable, transparent technique for making adjustments to this estimate on the basis of market data. While it makes intuitive sense that the market risk premium is high when share prices fall and volatility increases, regulators are concerned that an adjustment to the market risk premium will be subjective and lead to a lack of confidence amongst regulated entities and consumers.

This rationale was convenient prior to the global financial crisis. But as the figure above illustrates, this argument does not contemplate the situation where yields on government bonds exhibit sharp, sustained declines. This leads to the question of whether we have techniques and data available to us to make a timely estimate of the market risk premium.

1.2 Why is the solution not simple?

The problem outlined above is that assuming that the market risk premium is equal to a long term average equity market return above government bond yields led to implausibly low cost of equity estimates when bond yields fell substantially. This begs the question as to why the solution is not simply to estimate equity market returns as their long term average, and estimate the market risk premium as the difference between this long term average and the current risk free rate. The reason the solution is not quite so simple is that there are at least two possible explanations for low government bond yields at any point in time.

The first possible explanation is that there are low inflation expectations. In this circumstance it might be the case that the real expected return on equity is normal, so applying a constant market risk premium of 6% might be appropriate. In nominal terms it would lead to a low estimate of expected...
returns, compared to what we have observed historically. But the real expected return would be appropriate.

The second possible explanation is that there is a flight to quality. Investors pay high prices for the safest security available, pushing down yields on government bonds. This would occur when the cost of equity capital is high, and it would be entirely inappropriate to apply the normal market risk premium to these government bond yields to estimate the cost of equity. During the global financial crisis we observed illiquid debt markets, sharp falls in equity prices, investment funds increase their allocations to cash and falls in government bond yields. It is hard to argue against the flight to quality explanation in this circumstance.

The challenge, however, is that we need a technique for estimating the market risk premium in all circumstances, not just during normal market conditions (when applying a constant premium of 6% had previously seemed to suffice), and not just during crisis periods (when using a long term average equity return would probably have led to more plausible estimates of the cost of equity than applying a constant premium of 6%).

1.3 What are we trying to measure?

An alternative solution to the problem identified above is to alter the risk free rate assumption, rather than the estimate the market risk premium with respect to market conditions. This is an option being considered by the Tribunal and which has received broad support in submissions by regulated entities. The broad support for the use of long term average estimates for the risk free rate and the market risk premium requires some comment on what we are trying to measure and why, and what we are not trying to measure and why.

What we are trying to measure is the cost of equity capital at a point in time, which sets the present value of all future cash flows to equity holders equal to the share price. It can be labelled a “spot” cost of equity, or a “short run” cost of equity in the sense that it represents the cost of equity at one point in time. But this does not imply that it is the required return for an investment horizon over a short period of time. It is still an estimate of the cost of equity capital applying to all cash flows available to equity holders in perpetuity.

Stakeholders have commented that investors make decisions with a long term perspective which might differ from the short term equity returns implied by share prices. But it is important to recognise that what the share price implies is the long term required return of investors, if we derive that required return as the internal rate of return from all future cash flows. Consider the case of a superannuation fund that makes three investments – a 10 year corporate bond offering a yield to maturity of 8% per year, an investment in an unlisted infrastructure asset with an estimated internal rate of return of 10% per year, and an investment in a listed equity security with an estimated discount rate of 12% per year. All three investments have been evaluated with reference to expected cash flows over the long term.

3 Australian Rail Track Corporation (2013) stated that “ARTC has argued in previous submissions to the Tribunal that the best estimate of the true long-run market risk premium is the current long-run market risk premium (p.16).” EnergyAustralia (2013) stated that “[t]he approach used by IPART for the risk free rate should be considered in such a way that is consistent with the estimation of the market risk premium (p.3).” Sydney Catchment Authority (2013) noted that the use of a short-run risk free rate and a long-run MRP would not be internally consistent (p.3). Sydney Water submitted that the use of a long-term average risk free rate in combination with a long-term average MRP estimate, or the use of a short-run risk free rate with a short-run MRP estimate were both “modifications to the standard specification of the CAPM that could potentially resolve the issue of prevailing low risk free rates (p.22 of the NERA report).” Origin (2013) stated that the MRP and risk free rate should be estimated as long term averages, using the same averaging period, to avoid an under or overestimation of the return on equity (p.6). Furthermore, Origin unequivocally stated its view that it “does not believe that forward looking models for MRP provide a greater degree of certainty or accuracy around the MRP than historical averages.”
Now suppose that there is a financial crisis, leading to falls in the prices of all three risky securities. Corporate bond yields rise to 11% per year, the valuation of the unlisted infrastructure asset falls such that the IRR rises to 13% per year, and the price of the shares falls to the point where the discount rate for equity rises to 15%. The yields on these three securities have risen because they reflect the required returns to investors who are entitled to all future cash flows.

So what we are trying to measure is the true changes in equity investors’ required returns, over the entire asset life, under different market conditions. The motivation for the measurement of the true cost of capital relates to incentives. There is a risk that, if the regulated return is below the true cost of funds then investment will be delayed and reliability standards will be met using programs that rely upon higher operating costs. Alternatively, if the regulated return is above the true cost of funds then there is the risk that infrastructure providers will attempt to justify capital expenditure which is above what is economically efficient.

In setting the regulated return the Tribunal will need to consider these incentive implications as well as the potential adverse impacts of cost of capital estimates that vary over time. At the IPART workshop on 25 March 2013 participants noted some of these potential adverse impacts – that consumers might be adversely affected if utility prices vary over time with rises or falls in the stock market; investor confidence in the regulator might be lowered if there is substantial variation in regulated rates of return over time; two different utilities in the same industry might receive materially different regulated rates of return merely because of the timing of their regulatory determinations; and infrastructure owners including local councils are facing substantial reductions in revenue due to falls in the risk free rate of interest.

This leads to what our analysis does not attempt to measure, which is the economic consequences of setting the regulated rate of return at the prevailing cost of funds. It is a matter for the Tribunal to determine whether the objectives of regulation are most likely to be achieved by setting the regulated return in this manner, or with reference to historical realised returns (on equity or debt), or historical realised yields (on equity or debt). The only way in which stakeholders can debate the implications of any deviation in the regulated rate of return and the true cost of funds is if there is, in fact, a measurement of the true cost of funds.

1.4 Stability

In considering the estimates presented in this paper it is also important to note that more stable estimates over time are not necessarily better or worse. The cost of funds over time varies, even for the risk free proxy as illustrated in Figure 1. But we can only observe an estimate of the true cost of funds over time. This means that we cannot disentangle variation over time due to estimation error (or “noise”) and variation over time in the true cost of funds. An estimate which is relatively more stable over time might be better because it is contaminated with less noise, or it might be worse because it does not capture the true variation in the cost of capital.

For this reason we consider alternative estimates of the prevailing cost of funds, in an attempt to mitigate estimation error in any one metric. We derive estimates in two ways. One technique relies upon four market-wide indicators of economic conditions, and the second technique relies upon analyst forecasts for earnings and dividends. In turn, we present two alternative cost of capital estimates derived from analyst forecasts – we compute one set of estimates and use Bloomberg estimates as another source.

1.5 Analysis is independent of the CAPM

IPART relies upon the Capital Asset Pricing Model (“CAPM”) to estimate the cost of equity component of the regulated rate of return, and the market risk premium is an input into this model.
However, the estimate of the prevailing cost of equity for the market will be required, regardless of the particular model or estimation techniques used to estimate the cost of equity for the regulated entity. In its submission for Sydney Water (2013), NERA proposes that models other than the CAPM should be adopted, including the Fama & French model, the Black CAPM and the dividend growth model. NERA also considers the use of independent export reports. With respect to these first two models, the market risk premium estimate remains a direct input into the model. With respect to the application of a dividend growth model to a particular firm, or reference to independent expert reports, it is important for the Tribunal to consider what its estimate of the cost of equity would be for the average firm, so it can determine whether the risks to the regulated entity justify a cost of equity which is above or below average.

It is important to emphasise that the problem of implausibly low cost of equity estimates implied by low government bond yields is independent of IPART’s selection of the CAPM as its equation for computing the cost of equity. The problem would have arisen if any other equation or estimation technique was populated with the long run average equity market return relative to government bond yields and the current spot rate on government debt. In other words there are three issues that are independent – one issue is the risks that the Tribunal considers are incorporated into the cost of equity capital (this leads to the selection of the models for determining the cost of equity), the second issue is just what is the prevailing cost of equity at the time of the determination for the average firm, and the third issue is whether the cost of equity should be set at the prevailing cost of funds or as an estimate based upon long term realised returns.

1.6 Imputation credits

Our analysis does not consider the impact of imputation credits on the cost of capital. At all times in this paper our estimates of the cost of equity represent the expected returns from dividends and capital gains only. If part of the return allowed to a regulated entity reflects compensation for the value of imputation credits, then if our estimates were adopted, the total allowed return would need to be increased to allow for the value of these credits.
2. Alternative estimates

2.1 Introduction

To estimate the market cost of equity, and by extension the premium over government bond yields at each point in time, we present two feasible approaches. One approach is to examine some market-wide indicators of the market risk premium. Depending upon the level of these indicators compared to average levels, we can make an estimate of how far above or below a normal level is the market risk premium at any point in time. A second approach is to directly estimate the cost of capital as that which directly sets the present value of expected future dividends equal to current share prices. In the paragraphs below we discuss each of these approaches.

2.2 Market-wide indicators

There are four market-wide indicators of the market risk premium which are useful for estimation – dividend yield, risk free rate, corporate bond spread and term spread. These indicators are used in the finance literature as proxies for market conditions in a number of fields. For example, Petkova and Zhang (2005) measure the relative risk of value and growth stocks during periods of different market conditions. They use these four variables as indicators of the expected market risk premium and estimate the expected market risk premium as the predicted value from the following regression equation, presented as equation 1 in their paper:

\[ r_{mt+1} = \delta_0 + \delta_1 DIV_t + \delta_2 DEF_t + \delta_3 Term_t + \delta_4 TB_t + e_{mt+1} \]

where \( r_{mt+1} \) is the market return relative to the risk free rate in month \( t+1 \) and the four conditioning variables in month \( t \) are the dividend yield \( (DIV) \), default spread \( (DEF) \), the term spread \( (TERM) \) and the short term treasury bill rate \( (TB) \).

Given that there are no regulators in Australia that estimate the market risk premium directly with reference to these indicators, we have compiled estimates using an approach that we believe is as simple to estimate and explain to businesses and consumers as possible. There may be more sophisticated approaches to incorporating these indicators into the analysis. But at this stage we think it is important to establish the validity of this approach as providing useful information about the market risk premium at each point in time, without conjecture about just how precise the measurement can be made with more sophisticated analysis.

The advantage of this technique is that it is transparent and easily implemented. Its disadvantage is that it remains an indirect estimate of the market risk premium, rather than being a direct estimate of the discount rate incorporated into share prices at a point in time. It should be emphasised, however, that reference to these indicators is entirely consistent with the intuition of regulated entities that, given historically low government bond yields, the application of a constant MRP estimate of 6% is too low. They make the argument that it is implausible that equity finance at around 9.5% is cheaper than prior to the global financial crisis. In general terms they contend that equity market conditions are worse than five years before so the cost of equity should be higher than five years before. We simply take four indicators of those equity market conditions are derive an explicit estimate of the market risk premium.

The approach presented in this paper is to estimate, at each point in time, where the indicator lies relative to its historical distribution, and then apply this to a distribution for the market risk premium.

\footnote{In turn, Petkova and Zhang (2005) cite the following papers as justification for the use of these found indicators of the market risk premium – Fama and French (1988) for the dividend yield, Keim and Stambaugh (1986) for the default premium, Campbell (1987) and Fama and French (1989) for the term premium, and Fama and Schwert (1977) and Fama (1981) for the short-term Treasury bill rate.}
We have assumed that the market risk premium is uniformly distributed between 3% and 9%, so that the mid-point is equal to the regulators’ standard assumption that the market risk premium is 6%. We arrived at the lower bound of 3% because in estimates of the market risk premium derived from share prices published in the academic literature, there are few estimates that are below 3%, and that for the purposes of regulation it seems unrealistic to think that a regulator would actually set the MRP below this level. The regulator would be unlikely to set the MRP below this level because of the risk that the regulated rate of return is below the true cost of funds purely because of measurement error.

The four market-wide indicators we rely upon are:

1. The risk free rate – 10 year government bond yields estimated by the Reserve Bank of Australia;
2. The term spread – The difference between 10 year and 2 year government bond yields estimated by the Reserve Bank of Australia;
3. The corporate spread – The difference between the UBS all maturities credit yield and the UBS treasury yield; and
4. The dividend yield on the All Ordinaries Index, estimated by Datastream.

We take average values of these indicators each calendar month, and compute the percentile based upon where this average lies compared to all previous monthly averages and the current monthly average. In compiling percentiles we use all available historical information for the relevant indicator. To illustrate, in January 2013 we had the following four averages and percentiles:

1. The risk free rate was 3.4% which was the 99th percentile compared to the average monthly risk free rate from July 1969 to January 2013.\(^5\)
2. The term spread was 0.6% which was the 61st percentile compared to the average monthly term spread from January 1976 to January 2013.
3. The corporate spread was 1.0% which was the 67th percentile compared to the average monthly corporate spread from September 1996 to January 2013.\(^6\)
4. The dividend yield was 4.2% which was the 75th percentile compared to the average monthly dividend yield from January 1987 to January 2013.

All four indicators suggest that the market risk premium in January 2013 is high relative to what we would observe in average market conditions. On average, each indicator is at the 75th percentile of its historical distribution. Applying this to a uniform range of 3% to 9% for the market risk premium, we have an estimate of 7.5%, computed as \(3\% + 0.75 \times (9\% - 3\%) = 7.5\%\).

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\(^5\) With respect to the risk free rate we convert this from the 1st percentile to the 99th percentile so that it is directionally consistent with the other indicators.

\(^6\) This is not of the same magnitude as the investment grade corporate bond spread typically estimated by regulators in determining the debt component of the regulated rate of return. It is derived from a broad sample of corporate credit instruments with different default risk and different terms to maturities. The spread is lower than the spread on BBB or BBB+ corporate bonds with five or ten years to maturity.
In Figure 2 we illustrate our estimates of the market risk premium on a six monthly basis over the 11 year period from 2002 to 2012. The data points are average estimates every six months, but the estimates can also be computed as a point estimate on a monthly basis or as a rolling average every month. With respect to the six month average estimates the highest market cost of equity estimate was 13.6% in the second half of 2009 and the lowest cost of equity estimate was 10.6% in the second half of 2012. The range for the market risk premium was from a high of 8.7% observed in the first half of 2009 to a low of 5.9% observed in the first half of 2002. Until government bond yields began to decline in the second half of 2008, the average estimated market risk premium from 1H02 to 1H08 was 6.6%, which is 0.6% higher than under the assumption of a constant market risk premium of 6.0%.

2.3 Analyst-implied estimates

Estimates of the cost of equity derived from analyst forecasts for earnings and dividends are the most direct estimate of the cost of equity capital. In this section we present two sets of estimates. One set of estimates is derived from our own technique and the second set of estimates is compiled by Bloomberg according to Bloomberg’s technique. While a more direct approach than the market-wide indicators approach, this method suffers from two limitations. First, it is more computationally-intensive than the market-wide indicators approach. Second, it relies upon an assumed process by which dividends over a long period are expected to evolve. The specification of that process will influence both the level and variation of the estimated market risk premium over time. While these are relevant limitations, they are not insurmountable.

Cost of equity estimates derived from analyst forecasts are often referred to as dividend growth model estimates. The reason for this terminology is that the task is to estimate the cost of equity after accounting for near term dividend forecasts, typically from one to three years, and the growth in those
dividends over time. However it is important to understand that there is no requirement that dividends grow at a single, constant rate outside of this near term forecast horizon.

The conceptual task is relatively straightforward to understand. It is analogous to estimating the yield to maturity on corporate bonds as the discount rate which sets the present value of payments to bond holders equal to the bond price. The application, however, is more challenging because we need to estimate a perpetual series of dividends, despite only having a short series of dividend and earnings expectations from analyst forecasts. This means that we need to jointly estimate a series of dividends and a cost of capital. The dividend series will be determined, in the short term, by analyst expectations of earnings and dividends per share. But outside of this explicit forecast period, this dividend series will be determined by expectations for growth of those dividends. Depending on the model adopted there could be one or more growth stages. The reason we refer to this as a process by which dividends evolve is to emphasis that growth does not need to be constant at any particular stage or in perpetuity.

While convenient for computations, constant growth is just one process by which dividends could evolve.

The most important issue to understand about growth expectations is that these cannot be arbitrarily imposed on the analysis on the basis of what is considered reasonable by the person undertaking the task. What is being estimated is the growth rates incorporated into share prices set by the market, not imposed on the analysis from an external source.

The caution against imposing a growth rate on the analysis according to the researcher’s or analyst’s view as to what is correct is made by Easton (2006) who states:

In light of the fact that assumptions about the terminal growth rate are unlikely to be descriptively valid, the inferences based on the estimates of the expected rate of return that are based on these assumptions may be spurious. The appeal of O’Hanlon and Steele (2000), Easton, Taylor, Shroff and Sougiannis (2002) and Easton (2004) is that they simultaneously estimate the expected rate of return and the expected rate of growth that are implied by the data. The other methods assume a growth rate and calculate the expected rate of return that is implied by the data and the assumed growth rate. Differences between the true growth rate and the assumed growth rate will lead to errors in the estimate of the expected rate of return.

The simplest formation of the dividend discount model of equity valuation is the case where dividends are expected to grow at a constant rate in perpetuity. In this constant growth version of the dividend discount model, we have the following equation:

\[ P = \frac{D_1}{r_e - g} \]

where \( P \) is the share price, \( D_1 \) is the expected dividend in one year, \( r_e \) is the cost of equity capital and \( g \) is the constant expected growth rate of dividends.

So in this simplest case, we have a reasonable expectation for dividends, but need to jointly estimate the cost of equity and growth. Bloomberg uses a more detailed approach than this. It has two stages of growth prior to reaching this perpetual growth state, and the length of these stages is contingent upon whether the security is classified as having low, average, high or explosive growth. Ultimately, however, the assumption incorporated into the terminal value is that returns on reinvested earnings equal their cost of capital.

This means that Bloomberg solves the problem of simultaneously estimating \( g \) and \( r_e \) by assuming that, in the terminal state, \( g = (1 - \text{dividend payout ratio}) \times r_e \). This is the crucial assumption adopted by
Bloomberg to allow it so estimate the cost of equity capital for each firm in the market, and for the market risk premium as a market capitalisation-weighted average for all firms.\(^7\)

The process by which we project dividends and then simultaneously estimate \(g\) and \(r\) is different on two fronts. The first difference is that we use individual analyst forecasts for each stock to jointly estimate a set of three parameters (long-term growth, cost of equity and long-term return on equity). In contrast, Bloomberg relies upon the consensus (that is, average) dividend and earnings forecasts for each stock and imposes the assumptions that the long-term payout ratio is 45\% and that long-term returns on equity equal the cost of equity capital.

In our technique, we consider 2,672 possible values for the cost of equity, long-term growth and return on equity and determine which combination provides valuations close to analyst price targets, and which allows a smooth transition from near-term growth to long-term growth. The cost of equity takes on a range of 4\% to 20\%, long term ROE takes on a range of 3\% to 30\% (and which can’t be more than 1\% below the cost of equity) and long-term growth takes on a range of 1\% to 10\% (and which must be less than the cost of equity). We measure ROE according to earnings per share forecasts in year two and book value of equity at the end of year one, and then assume that this return on equity changes incrementally in equal amounts to the long-term ROE estimate. The dividend payout ratio also changes incrementally in equal amounts to the long-term dividend payout ratio, which is equal to \(1 - \frac{g}{\text{ROE}}\).

In estimating the beginning dividend payout ratio, we take into account growth from new share issuance. On average, firms issue 1.7\% new shares each year, which will lead to positive growth in earnings per share if investments made from that new equity earn returns above the cost of capital. So we first estimate combined growth from new share issuance and reinvestment of earnings, and then ask, “If growth was instead financed entirely with reinvestment of earnings rather than new share issuance, what would the reinvestment rate need to be to achieve the same growth?”

From all combinations of \(r, g\) and ROE this allows us to compute 2,672 valuations for each analyst price target, earnings and dividend forecast on each stock. We take all the cases in which the valuation is within 1\% of the price target. We then want to know which combination of inputs provides the best fit, or in other words, which is most likely to represent the dividend projections and discount rate incorporated into the valuation. Our criteria is to compare the earnings growth rate in year 10 with the long term growth rate. We select the case in which the ratio of year 10 growth to long term growth is closest to one, and this provides us with our best estimate of the cost of equity, long-term growth and long term return on equity.\(^8\)

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\(^7\) Note that the cost of equity estimates that Bloomberg reports for individual firms are a combination of dividend discount model estimation and a Capital Asset Pricing Model estimate. Bloomberg compiles individual firm cost of equity estimates, takes a market capitalisation weighted average of these estimates to determine the market-wide cost of equity and market risk premium, and then applies its estimate of firm-specific beta to determine each firm’s cost of equity estimate.

\(^8\) The process by which we project earnings and dividends over a 10 year forecast horizon and then into perpetuity is presented in more detail in Fitzgerald, Gray, Hall and Jeyaraj (2013). There are two differences between the method presented in that paper and the one applied here. First, in the current analysis we incrementally adjust the year two dividend payout ratio to the long term dividend payout ratio. In the academic paper we maintain a constant dividend payout ratio over the first 10 years and then shift in one step to the long term dividend payout ratio. Second, in the current analysis we determine the best estimates according to the ratio of year 10 growth in earnings compared to long term growth in earnings. The ratio closest to one implies the smoothest transition of growth over time. In the academic paper we assume that all analysts covering the stock incorporate the same cost of equity capital, long term growth rate and long term ROE and measure which combination generates the lowest dispersion of valuations relative to price targets. This assumption leads to estimation error because the analyst price targets exhibit too much dispersion for it to be reasonable to assume they all have the same long term inputs. Other published papers make the even more tenuous assumption that all firms in the same industry have the same long term expectations.
In the table below we summarise the differences between the computation of our cost of equity estimates and those of Bloomberg. There are two fundamental differences. First, Bloomberg makes the assumption that long term growth is equal to a long term reinvestment rate of 55% and the cost of equity capital. In other words, Bloomberg assumes that investments are expected to earn a return equal to the cost of equity capital in the mature stage. In contrast, we transition to a variety of long term growth rates and ROE assumptions, and select the growth rate which provides a valuation close to price target and for which the ratio of year 10 growth to long term growth is closest to one.

Second, our analysis is performed for each analyst covering each firm, rather than for the average analyst covering each firm. This provides a richer data set for analysis and allows us to match earnings expectations with price targets of the same analyst.

In this paper our estimates of the market cost of equity is the market capitalisation weighted average estimate for all stocks for which sufficient information is available for analysis. Each six months we take an average of the cost of equity across all analyst forecasts for each stock, and to estimate the cost of equity for the market we take a market capitalisation average of the cost of equity estimates for each stock.

The total number of analyst inputs which had sufficient data available for analysis was 39,565. This means that over the 10.5 year period there were just under 40,000 combinations of earnings per share expectations, dividends per share expectations and price targets for Australian-listed firms with all other data available for analysis. An individual analyst can make more than one input for each firm in a six month period and these inputs are incorporated into the analysis.

This allows us to construct a sample of 4,568 observations. This means that, on average, each time a firm appears in a six month period, the data is the result of 8.7 analyst inputs and estimates of the cost of equity capital. There were 561 individual firms in the dataset which means that, on average, each firm appears in the dataset 8.1 times over the 10.5 year period.

In Figure 3 we present analyst-implied estimates of the cost of equity capital from our computations and those of Bloomberg. Our estimates of the cost of equity range from 9.7% in the first half of 2006 to 11.3% in the first half of 2009. Our estimates of the market risk premium range from 4.1% in the second half of 2007 to 7.9% in the second half of 2012. There is a noticeable increase in the estimated market risk premium from the second half of 2008, which coincides with the global financial crisis. From 2H02 to 1H08 the average estimated cost of equity is 10.3%, which increases to an average 10.9% from 2H08 to 2H12. The market risk premium increases from an estimated 4.7% over 2H02 to 1H08, to an average 6.2% from 2H08 to 2H12.

Bloomberg estimates are only available from the second half of 2008 onwards. For the four and a half years of data that are available, the Bloomberg estimates of the cost of equity are higher than our estimates, by an average of 2.8%. The Bloomberg estimate of the cost of equity averages 13.7%, compared to our estimate of 10.9%. This corresponds to an average market risk premium estimate from Bloomberg of 9.0%, compared to our estimate of 6.2%.

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9 The Bloomberg estimates we present are a market capitalisation weighted average for the Australian equity market for which analyst forecasts are available. Note that the Bloomberg estimates for each individual stock are actually a combination the CAPM beta estimate from regression analysis, the risk-free rate and the market risk premium from the dividend growth analysis. Bloomberg does not report dividend growth cost of capital estimates for individual stocks.
Table 1. Comparison between SFG and Bloomberg estimates of the cost of equity

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<th>SFG</th>
<th>Bloomberg</th>
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<td>Time period prior to</td>
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<td>19 years</td>
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<td>constant/mature growth</td>
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<td>What is the ROE at</td>
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<td>maturity?</td>
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<td>What is the dividend</td>
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<td>maturity?</td>
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<tr>
<td>What is the constant</td>
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<td>$(1 - DPR) \times r_e$</td>
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<td>long term ROE over</td>
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<td>remaining 8 years</td>
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<td>Data</td>
<td>Individual analyst</td>
<td>growth rate over transition</td>
</tr>
<tr>
<td></td>
<td>forecasts of dividends</td>
<td>stage</td>
</tr>
<tr>
<td></td>
<td>and earnings matched</td>
<td></td>
</tr>
<tr>
<td></td>
<td>with the individual</td>
<td></td>
</tr>
<tr>
<td></td>
<td>analyst price target</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>On each date, average</td>
</tr>
<tr>
<td></td>
<td></td>
<td>values computed for all</td>
</tr>
<tr>
<td></td>
<td></td>
<td>outstanding analyst inputs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>available at that date.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Earnings and dividend</td>
</tr>
<tr>
<td></td>
<td></td>
<td>expectations matched with</td>
</tr>
<tr>
<td></td>
<td></td>
<td>share price.</td>
</tr>
</tbody>
</table>

Over the time period for which data is available, it is clear that the Bloomberg estimates of the market cost of equity are both higher than our estimates, and more variable over time. We cannot say with certainty which series exhibited the “correct” level of variation over time because both series are estimates of the cost of capital. The Bloomberg series could be more volatile over time because the true cost of equity varied considerably over this time period; or the Bloomberg series could be more volatile because of noise.

The Bloomberg series is more sensitive to short-term price fluctuations because analysts do not instantaneously adjust their earnings forecasts every time the share price moves. When there is a large change in the share price, this reflects news about expected cash flows, or news about the risk of those cash flows, or both. If analysts instantaneously adjusted their earnings forecasts every time the share price moved, the news about expected cash flows would be reflected in the share price and the analyst’s earnings forecast. But if the share price changes and analysts do not immediately adjust their earnings forecasts, the movement in the implied cost of capital will be overstated.
An example illustrates the point. For the purposes of the example we use the constant growth dividend discount model, although Bloomberg does not assume constant growth until a long period into the future. Suppose that a stock is trading at $10.00 per share, on expectations that the next dividend will be $0.50, grow at 6% in perpetuity, and the cost of capital is 11%. That is, we have \( P = \frac{D_1}{r - g} \) = \( \frac{0.50}{0.11 - 0.06} \) = $10.00. Now suppose that the market receives bad news about dividends, so expected dividends fall to $0.40. There is no change in risk and no change in the anticipated growth of those dividends. The share price falls by 20% to $8.00.

If analyst forecasts had been immediately updated to reflect the dividend fall to $0.40, the implied cost of equity would still be 11%. We would have \( r_e = \frac{D_1}{P} + g = \frac{0.40}{8.00} + 0.06 = 0.05 + 0.06 = 11.00\% \). But if analyst forecasts were not updated at all, the share price movement will lead to an estimate of the cost of capital which is unreasonably high. If the dataset still includes a dividend forecast of $0.50 we would have \( r_e = \frac{D_1}{P} + g = \frac{0.50}{8.00} + 0.06 = 0.0625 + 0.06 = 12.65\% \).

At each point in time, the consensus analyst forecasts used by Bloomberg lag behind the information contained in share prices, so time series of the cost of equity will exhibit more volatility than the true cost of capital. Our estimates are not affected by this lag, because our estimates are made with respect to analyst earnings forecasts and price targets. In addition, those estimates of earnings forecasts and price targets are made at approximately the same point in time by the same analyst.

The discussion above explains why the Bloomberg estimates exhibit more variation over time than our estimates. We also need to consider why the Bloomberg estimates are higher than our estimates over the recent time period. On average this difference is 2.8% over the period 2H08 to 2H12. This can be allocated into a 1.0% difference from higher dividend yields in the Bloomberg estimates and 1.8% from assumptions which lead to higher growth projections.
The difference in yields is due to Bloomberg matching analyst earnings forecasts with share prices, rather than price targets. The difference in growth assumptions results from Bloomberg allowing higher average returns on investment in the early years of cash flow forecasts, before setting those returns equal to the cost of capital in the long-term. The profile for investment returns which underpin our cost of equity estimates is smoother than the Bloomberg profile. On average the return on equity generated by our technique, in the long term, is similar to existing returns on equity for the firms. Firms earning high returns initially eventually earn lower returns, and firms earning low returns eventually earn higher returns. But on average returns on equity across the sample, and across industries, are approximately the same in the long term as in the historical data. In contrast, the implied returns on investment which underpin the Bloomberg estimates are higher than observed in historical data, and lower in the long-term. The net impact of this difference in returns is higher growth rates from the Bloomberg estimates.

2.4 Summary of cost of equity and market risk premium estimates

It is useful to summarise the various estimates of the cost of equity and market risk premium for two periods of 2H02 to 1H08, and 2H08 to 2H12. Average estimates are presented in Table 2. In the first period which precedes the global financial crisis, we have average estimates for the cost of equity of 10.3% implied by analyst forecasts, 11.6% if we simply add 6.0% to the risk free rate and 12.3% from market-wide indicators. These averages correspond to MRP estimates of 4.7%, 6.0% and 6.6%, respectively.

In the second period, the average cost of equity estimates from analyst forecasts increases to 10.9% and the average estimate from market-wide indicators increases to 12.6%. We also have an estimate from Bloomberg which averages 13.7%. These three estimates correspond to MRP estimates of 6.2%, 7.9% and 9.0%, respectively. In contrast, applying a constant MRP estimate of 6.0% would imply that the cost of equity had fallen by 0.9% from the first period.

Table 2. Estimates of the cost of equity and market risk premium

<table>
<thead>
<tr>
<th>Period</th>
<th>Technique</th>
<th>Cost of equity (%)</th>
<th>MRP (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2H02 to 1H08</td>
<td>rf + 6%</td>
<td>11.6</td>
<td>6.0</td>
</tr>
<tr>
<td></td>
<td>Market-wide indicators</td>
<td>12.3</td>
<td>6.6</td>
</tr>
<tr>
<td></td>
<td>Analyst implied (SFG)</td>
<td>10.3</td>
<td>4.7</td>
</tr>
<tr>
<td></td>
<td>Analyst implied (Bloomberg)</td>
<td>Not available</td>
<td>Not available</td>
</tr>
<tr>
<td>2H08 to 2H12</td>
<td>rf + 6%</td>
<td>10.7</td>
<td>6.0</td>
</tr>
<tr>
<td></td>
<td>Market-wide indicators</td>
<td>12.6</td>
<td>7.9</td>
</tr>
<tr>
<td></td>
<td>Analyst implied (SFG)</td>
<td>10.9</td>
<td>6.4</td>
</tr>
<tr>
<td></td>
<td>Analyst implied (Bloomberg)</td>
<td>13.7</td>
<td>9.0</td>
</tr>
</tbody>
</table>

The average risk free rate from 1H02 to 1H08 is 5.7% and the average risk free rate from 2H08 to 2H12 is 4.7%.

2.5 Implied volatility based models

With respect to implied volatility based models based on options, this can be considered an extension to the economic indicators approach discussed above, in which the market implied volatility implied by options is another indicator of risk. In this case, we have an explicit equation to estimate the market risk premium. The Sharpe ratio is the ratio of the market risk premium to market volatility. So if we have an estimate of the Sharpe ratio and an estimate of market volatility we have an estimate of the market risk premium.

A specific application of this technique is presented by Bishop, Fitzsimmons and Officer (2011). The authors document the implied volatility from call options on the S&P/ASX 200 over 14 years from 1997 to 2010, highlighting two periods when implied volatility is above average for extended periods of
time. The first period is from October 1997 to June 2000, which coincides with the Asian currency crisis and the peak of the U.S. technology sector in 2000. The second period is from June 2007 to December 2010 when their sample period ends and which coincides with the global financial crisis. They also note that the correlation between the volatility implied by call option prices and the 90-day standard deviation of returns is 90%, implying that stock return volatility over a recent period can be used as a proxy for the volatility implicit in stock prices at a point in time.

As a specific example, what is required to estimate the market risk premium is an estimate of the amount of risk (the standard deviation of stock returns) and the return the market requires per unit of risk, also termed the price of risk or the Sharpe ratio. While we can estimate volatility with reference to call option prices or as a trailing average of short-term historical stock returns, we are unable to directly observe the price of risk at any particular point in time. The authors’ estimate of the price of risk is 0.43, which is the ratio of 6% (the historical average excess returns) to 14% (average annualised volatility from January 1980 to November 2009 derived from 30 or 90 day moving averages of daily data).

So for example, if the estimated volatility was 22.5% (as it was at the time the authors wrote their paper) one estimate of the market risk premium at that time would be 9.6%, computed as $0.225 \times \frac{0.06}{0.14} = 0.225 \times 0.429 = 0.096$. Put another way, the estimated volatility at the time of writing (22.5%) was 61% higher than the estimated historical volatility (14%). This implies that the market risk premium should also be 61% higher than average, so $0.06 \times 1.61 = 9.6\%$.

A limitation of this analysis is that we have no objective measure of the Sharpe ratio at each point in time. We can estimate the average excess return relative to volatility in time series. But you can have a situation in which volatility is high, but investors’ required return per unit of volatility is low (that is, a low price of risk).

Furthermore, even if we make the assumption that historical stock returns can be used to measure a constant price of risk, there are material differences in possible assumptions. For example, an alternative estimate of the price of risk is 0.27 (Brailsford, Handley and Maheswaran, 2012). This is the ratio of annual average excess returns of 6.1% relative to the standard deviation of annual returns of 22.7% over the 53 years from 1958 to 2010. Under this alternative assumption the market implied volatility of 22.5% is approximately normal, so the estimated market risk premium will also be approximately normal. The reason for the difference in estimated Sharpe ratios, especially over the same time periods, is that estimates of annual volatility derived from daily data are generally lower than standard deviation estimates using yearly data.

The final limitation of this application of volatility based models is that the implied volatility from call options reflects volatility over a relatively short period of time. So the authors recommend that the market risk premium estimate gradually reverts to a long-term average value. They do not reach a definitive conclusion as to how long this period of time should be, but imply that five years might be reasonable as this approximates the length of recovery from a market crash.

So there are three concerns with the direct application of volatility based models to the market risk premium: (1) we cannot directly observe the price of risk at any time; (2) if we rely upon an estimated

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10 Recall that the data from 1958 onwards is considered by the authors of that study to be more reliable than the data prior to 1958. Also note that the estimates are approximately the same if we only use the data reported by Brailsford, Handley and Maheswaran (2012) from 1980 to 2009. In that series the average excess return is 5.9% and the standard deviation of excess returns is 23.3%, implying a Sharpe ratio of 0.25.
price of risk from historical returns there can be substantial differences in estimates; and (3) we require an assumption about how long it will take for conditions to revert to normal.\textsuperscript{11}

However, these are concerns only with the direct application of volatility based models to estimate the market risk premium as the product of a price of risk and a volatility estimate. Those concerns do not invalidate using implied volatility as a directional indicator of the market risk premium, alongside the indicators considered earlier (dividend yield, credit spread, term spread and the risk free rate). The task at hand is making the most reliable estimate of the market risk premium at each point in time. This estimate is likely to be improved by also incorporating market implied volatility as an indicator of whether the market risk premium is above- or below-average. This can be incorporated into the estimate of the market risk premium in the same manner as the other four indicators. This avoids needing to make an assumption about the market price of risk at each point in time, but it does require making the alternative assumption about the upper and lower bounds of the market risk premium (recall we used a range of 3\% to 9\%) and how estimated volatility maps onto this range (we assumed a uniform distribution). This is likely to provide a more reliable estimate of the prevailing cost of equity at each point in time than simply adding a constant premium of 6\% to government bond yields.

2.6 Surveys

With respect to survey-based estimates of the market risk premium, surveys presently available are unlikely to provide reliable estimates of the market risk premium. For survey evidence to be relied upon, it must be clear that the question being asked relates to an assessment of the cost of capital at the point in time. It cannot be an estimate of long-term average returns. For example, if we were to ask respondents what government bond yields are today, a good respondent would refer to the RBA website and quote the most recent government bond yield. The respondent would not compile the long term average government bond yield and would not form a view that yields are too high or low relative to what the respondent would value government bonds at. There is a risk in equity market surveys that respondents use their own estimate of a normal equity market return, rather than what is incorporated into equity prices.

A second limitation of surveys is that the respondent does not have an economic stake in the conclusion, unlike market participants. Even equity analysts, while not actually trading the stocks they cover, know that their analysis is scrutinised by clients and their sales desk. So their earnings forecasts, dividend forecasts, and price targets (and by extension their cost of capital assumptions) will have been framed on this basis.

A survey which has been given some coverage in recent times is that of Fernandez, Aguirreamalloa and Corres (2011).\textsuperscript{12} Respondents in that survey were asked the following three questions.

1. The Market Risk Premium that I am using in 2011 for my country _________ is: _______\%
2. The Market Risk Premium that I am using in 2011 for United States is: _______\%
3. Books or articles that I use to support this number:

There were 3,874 responses with market risk premium figures excluding outliers, 124 outliers and 2,016 responses in which no figure was provided. For the United States there were 1,503 responses and the

\textsuperscript{11} The Australian Energy Regulator relied upon similar reasoning to reject the use of implied volatility of an indicator of the market risk premium in its decision with respect to Multinet in 2012. The regulator rejected the use of implied volatility as both a directional indicator of the market risk premium (as submitted by SFG Consulting) and for making a direct estimate of the market risk premium (as submitted by Value Adviser Associates.

\textsuperscript{12} The IPART discussion paper refers to a more recent version of the survey paper released in 2012, but the same concerns remain.
average MRP estimate was 5.5%. For Australia there were 40 responses and the average MRP estimate was 5.8%.

Of most concern in the application of the survey is the sources used to support the MRP estimate. These responses suggest that respondents relied primarily upon historic average returns to estimate the MRP. There were 1,719 sources listed by respondents to justify their answer and at least 40% of sources are likely to represent estimates based upon historical returns. We have no way of knowing whether the participants rely upon historic returns because they consider this to be the best estimate of the prevailing market risk premium, or because they simply use a long-term MRP estimate for all valuations, regardless of market conditions.

Surveys have the appeal of being relatively easy to explain to stakeholders, and if properly implemented could provide a direct estimate of the market risk premium at a point in time. But the practical impediments to implementing a large-scale, controlled survey in a timely manner should not be underestimated. In a sense, submissions to regulators already constitute a survey, albeit with a small sample of very detailed responses. The challenge of survey evidence even comes down to the question of who can be asked the question. Do we survey investors in infrastructure assets, who would benefit from higher regulated rates of return? Do we survey equity analysts, when we can already derive their estimates of the cost of equity from their earnings forecasts and price targets?

While not wanting to be entirely dismissive of surveys, we have not observed a survey which could both be considered an informative estimate of the prevailing market risk premium and which is sufficiently timely to be used in regulation. We are able to examine surveys which indicate what participants thought the market risk premium was at a previous point in time, and this might aide our understanding of the factors associated with the market risk premium. But there is likely to be more benefit in examination of market data than examination of surveys.
3. Conclusion

In this report we recommend estimating the market risk premium with reference to both market indicators and the cost of equity capital derived from analyst forecasts. With respect to the market-wide indicators approach we recommend the use of the four indicators we have used in measurement (dividend yield, corporate spread, term spread and risk-free rate). Another potential indicator is the volatility implied by option prices, although we note that there are limitations associated with the direct application of this indicator in an equation.

With respect to analyst-implied estimates, we have presented a technique that generates a cost of equity for the market which is reasonably stable over time, but does exhibit the expected upwards movement during the global financial crisis. It allows the cost of equity to be determined by a large sample of data rather than an assumption about the growth rates which are appropriate in the view of the analyst tasked with estimating the cost of capital.

Both estimation techniques provide useful information for estimating the market risk premium using an objective process. They overcome the limitation of estimating the cost of equity by adding a constant estimate of the market risk premium to government bond yields, which has led to implausibly low estimates of the cost of equity in recent years.
4. References

C How we measure economic uncertainty

As Section 8 of this report discussed, under our new methodology for setting the WACC, we will use a decision-making framework to guide us in selecting the WACC point estimate. One element of this framework is a monthly uncertainty index, which measures the level of economic uncertainty in Australia.

C.1 Data

To construct our uncertainty index, we have used 4 variables as a proxy for economic uncertainty, which we download from Thomson Reuters Datastream. These are:

1. **S&P/ASX 200 VIX Index.** To obtain monthly observations, we average daily S&P/ASX 200 VIX Index values over a month. The S&P/ASX 200 VIX Index is not available before 1 January 2008. For observations prior to this date, we use realised volatility data.

2. **Dispersion in analysts’ forecasts** for companies in the S&P/ASX200 Index, which is available monthly.

3. **Credit spreads,** which are calculated as the difference between the UBS Australian all maturities credit yield and UBS Australian Treasury all maturities yield on a monthly basis. To obtain monthly observations, we average daily credit spreads over a month.

4. **Bills-OIS spreads,** which are available monthly.1 The Bills-OIS spreads are calculated as the difference between 90-day Bank bills and 90-day OIS.

C.2 Construction methodology

We have followed a methodology the Bank of England published in an article in its second quarterly bulletin of 2013 (BoE (2013)), which showed that economic uncertainty has a negative impact on economic activity.2

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1 We note that the 90-day Bank bills and the 90-day OIS data are available both daily and monthly through RBA’s website, but Thomson Reuters Datastream provides monthly rates, which are daily rates averaged over a month.

2 Due to data availability or accessibility, we could not obtain the same set of proxy variables as in BoE (2013). When BoE constructed its own indicator of uncertainty it used the following data: FTSE option-implied volatility, sterling option implied volatility, dispersion of analysts' earnings forecasts, dispersion of annual GDP growth forecasts, GfK unemployment expectations balance, CBI ‘demand uncertainty limiting investment’ score and a number of press articles citing ‘economic uncertainty’. Bank of England, 2013, *Macroeconomic uncertainty: what is it, how can we measure it and why does it matter?*, pp 100-109.
This method involves using a statistical technique called principal component analysis (PCA). PCA is a way of identifying patterns in data and expressing the data in a way which highlights their similarities and differences. Using this method, we combine the 4 uncertainty proxy variables and extract a single variable, called a principal component, which explains most of the variation in the original set of the 4 uncertainty proxy variables.

The uncertainty index resulting from the PCA analysis is shown in Figure 8.2. The uncertainty index has a mean of 0 and the standard deviation of 1. Each of the 4 uncertainty proxy variables is highly correlated with the uncertainty index (Table C.1).

<table>
<thead>
<tr>
<th>Table C.1 Correlation of individual uncertainty proxies with the index</th>
</tr>
</thead>
<tbody>
<tr>
<td>S&amp;P/ASX 200 VIX Index</td>
</tr>
<tr>
<td>Dispersion in analysts' forecasts</td>
</tr>
<tr>
<td>Credit spread</td>
</tr>
<tr>
<td>Bills-OIS spread</td>
</tr>
</tbody>
</table>

*Note:* The uncertainty index is constructed using data from July 2001 to October 2013.

*Source:* Thomson Reuters Datastream and IPART analysis.
D Biannual market update
Outlook

Summary

- Since mid-2013, midpoint WACC estimates have increased marginally and WACC ranges have narrowed.
- The uncertainty index is currently close to its long term average value of 0.
- Under current circumstances, IPART would not consider departing from the midpoint WACC.

Estimated WACC Parameters and Range (economy wide)¹

<table>
<thead>
<tr>
<th>Table 1  Market-based parameters as of 31 October 2013</th>
<th>RFR</th>
<th>DRP</th>
<th>MRP</th>
<th>Inflation</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 days</td>
<td>4.0%</td>
<td>1.8%</td>
<td>7.9%</td>
<td>2.8%</td>
</tr>
<tr>
<td>10 years</td>
<td>5.1%</td>
<td>2.4%</td>
<td>6.0%</td>
<td>2.9%</td>
</tr>
<tr>
<td>Midpoint</td>
<td>4.6%</td>
<td>2.1%</td>
<td>6.9%</td>
<td>2.8%</td>
</tr>
</tbody>
</table>

Table 2  IPART’s final WACC range as of 31 October 2013

<table>
<thead>
<tr>
<th></th>
<th>Lower</th>
<th>Midpoint</th>
<th>Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vanilla WACC</td>
<td>8.3%</td>
<td>8.6%</td>
<td>9.0%</td>
</tr>
<tr>
<td>Real post-tax</td>
<td>5.3%</td>
<td>5.6%</td>
<td>5.9%</td>
</tr>
</tbody>
</table>

Economic Uncertainty

- The index shows that uncertainty has trended down following positive spikes in 2008, 2009 and 2011.
- The uncertainty index is close to 0, suggesting uncertainty is currently in line with the long term average.
- Based on the current level of the index, we would not consider moving away from the midpoint WACC.

¹ RFR, DRP and MRP in Table 1 refer to risk-free rate, debt risk premium, and market risk premium. RFR, DRP, MRP and inflation are midpoint values and expressed in nominal terms. The WACC estimates in Table 2 are post-tax WACCs and assume an equity beta of 1, 10-year target term-to-maturity and a gearing ratio of 60%.
Analysis
Industry-specific WACC midpoints and ranges

WACC estimates declined throughout 2012 and the first half of 2013.

As WACC estimates declined, the range between upper and lower bounds appears to have widened.

WACC estimates hit record low levels around mid-2013.

Since mid-2013, WACC estimates have generally shown modest upward movements.

Since mid-2013, the WACC range has narrowed.
WACC parameters

<table>
<thead>
<tr>
<th>Sector</th>
<th>Beta</th>
<th>Target term to maturity</th>
<th>Gearing Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>Mid</td>
<td>High</td>
</tr>
<tr>
<td>Water</td>
<td>0.60</td>
<td>0.70</td>
<td>0.80</td>
</tr>
<tr>
<td>Transport</td>
<td>0.80</td>
<td>0.90</td>
<td>1.00</td>
</tr>
<tr>
<td>Electricity - Generation</td>
<td>0.95</td>
<td>1.05</td>
<td>1.15</td>
</tr>
<tr>
<td>Electricity - Retail</td>
<td>0.90</td>
<td>1.00</td>
<td>1.10</td>
</tr>
</tbody>
</table>

Uncertainty index

- The uncertainty index summarises 4 key financial market indicators. As of 31 October 2013:
  - Equity market volatility is currently **slightly above average**.
  - Dispersion in analysts’ forecasts is currently **slightly below average**.
  - Credit spread is currently **below average**.
  - Bills-OIS spread is currently **below average**.
- The uncertainty index is currently less than 1 standard deviation away from the long term average.
- The methodology for the uncertainty index and our decision rule relating to moving away from the midpoint WACC are provided in the **WACC Methodology - Final Decision**.

Additional financial market and economic information (illustration only)

<table>
<thead>
<tr>
<th>Cost of Debt</th>
<th>Cost of Equity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Market Data</td>
<td>Trending up</td>
</tr>
<tr>
<td>2. Analyst Reports</td>
<td>Stable</td>
</tr>
<tr>
<td>3. Expert Consultant Reports</td>
<td>Stable</td>
</tr>
</tbody>
</table>

- Market data:
  - Corporate debt issues over the last 6 months indicate that the spread over Commonwealth Government Securities is trending upwards (Kanganews).
  - The interest SWAP curve has remained relatively stable over the last 6 months.
  - Recent equity issues (eg, OzForex) indicate strong demand and, consequently, high price to earnings ratios. This suggests downward pressure the on cost of equity.

- Analyst reports:
  - We have reviewed recent equity analyst reports on utilities and the utility sector.
  - Analysts have not significantly changed their cost of capital assumptions (ie, risk free rate, market risk premium and debt risk premium) over the last 6 months.

- Expert consultant reports:
  - We have reviewed a recent expert consultant report from BDO. This report includes a detailed discount rate assessment which contains the following:
    - Risk free rate: 10-year Commonwealth Government Security yield of 3.82%.
    - Cost of debt: commercial loan rates ranging from 5% to 7%. This is consistent with our estimates for the cost of debt.
    - Cost of equity: market risk premium (MRP) of 6% based on the long run average MRP. This is consistent with the midpoint of our MRP range used to estimate the WACC using long-term averages.

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2 IPART, **WACC Methodology – Final Decision**, December 2013.