



Rate of return

**CAPM and alternative
return on equity models**

Draft working paper

August 2020

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Shortened forms

Shortened form	Extended form
2018 Instrument	The rate of return instrument published on 17 December 2018
2022 Instrument	The rate of return instrument to be published on 16 December 2022
AER	Australian Energy Regulator
Brattle	The Brattle Group
CAPM	Capital asset pricing model (Sharpe-Lintner CAPM)
CGS	Commonwealth government securities
DGM	Dividend growth model
ERP	Equity risk premium
ICAPM	International capital asset pricing model
Instrument	Rate of return instrument
MRP	Market risk premium
NEL	National electricity law
NEO	National electricity objective
NGL	National gas law
NGO	National gas objective
SL CAPM	Sharpe-Lintner Capital Asset Pricing Model (or just CAPM)
WACC	Weighted average cost of capital

1 Overview

This working paper is part of a series that we will produce as part of our pathway to the 2022 rate of return Instrument. The outcomes from these working papers will feed in to the active phase of our 2022 rate of return Instrument review. This information will assist us to develop a 2022 rate of return Instrument that sets a rate of return that contributes to the achievement of the National Gas Objective (NGO) and National Electricity Objective (NEO).¹ These objectives focus on the long term interests of consumers.² In advancing consumers' interests we aim to promote efficient investment in and operation of regulated energy businesses.

1.1 The rate of return

Investors in any business expect to receive an additional return above their initial investment (or capital). We use the phrase 'rate of return on capital'—or just 'rate of return'—to refer to this additional amount when expressed as a percentage of the initial investment.

We estimate the rate of return for regulated energy businesses by combining the returns of two sources of funds for investment: equity and debt. The rate of return provides the business funds to service the interest on its loans and give a return to shareholders.

An accurate estimate of the rate of return is necessary to promote efficient prices in the long-term interests of consumers. If the rate of return is set too low, the network business may not be able to attract sufficient funds to be able to make the required investments in the network and reliability may decline. Conversely, if the rate of return is set too high, the network business may seek to spend too much and consumers will pay inefficiently high tariffs.

Therefore there is a need to evaluate the two sources of funds for investment, to determine what return investors expect to receive, and to set a regulated rate of return that is sufficient to attract capital investment.

1.2 Why this topic?

We can directly observe the return on debt, but it is more difficult to observe the expected return on equity. As a result a variety of return on equity models have been proposed, informed by varying types of evidence. Estimating the return on equity is complex and contentious, with experts and regulators reaching different positions on the strengths and weaknesses of different models, how those models should be

¹ NGL, cl. 23; NEL, cl. 7.

² The NGO is to promote efficient investment in, and efficient operation and use of, natural gas services for the long term interests of consumers of natural gas with respect to price, quality, safety, reliability and security of supply of natural gas. The NEO is to promote efficient investment in, and efficient operation and use of, electricity services for the long term interest of consumers of electricity with respect to: price, quality, safety and reliability, and security of supply of electricity; and the reliability, safety and security of the national electricity system.

implemented, and return on equity outcomes. There is no one 'right answer' to be found.

In developing the 2018 Instrument, we used the standard (Sharpe-Lintner) Capital Asset Pricing Model (CAPM) as the 'foundation model' and given a primary role in the determination of the return on equity. We had regard to other models, however we placed less reliance upon them than in the 2013 Guidelines as our confidence in their informative power had diminished.

Looking to the 2022 Instrument, it is important that we carefully examine a broad set of return on equity models to determine which model/s we should use. For each model, we want to assess its reliability, relevance to the Australian benchmark, suitability for use in our regulated environment and also its simplicity. This includes having regard to any recent developments in finance theory and/or practice. We engaged Professors Graham Partington and Stephen Satchell to provide us with expert advice on this matter.³ A second report, by The Brattle Group, also provides relevant information on the use of return on equity models by international regulators.⁴

We have selected this topic as a working paper because it goes to the foundation of our return on equity approach. Resolving which return on equity model (or models) are appropriate for regulatory use ahead of the main review would allow efficient consideration of subsequent matters, such as the input parameters for the chosen model/s.

1.3 Possible options for 2022

Over many years, we have extensively explored approaches for estimating the return on equity, including in the 2018 instrument process. As we move toward the 2022 instrument we will draw on that body of work, but we are genuinely open to hearing suggestions for any improvements we can make. We therefore welcome the different perspectives and views presented in the reports by Professors Partington and Satchell and The Brattle Group as an opportunity to explore potential adjustments for improving outcomes for energy consumers.

Of course, we are open to hearing any views you wish to put to us. However, in this paper, we highlight particular aspects that we think are most profitable to explore. Many of these highlighted aspects arise from the different perspectives and views in the two reports we have recently obtained. We also highlight some areas where we think there are more settled views and agreement. We hope you find this guidance useful.

Our current assessment is that the standard Sharpe-Lintner capital asset pricing model (SL CAPM or just CAPM) should play a major role in our determination of the return on equity in the 2022 Instrument. The CAPM is the preeminent model; it has a strong theoretical basis, is widely used by market practitioners, and is more reliable than any of the alternatives identified. This is reflected in its use by all international regulators reviewed—and for most, it is the only model used.

³ Partington and Satchell, *Report to the AER, Alternative asset pricing models*, 30 June 2020.

⁴ The Brattle Group, *A review of international approaches to regulated rates of return, Prepared for the Australian Energy Regulator*, 30 June 2020.

However, the implementation of the CAPM matters, in that different methods for calculating input parameters can lead to substantially different rate of return outcomes. There is expert disagreement on how best to apply the CAPM, and variation in how it is applied by overseas regulators.

One of the perspectives coming from the Brattle Group report is the suggestion we consider including an explicit forward-looking element in our construction of the return on equity. Our assessment is that our 2018 return on equity approach already included some forward-looking information. Nonetheless, we would like to hear views on whether changes are necessary or desirable and if so how it might be done. Drawing from the two reports there seem to be two categories of changes we might examine. We could consider how to include a more forward-looking return on equity model, or we could consider how the CAPM is implemented—that is, whether we can draw on more forward-looking inputs when we populate the model.

For a forward-looking model, the Brattle report suggested using the dividend growth model (DGM) at the overall return on equity level. However, there are many different specifications of the DGM with different formulae and inputs. The Partington and Satchell report did not recommend any use of the DGM, primarily because of implementation problems. Our current assessment of the dividend growth model is that there are significant challenges to overcome before it could be used as an alternative or companion to the CAPM.

For forward-looking inputs to the CAPM, there are a number of options around the way we estimate the market risk premium (MRP), equity beta and the risk free rate (RFR). The DGM can be used to estimate a 'forward-looking' market risk premium (instead of the overall return on equity), and the Brattle report noted this was done by some international regulators. There is variation in how the DGM output is used—for instance, the Bank of England focuses not on the precise level of the market risk premium estimated using its DGM, but on changes in the market risk premium over time and relative to historic averages.⁵ Against this, Partington and Satchell's assessment that the DGM was unreliable would also apply to this use of the DGM. We are interested in views on whether we could include a forward-looking perspective by using the DGM or some other approach (such as surveys) to inform our choice of market risk premium.

Another option relates to the relationship between the risk free rate and the market risk premium in the standard CAPM. Different models posit different relationships between these parameters. Under the 2018 instrument, we make no adjustment to the market risk premium when the risk free rate changes. The Brattle report notes the use of a total market return approach (also known as the Wright approach) by UK regulators, where it is assumed that there is an offsetting movement in the market risk premium (equal magnitude, opposite sign) when the risk free rate changes. We consider the

⁵ Bank of England, *Quarterly Bulletin, An improved model for understanding equity prices*, 2017 Q2. Note there are different naming conventions in this article - the term dividend discount model (or DDM) is used instead of DGM, and the term equity risk premium (or ERP) is used instead of market risk premium (MRP). In our working paper, we use equity risk premium to refer to the firm-specific margin above the risk free rate, not the market risk premium.

total market return approach is unlikely to reflect conditions in financial markets.⁶ However, we would like to hear views on whether there is a relationship between movements in the risk free rate and market risk premium, and if so how this might be reflected in our approach.

Another option suggested by Brattle was the potential to estimate equity beta using a shorter series of more recent data with frequent (daily or weekly) return observations. This would be more reflective of recent market conditions and so make the CAPM less 'backward-looking'. However, Partington and Satchell suggest that longer return periods (monthly or quarterly) will provide a more reliable estimate of equity beta, and this means we need a longer data window as well. Alongside this, there is also disagreement on whether to use international firms in the comparator set for estimating equity beta. We invite submissions on how we should develop beta estimates that are representative of the risks associated with the regulated entities.

Although we raise options above around model inputs, we remind stakeholders that we do not need to resolve all model input questions as part of this working paper. Our intent is that making progress now will allow us to undertake more targeted consideration and consultation as the process progresses. We do need to consider issues around inputs where they are material to the evaluation of a particular model.

Another perspective raised by the Brattle Group is the suggestion that we might employ multiple return on equity models. Aside from the standard CAPM and DGM discussed above, our current assessment of the other candidate models is they have substantial limitations (the Black CAPM, international CAPM, consumption CAPM, Fama-French factor models, and a fixed-rate-plus-margin model). They see almost no use by overseas regulators.⁷ On the information available to us at this time, it is therefore not clear how these models could have a role in setting our regulated return on equity. Nevertheless, if you are aware of new material that might support the use of these models, we would welcome that material.

More broadly, if you are aware of new material on how we might combine multiple models then we would welcome that material. Our current assessment is that using multiple models is difficult to justify. In particular we need to carefully consider whether using one model in isolation (the best available candidate) or multiple models will lead to a more or less reliable return on equity.

1.4 Next steps

We invite stakeholder submissions in response to this draft working paper by Monday 9 October 2020.

Our normal practice is to hold a public forum during the submission period, where stakeholders can ask questions of the AER and interact directly to hear each other's

⁶ AER, *Rate of return instrument, Explanatory Statement*, December 2018, pp. 85–86.

⁷ The exception is that the US FERC uses a risk premium model alongside the CAPM and DGM. The risk premium model could be considered a form of the fixed-rate-plus-margin approach. Its CAPM implementation includes a size adjustment, which could be considered a partial step towards the Fama-French three factor model.

perspectives. However, government restrictions in response to the COVID-19 pandemic mean this cannot be an in-person meeting.

Our current intent is to hold an online event on Wednesday 16 September 2020. Information about the online forum will be available on the AER's website in due course.

After consideration of submissions, we expect to conclude this working paper topic with the release of a final working paper in December 2020.

Making a submission

Written submissions should be emailed to the AER at RateOfReturn@aer.gov.au by close of business, 9 October 2020.

Alternatively, submissions can be sent to:

Mr Warwick Anderson
General Manager
Networks Finance and Reporting
Australian Energy Regulator
GPO Box 520
Melbourne Vic 3001

We prefer that all submissions be sent in an electronic format in Microsoft Word or other text-readable document form and publicly available, to facilitate an informed, transparent and robust consultation process.

Submissions will be treated as public documents and posted on the AER's website unless prior arrangements are made with the AER to treat the submission, or portions of it, as confidential. Those wishing to submit confidential information are requested to:

- clearly identify the information that is the subject of the confidentiality claim; and
- provide a non-confidential version of the submission in a form suitable for publication.

All non-confidential submissions will be placed on the AER's website at www.aer.gov.au. For further information regarding the AER's use and disclosure of information provided to it, see the ACCC/AER Information Policy, June 2014 available on the AER's website.

Enquiries about this paper, or about lodging submissions, should be directed to the Network Reporting and Finance branch of the AER on (03) 9290 1800.

2 Process background

2.1 What is the rate of return Instrument?

The rate of return Instrument specifies how we determine the allowed rate of return on capital in regulatory determinations for energy networks. It specifies the mathematical formulae we will use to calculate the rate of return, and how we will obtain inputs for those formulae. It specifies some inputs (fixed for the duration of the Instrument) and for others specifies the process by which we will measure market data and use it as an input at the time of a decision.

The current rate of return Instrument was published on 17 December 2018 (the 2018 Instrument). In December 2022 we will publish the next rate of return Instrument (the 2022 Instrument). This binding Instrument will determine the allowed rate of return on capital for the following four year period.

Estimating the rate of return is a complex task. We estimate the returns required by investors in view of the risks associated with energy network companies compared to their other investment opportunities. We make this judgement by examining a broad range of evidence including financial market data, models of financial returns, the latest investment knowledge and the views of all stakeholders.

2.2 What is our 'Pathway to 2022'?

We use the term 'Pathway to 2022' to describe the process by which we will develop the 2022 Instrument. We consulted with stakeholders about what steps should be included and what role various reference groups should play.⁸ We issued a position paper in May 2020 setting out our high level plan.⁹

The active phase of the 2022 review will commence in mid-2021. Prior to this, our pathway to 2022 includes:

- Rate of return annual updates—to provide information on rate of return data in the years between reviews; particularly updated times series data used in the 2018 Instrument (or used to inform the development of the 2018 Instrument).
- Establishing reference groups—to ensure we hear stakeholder perspectives from consumers, investors and retailers.
- Working papers—such as this paper.

Outcomes from our 2020 Inflation review will also flow into the development of the 2022 Instrument.¹⁰

⁸ AER, *Consultation paper, Pathway to the 2022 rate of return Instrument*, November 2019; see also The Brattle Group, *Stakeholder feedback on the AER's process for the 2018 rate of return Instrument*, 27 June 2019.

⁹ AER, *Position paper, Pathway to the 2022 rate of return Instrument*, 29 May 2020.

¹⁰ AER, *Initiation notice, 2020 review of inflation approach*, 7 April 2020; AER, *Discussion paper, Regulatory treatment of inflation*, 25 May 2020, p. 14.

We will consult further on the process for the active phase of the review, including lower-level details not addressed in our May 2020 position paper, as we get closer to 2022.

2.3 What is the intent of the working papers series?

Our rate of return working papers discuss issues and evidence on key rate of return topics, and allow us to hear from stakeholders in response.

On each chosen topic, we expect to release a draft working paper (usually accompanied by an expert report), before a submission period. We will facilitate discussion with stakeholders within the restrictions arising from the COVID-19 pandemic, such as by hosting an online meeting. We will then release a final working paper with our response to submissions.

In selecting topics for working papers, we have had regard to whether topics could be constructively considered as discrete issues in advance of the active phase of the review.¹¹ We have also taken into account stakeholder feedback on the topics of interest or importance.¹²

We intend that all this material will feed in to the main phase of the review, providing a foundation for constructive discussion and helping alleviate time pressure in the active phase.

As noted in section 1.2, the topic of this paper (CAPM and alternative return on equity models) goes to the foundation of our return on equity approach. Stakeholders submitted (in response to the pathway to 2022 consultation paper) that the AER should evaluate its use of the CAPM in the 2018 Instrument. We considered that this topic could be appropriately addressed ahead of the active phase of the review. Furthermore, addressing fundamental issues ahead of the main review might lead to other work in sequence (e.g. parameters for use within chosen models).

2.4 Interactions with other working papers

We have published this paper simultaneously with our second draft working paper, on international regulatory approaches to the rate of return.¹³ It provides a framework for comparing overseas regulatory approaches to the AER's approach, and identifies some key differences that suggest possible changes to our approach. That working paper is accompanied by an expert report by The Brattle Group (Brattle).¹⁴

We have released these documents simultaneously because there are areas of overlap between the two topics. In particular, consideration of international rate of return approaches necessarily includes their method for estimating the return on equity and

¹¹ AER, *Position paper, Pathway to the 2022 rate of return Instrument*, 29 May 2020, pp. 9–10.

¹² AER, *Position paper, Pathway to the 2022 rate of return Instrument*, 29 May 2020, p. 22.

¹³ AER, *Rate of return, International regulatory approaches to the rate of return, Draft working paper*, 27 August 2020

¹⁴ The Brattle Group, *A review of international approaches to regulated rates of return, Prepared for the Australian Energy Regulator*, 30 June 2020.

use of return on equity models (as well as return on debt, gearing, tax, and the overall rate of return).

To reduce duplication, we discuss overlapping material in one location only. This working paper contains our primary discussion on:

- return on equity models (whether prompted by the Partington and Satchell report, or the international review conducted by The Brattle Group).
- the technical methodology for estimating return on equity model parameters, including the use of international comparators and international data.

Our first draft working paper was on the energy networks' debt data.¹⁵ It looked at evidence on actual debt costs incurred by regulated networks and discussed how this data might be used to inform the 2022 instrument. It complements this paper because it deals with the other source of investment (debt). The draft working paper on debt data was released in June 2020, and we expect to release the final working paper at the end of October 2020.

¹⁵ AER, *Rate of return, Energy networks debt data, Draft working paper*, 26 June 2020. The project page is <https://www.aer.gov.au/networks-pipelines/guidelines-schemes-models-reviews/energy-network-debt-data-pathway-to-rate-of-return-2022>.

3 Return on equity in the 2018 instrument

3.1 Background to the rate of return framework

We apply a 'building block' model to set regulated revenues for electricity and gas network service providers. The building blocks—return on capital, return of capital, operating expenditure and tax—reflect the expected costs that would be incurred by a benchmark efficient entity operating the network. This is a form of incentive regulation, as building blocks are estimated in advance for a regulatory control period (typically five years) and the networks retain any benefit (or bears any detriment) where it is able to reduce costs below the AER's estimates. Revealed costs are then used to inform building block estimates for the following control period, so that efficiency gains are passed on to consumers. We also operate a number of incentive schemes in conjunction with the building block framework.

The return on capital building block is set by applying a rate of return on capital to the regulatory asset base each year. The AER currently estimates the allowed rate of return for regulated businesses using the approach set out in the 2018 Instrument. The rate of return instrument is binding under the National Electricity Law and National Gas Law. This means that the AER and network businesses are required to set the rate of return according to the current Instrument.

The 2018 Instrument applies the following key characteristics when estimating a businesses' allowed rate of return:¹⁶

1. It use a nominal vanilla weighted average cost of capital (WACC) formulation.¹⁷
2. It assumes a 40% equity and 60% debt capital structure.
3. It uses a domestic CAPM to estimate the return on equity. This is implemented as:
 - (a) The risk free rate (RFR) is estimated from the yield on 10 year to maturity Commonwealth Government Securities (CGS) over a short averaging period (20 to 60 business days) prior to the commencement of the regulatory control period.
 - (b) Equity beta of 0.6 (fixed for the life of the 2018 Instrument).
 - (c) Market risk premium of 6.1 per cent (also fixed for the life of the 2018 Instrument).
 - (d) The return on equity is therefore the risk free rate plus a fixed equity risk premium of 3.66%.¹⁸
4. It uses a trailing average portfolio for the allowed return on debt, updating 10 per cent of the portfolio estimate annually (i.e. a 10 year rolling window of annual debt observations).

¹⁶ AER, *Rate of return instrument, Explanatory Statement*, December 2018, pp. 13–16.

¹⁷ Used in a post-tax revenue model, i.e. effect of the interest tax shield is considered in cashflows.

¹⁸ The equity risk premium is the product of beta and the market risk premium.

5. The annual return on debt is based on debt costs for the benchmark BBB+ credit rating at a 10 year term, estimated by weighting A rated and BBB rated benchmark curves (from a number of providers) over an averaging period.
6. Market data for the return on debt and risk free rate is sourced from averaging periods nominated by the network businesses in advance.

3.2 Overall return on equity

3.2.1 Foundation model approach

In 2018, the foundation model approach (six step process) provided a framework for systematically considering relevant information and then exercising our judgement on the appropriate regulated return on equity. It did not require information to be used if it did not satisfy our assessment criteria. Therefore our approach was to assess all information and employ it according to its merits. Figure 1 (on the following page) presents the six steps used in 2018 graphically.

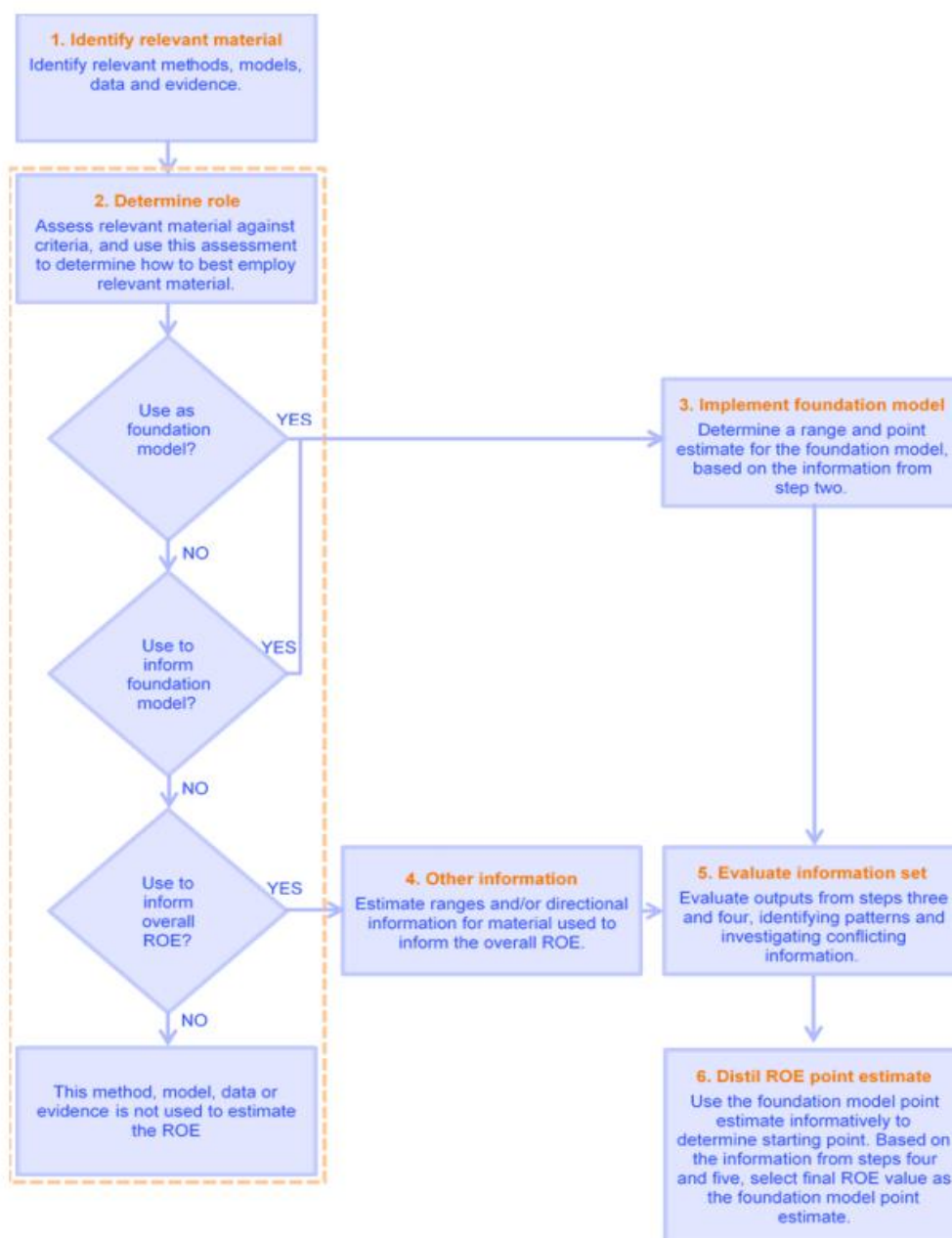
We identified the relevant material and the roles assigned to each piece of material under step 1 and 2 of our foundation model approach. This is summarised in Table 3.1.

Table 3.1 Relevant material and role

Material (Step 1)	Role in 2018 and relevant merit (Step 2)
Sharpe-Lintner Capital Asset Pricing Model (SL CAPM)	Foundation model.
Black CAPM	Related to the overall return on equity. However at the time of the finalising the 2018 instrument we had diminished confidence in the robustness of the Black CAPM. We were not persuaded to adjust the SL CAPM estimate for the theory of the Black CAPM.
Dividend growth models (DGMs)	Can be used to inform the market risk premium. However at the time of the finalising the 2018 instrument we had diminished confidence in the robustness of the DGMs. We were not persuaded to select a market risk premium toward the top of the observed empirical estimates of historical excess returns.
Fama-French three factor model	No role.
Wright approach	We have diminished confidence in the robustness of the Wright approach leading us to place no reliance on it.

Source: AER, *Rate of return instrument, Explanatory Statement*, December 2018, pp. 82–83.

Figure 1 Foundation model approach flowchart



The description of roles for return on equity models in Table 3.1 is best understood within the context of our 2013 rate of return guidelines (2013 Guidelines). In our 2013 review, we gave weight to the DGM and the theory of the Black CAPM when implementing steps 2 to 4 of our foundation model approach. These were used to inform us of the appropriate point estimate for the market risk premium and equity beta, respectively. In the 2018 review, we had regard to these two models in the application of our foundation model approach but our confidence in their informative power to determine the appropriate market risk premium and equity beta point estimate had diminished.¹⁹

¹⁹ AER, *Rate of return instrument, Explanatory Statement*, December 2018, p. 79.

In 2018, we considered the SL CAPM to be the most appropriate model to reflect the systematic risk. Therefore we decided to use the SL CAPM as the principal model for determining an initial range and point estimate for the return on equity.

In the 2018 Instrument, our final decision was to calculate the return on equity using the SL CAPM with a market risk premium of 6.1 per cent and an equity beta of 0.6 resulting in an equity risk premium of 3.66 per cent. We combine this equity risk premium with a risk free rate observed at the time the 2018 Instrument is applied.

4 Expert reports

To assist with our fundamental review of all aspects of our rate of return approach, we commissioned expert reports on two topics at the end of the 19-20 financial year:

- *Alternative asset pricing models* by Graham Partington and Stephen Satchell.
- *International regulatory approaches to the rate of return* by The Brattle Group.

4.1 The Partington and Satchell report to the AER

We engaged Graham Partington and Stephen Satchell to provide expert advice on return on equity models specifically for this working paper.²⁰ They have extensive experience as senior academics in Finance and have published textbooks and many research papers. These experts have advised the AER in previous rate of return determinations and in the development of both the 2013 Guidelines and 2018 Instrument.

The models assessed in the Partington and Satchell report are as follows:

- Sharpe-Lintner CAPM (SL CAPM or just CAPM)
- Dividend Growth Model (DGM)
- International CAPM (ICAPM)
- Black CAPM
- Fama-French three factor model
- Consumption based asset pricing models
- Risk-free rate plus a fixed margin.

The report assessed these asset pricing models against a set of criteria prescribed by the AER. These criteria were reliability, relevance to the Australian benchmark, suitability for use in regulated environment and simplicity. Partington and Satchell expanded on the prescribed criteria to distinguish several further key factors:²¹

- Theoretical support for the model
- Extensive use over time in estimating the weighted average cost of capital (WACC)
- Limited opportunities for gaming
- Empirical validation.

We consider that these additional criteria are consistent with our initially specified set, identifying some factors for further detailed examination. Partington and Satchell also looked at the testing, theory, and implementation of the models in arriving at their evaluation and recommendations.

²⁰ Partington and Satchell, *Report to the AER: Alternative Asset Pricing Models*, June 2020.

²¹ Partington and Satchell, *Report to the AER: Alternative Asset Pricing Models*, June 2020, pp. 6, 9–10.

The Partington and Satchell report concluded that the only model recommended for use for estimating the return on equity in a regulatory environment was the SL CAPM. This model was found to be robust with a clear theoretical foundation based on finance and economic principles. The model is straightforward, which means it can be understood by a wider audience, Australian data is easily obtained for its estimation and calculations are easy to replicate. It is a model that is most likely to give estimates that have the least error and are unbiased.²²

Partington and Satchell noted that there was a considerable body of empirical work that did not support the CAPM. In particular:²³

- Observed returns from low beta stocks tended to outperform the expected returns implied by the Sharpe-Lintner CAPM.²⁴ Conversely, the observed returns on high beta stocks tended to underperform the expected returns implied by the SL CAPM.
- Although the SL CAPM predicted that only exposure to market risk should matter for expected returns, various other factors appeared to explain return outcomes.

However, Partington and Satchell noted that there are significant problems in testing asset pricing models and suggested that these empirical results needed to be interpreted with regard to the limitations of the empirical tests. They identified several categories of concern:²⁵

- Problems with data. Imperfections in the available data may introduce material errors into the test. This pertains to the composition of the market portfolio, beta construction, and even the measure of actual returns (as expected returns are not observable).
- Problems with test design. There are known econometric design issues around asset pricing tests that could lead to incorrect findings; and data mining (perhaps unintentionally) can lead to false positives.
- Problems with interpretation. Experts differ on their interpretations of even well designed asset pricing tests.

Partington and Satchell also reviewed a number of papers that supported the model on theoretical and empirical grounds.²⁶ For example, the report noted a 2016 paper by Berk and van Binsbergen, who concluded:²⁷

Our study is motivated by revealed preference theory: if the asset pricing model under consideration correctly prices risk, then investors must be using it, and must be allocating their money based on that risk model. Consistent with this theory, we find that investors' capital flows in and out of mutual funds does reliably distinguish between asset pricing models. We find that the CAPM outperforms all extensions to the original model, which implies, given our current

²² Partington and Satchell, *Report to the AER: Alternative Asset Pricing Models*, June 2020, pp. 15–29.

²³ Partington and Satchell, *Report to the AER: Alternative Asset Pricing Models*, June 2020, pp. 15–16.

²⁴ The low beta case is more relevant to regulated energy businesses.

²⁵ Partington and Satchell, *Report to the AER: Alternative Asset Pricing Models*, June 2020, pp. 11–14.

²⁶ Partington and Satchell, *Report to the AER: Alternative Asset Pricing Models*, June 2020, pp. 15–16.

²⁷ Berk, J. and van Binsbergen J., 2016, Assessing asset pricing models using revealed preference, *Journal of Financial Economics*, vol. 119, pp. 1-23 cited in Partington and Satchell, *Report to the AER: Alternative Asset Pricing Models*, June 2020, p. 16.

level of knowledge, that it is still the best method to use to compute the cost of capital of an investment opportunity.

Partington and Satchell concluded that while the SL CAPM had been subject to empirical attacks it also had empirical support, especially in recent research.

The Partington and Satchell report recommended the SL CAPM for use for estimating the return on equity in a regulatory environment. The model met the AER's criteria of reliability, relevance, suitability and simplicity. The report also drew attention to the model's extensive practical use over time.²⁸

Partington and Satchell did not recommend we use any of the other asset pricing models they evaluated:

- The DGM was not recommended for use for a variety of reasons principally related to implementation difficulties. The DGM is discussed in a separate section below.
- The International CAPM was not recommended largely because of unrealistic assumptions underpinning the model, and because of the difficulty of Australian implementation when replacing the domestic equity premium with a global premium. They concluded that using an international CAPM added significant difficulties for no clear benefit.²⁹
- The Black CAPM was not recommended as there was little benefit in undertaking this estimation method when there was a widely accepted and easily observable measure of the risk-free rate, which was the return on 10-year CGS. Moreover, estimation of the zero-beta return typically throws up rather large, quite variable, and implausible values. Partington and Satchell did not see any merit in its use in a regulatory environment.³⁰
- The Fama-French three factor model and its variants (with four, five or more factors) were not recommended. The report found that this class of models had very little economic underpinnings as they were not based on a theoretical model. The Fama-French models were rarely used for estimation of the cost of equity by companies, or for regulatory purposes. The factors could be constructed in many different ways and therefore could be easily manipulated to give specific answers.³¹
- The report did not recommend the use of a consumption based CAPM, even though it had strong theoretical arguments in its favour. Unfortunately its empirical performance was poor and there were complex implementation issues to do with estimation and data. The model was not currently a practical tool that could be used for regulation.³²
- Finally, the report considered a model where equity return equals the risk-free rate plus a fixed margin. This was simple to understand, needed very little data and

²⁸ Partington and Satchell, *Report to the AER: Alternative Asset Pricing Models*, June 2020, p. 27.

²⁹ Partington and Satchell, *Report to the AER: Alternative Asset Pricing Models*, June 2020, pp. 26-33.

³⁰ Partington and Satchell, *Report to the AER: Alternative Asset Pricing Models*, June 2020, pp. 34-37.

³¹ Partington and Satchell, *Report to the AER: Alternative Asset Pricing Models*, June 2020, pp. 37-48.

³² Partington and Satchell, *Report to the AER: Alternative Asset Pricing Models*, June 2020, pp. 48-49.

would be able to be understood by a broad stakeholder set. However, it was not obvious how the fixed margin would be determined on an objective basis and so it was not recommended for use.³³

Use of multiple return on equity models

Partington and Satchell recommended that we use one model (the SL CAPM) as all other models were not suitable for use in a regulatory environment.

The Partington and Satchell report considered the use of multiple models—that is, the position that a better estimate can be obtained by averaging across a number of asset pricing models, rather than relying on a single model. In their view, this could be true when the models were measuring the same thing and the measurements were unbiased. However, in the case of asset pricing models, it was not clear that this was always the case. Averaging a poor model with a good model gives an inferior outcome to simply using the good model on its own. There needs to be a strong case for the use of the additional models.³⁴ The Partington and Satchell report identified substantial limitations and problems for all of the non-CAPM alternatives they considered.

An additional problem in the regulatory context was that averaging adds to the gameable dimensions of the regulatory process.

Partington and Satchell's conclusion was that, given the available evidence on return on equity models, the use of a single model (the CAPM) was the best option.

Use of the dividend growth model (DGM)

Partington and Satchell stated there were positive aspects to the DGM, as the model was based on economic and financial principles and had a strong theoretical foundation.

However, Partington and Satchell considered that implementation of the DGM was problematic.³⁵ If we were to use the DGM to estimate the cost of equity for network businesses, there would be several implementation questions to consider:³⁶

- Which of the possible DGMs best fits the nature of a regulated network?
- How should we populate the input variables? The key inputs are the magnitude of expected dividends, growth rate(s), pattern of growth assumed, and the assumed length of the various growth regimes.
- How do we account for upward bias in analyst forecasts and sticky dividends?
- How would we make adequate adjustment for expected capital contributions and withdrawals, and in particular the impact of dividend reinvestment plans?

³³ Partington and Satchell, *Report to the AER: Alternative Asset Pricing Models*, June 2020, pp. 49–51.

³⁴ Partington, *Report to the AER: Return on equity (Updated)*, April 2015, p. 15.

³⁵ Partington and Satchell, *Report to the AER: Alternative Asset Pricing Models*, June 2020, p. 52.

³⁶ Partington and Satchell, *Report to the AER: Alternative Asset Pricing Models*, June 2020, pp. 60–63.

The answers to these questions were not settled, and they have a material impact on the resulting DGM estimate. The range of DGM implementation options also opens significant opportunities for gaming.³⁷

The report also drew reference to survey evidence that suggested the DGM had fallen out of favour over time.³⁸

Partington and Satchell concluded that the DGM had the potential to be relevant, but it was not reliable or suitable. Depending on its implementation, the use of the DGM can be transparent and replicable but given the range of choices available it was wide open to gaming and the risk of error and bias in the use of the DGM was substantial. The model can be relatively simple, but how simple depends on which variant of the model was implemented. In respect to practical use, the DGM failed the test of time.

Partington and Satchell therefore did not recommend the use of this model for regulatory purposes.³⁹

Beta methodology

Regarding the term over which beta is estimated, Partington and Satchell stated that the choice can vary, but estimates were frequently based on two to five years of data.⁴⁰ If beta was time varying then a short term might be preferred, but if beta was believed to be mean reverting then a longer term may be favoured.⁴¹

The report however drew reference to a report submitted by Wright, Burns, Mason and Pickford (2018) to UK regulators, recommending that all inputs to the CAPM should be for a consistent time horizon. This paper recommends that the horizon be ten years, but stresses that consistency is more important than the choice of horizon. Wright and Robertson in an appendix to the report further emphasise the importance of estimating beta using a term that is consistent with the CAPM investment horizon.

Partington and Satchell concluded that the idea of consistency in the components of the CAPM has merit, but noted the use of beta estimates based on ten years of data was not common. Longer estimation periods also carried greater risks of structural breaks.

There is also evidence to suggest that betas of network businesses have been rather stable over time and no mean reversion adjustment seems warranted. Henry (2008) in his report to the AER concludes that with respect to estimating beta for network businesses no adjustment is required for mean reversion.

In terms of frequency, Partington and Satchell stated that there was research that concluded that low frequency (monthly or quarterly) data was to be preferred to high

³⁷ Partington and Satchell, *Report to the AER: Alternative Asset Pricing Models*, June 2020, p. 59.

³⁸ Partington and Satchell, *Report to the AER: Alternative Asset Pricing Models*, June 2020, p. 63.

³⁹ Partington and Satchell, *Report to the AER: Alternative Asset Pricing Models*, June 2020, p. 64.

⁴⁰ Partington and Satchell, *Report to the AER: Alternative Asset Pricing Models*, June 2020, pp. 21–22.

⁴¹ Partington and Satchell, *Report to the AER: Alternative Asset Pricing Models*, June 2020, p. 21.

frequency data (daily or weekly). They drew reference to a paper presented by Gregory, Hua and Tharyan:⁴²

"Our conclusions are unequivocal and have important policy implications for regulatory use of the CAPM, as they imply that low frequency beta estimates should always be preferred to high frequency beta estimates".

Recent research has shown that low beta bias will shrink to insignificance with longer holding periods and shorter holding periods are a poor measure of fundamental risk exposure.

They concluded that in order to measure the fundamental risk exposures of a firm it was best to use low frequency estimates of beta. This implies that short data windows are insufficient as not enough data points will be available.⁴³

The Partington and Satchell report also explored the complexity of implementing the International CAPM in the Australian market and discussed approaches to convert international betas to domestic betas. They concluded that whichever approach one takes, there was no logically justifiable way of taking unadjusted international betas and using them as a domestic Australian betas.

Partington and Satchell also stated that there was potential for examining the accounts of domestic de-listed comparator firms and computing accounting betas. However they were cautious about the overall applicability of this approach.

Relevance of international data

Partington and Satchell did not recommend the use of world or international CAPMs to measure Australian dollar systematic return risk for Australian energy companies or to create extra comparators for the AER comparator set. Their view was that international market data (i.e. derivation of market risk premium or beta) would not be equal to Australian market data and comparison required extensive adjustment.

Relationship between the risk free rate and the market risk premium

The Partington and Satchell report commented briefly on the Wright approach, a model that assumes a stable total market return and perfect negative correlation between the risk free rate and the market risk premium. Partington and Satchell stated that they found this implausible—for example, where the risk free rate was above the historical average return (as has been the case) it would lead to a negative market risk premium.⁴⁴

⁴² Gregory, A., Hua, S., and Tharyan, R., 2016, In search of beta, working paper, University of Exeter Business School, p. 2, subsequently published in *British Accounting Review*, 2018, cited in Partington and Satchell, *Report to the AER: Alternative Asset Pricing Models*, June 2020, p. 22.

⁴³ Partington and Satchell noted that 3 to 5 year windows were commonly used with monthly observations. Quarterly data would require a longer window (more than six years, based on the observation that 24 data points was insufficient). Partington and Satchell, *Report to the AER: Alternative Asset Pricing Models*, June 2020, p. 21.

⁴⁴ Partington and Satchell, *Report to the AER: Alternative Asset Pricing Models*, June 2020, p. 23.

4.2 The Brattle report to the AER

The Brattle report is a review of international regulatory approaches to the rate of return. This is the topic of a separate working paper. However, several areas of the Brattle report focus on the return on equity models used by overseas regulators, and we discuss these elements of the Brattle report below. The Brattle report also makes a number of concluding suggestions relevant to return on equity models.

A key finding of the Brattle report is that all the international regulators assessed make use of the CAPM as a core of their approach to estimating the rate of return on equity.⁴⁵ Their CAPM implementations differ, and the report details the extent of varying practice in how regulators populate CAPM inputs (risk free rate, market risk premium and equity beta).⁴⁶

Use of multiple return on equity models

The Brattle report noted that all regulators except two (the US regulators FERC and STB) relied on a single model (the CAPM) to estimate the return on equity. Nonetheless, Brattle concluded that there were benefits to using multiples models to estimate the return on equity. In their view, relying on multiple models—or a crosscheck based on alternative models—would allow the regulator to consider a broader set of information about market conditions and the industry.⁴⁷ The different inputs to the different models allowed consideration of a broader set of market information and so different insights into the rate of return.

Use of forward looking evidence and the Dividend Growth Model (DGM)

The Brattle report referred to the CAPM as a model that relies on backward-looking information (particularly when populated with a historical market risk premium) and the DGM as a model that uses forward-looking information. On the basis that combining backward and forward looking perspectives would aid insight into investors' required returns, Brattle suggested that it would be beneficial to use the DGM in conjunction with the CAPM.⁴⁸

In addition, Brattle suggested that the implementation of the CAPM could also be improved by the use of some 'forward-looking' evidence when estimating inputs such as the market risk premium and the risk free rate. Using the DGM to estimate the market risk premium would provide more contemporaneous information, and this was particularly important during periods of changes in financial markets.

Beta methodology

⁴⁵ The Brattle Group, *A Review of International Approaches to Regulated Rates of Return*, June 2020 pp. 16, 33–34.

⁴⁶ The Brattle Group, *A Review of International Approaches to Regulated Rates of Return*, June 2020 pp. 34–45.

⁴⁷ The Brattle Group, *A Review of International Approaches to Regulated Rates of Return*, June 2020 p. 35, 59–60.

⁴⁸ The Brattle Group, *A Review of International Approaches to Regulated Rates of Return*, June 2020 p. 58–59.

The Brattle report made two suggestions around beta estimation.⁴⁹ First, Brattle concluded that it was best to use an estimation window of 2–5 years using daily or weekly return data to estimate the equity beta. A longer estimation window would fail to give sufficient weight to current market conditions. Using daily or weekly observation frequencies would provide enough data points and statistical reliability from this shorter window. Most overseas regulators reviewed by Brattle used this approach.

Second, Brattle suggested that we consider the use of international comparators to provide further data on beta. Brattle considered that with careful consideration, it was possible to add utilities operating in different jurisdictions that had comparable business risks and regulatory frameworks. It was also important to use countries with diversified local market indexes (such as Australia, the UK and USA). Thus, the use of betas assessed in their domestic market could provide useful information about the systematic risk of Australian regulated businesses. Four of the seven overseas regulators assessed, (ACM, ARERA, FERC, NZCC) included non-local companies in their beta comparator set.

Relevance of international data

Brattle found a broad degree of commonality between regulatory frameworks and objectives in Australia and overseas but still noted that the rates of return were not necessarily directly comparable. With consideration of this context, Brattle conducted direct comparisons between international market data (i.e. derivation of market risk premium or beta) and Australian market data.⁵⁰

Relationship between the risk free rate and the market risk premium

The Brattle report noted ARERA and the UK regulators (Ofgem and Ofwat) calculated the market risk premium using the Wright approach (or total market return approach). The market risk premium is calculated as the difference between the overall historical return on equity and the prevailing risk free rate.⁵¹

⁴⁹ The Brattle Group, *A Review of International Approaches to Regulated Rates of Return*, June 2020 p. 41–43, 60–61.

⁵⁰ The Brattle Group, *A Review of International Approaches to Regulated Rates of Return*, June 2020, pp. 49–57.

⁵¹ The Brattle Group, *A Review of International Approaches to Regulated Rates of Return*, June 2020, p. 44.

5 Use in the 2022 rate of return review

In this chapter, we discuss our current assessment of how we might use return on equity model/s in developing the 2022 Instrument. This assessment may change after we hear from stakeholders and undertake further analysis. We draw on the two new expert reports as well as our previous examination of return on equity issues.

We have highlighted particular options to provide constructive guidance to stakeholders preparing their submissions. In several areas we invite suggestions as to how we might best address challenges around particular models. Of course, we are open to hearing any views you wish to put to us.

Although we raise options in this chapter around model inputs, we remind stakeholders that we do not need to resolve all model input questions as part of this working paper. Our intent is that making progress now will allow us to undertake more targeted consideration and consultation as the process progresses.⁵² We do need to consider issues around inputs where they are material to the evaluation of a particular model.

5.1 Use of the CAPM

Our current assessment is that the (standard Sharpe-Lintner) CAPM should play a major role in our determination of the return on equity in the 2022 Instrument.

After consideration of the new expert reports, as well as our understanding of the CAPM built up through prior rate of return processes, we consider that the CAPM is the preeminent model. This is because:

- It has a strong theoretical basis.
- It is widely used by market practitioners, including in Australia. This points to its reliability and relevance to the Australian benchmark.
- It is used by all international regulators reviewed—and for five of the seven, it is the only model used.

We have carefully considered the empirical evidence, including:

- The empirical evidence both for and against the CAPM.
- The empirical evidence for and against models that are often compared against the CAPM (such as the Black CAPM).
- The need to carefully interpret the empirical testing of asset pricing models, given the limitations of our available testing approaches.

While we acknowledge the conflicting evidence, we consider the empirical evidence—including the recent papers noted in the Partington and Satchell report—supports the use of the SL CAPM for estimating expected returns, over the other models identified.

The CAPM is reliable, relevant, suitable and simple. For these reasons, our current assessment is that it should play a major role in the 2022 Instrument.

⁵² This might occur in subsequent working papers; or in discussion papers during the main phase of the 2022 review.

However, the implementation of the CAPM matters, in that different methods for calculating input parameters can lead to substantially different rate of return outcomes. There is expert disagreement on how best to apply the CAPM, and variation in how it is applied by overseas regulators. We are particularly interested in ways to make our use of the CAPM more ‘forward-looking’, as discussed next.

5.2 A forward looking rate of return

One of the perspectives coming from the Brattle Group report is the suggestion we consider including an explicit forward-looking element in our construction of the return on equity. We would like to hear views on whether this is necessary or desirable; and if so how it might be done. Drawing from the two reports there seem to be two categories of changes we might consider:

- how to include a more forward-looking return on equity model (other than the CAPM).
- how to include more forward-looking inputs when we implement the CAPM.

5.2.1 Forward-looking model

The primary candidate for a more forward-looking model is the DGM. The Brattle report stated:⁵³

Since the [DGM] is inherently forward-looking, it is particularly beneficial to put some weight on this model if the CAPM implementation is purely backwards-looking.⁵⁴

The two expert reports provided contrasting positions, as summarised in section 4:

- Brattle identified two key advantages to the DGM inputs (i.e. dividends, growth rates and stock prices). They were forward-looking, and also drew on different information to the CAPM inputs, thus providing a broader overall information set.⁵⁵ The Brattle report noted that this forward-looking perspective was particularly important during periods of change in financial markets.
- Partington and Satchell report did not recommend any use of the DGM, primarily because of the issues surrounding the implementation of the model, as summarised in section 4.1. Partington and Satchell considered the DGM estimate would not be a reliable or suitable measure of the return on equity. The key reason was that the DGM required forward-looking inputs that cannot be directly observed. The inputs therefore require assumptions about future dividends, growth patterns, and equity contributions and withdrawals. If these inputs were unreliable—and this appeared to often be the case—the resulting estimate of the return on equity (or market risk premium) would also be unreliable.

⁵³ The Brattle Group, *A Review of International Approaches to Regulated Rates of Return*, June 2020, p. 59.

⁵⁴ The original quote has DCF (Discounted Cash Flow model) instead of DGM; the two labels are synonymous.

⁵⁵ The Brattle Group, *A Review of International Approaches to Regulated Rates of Return*, June 2020, pp. 35, 59.

We agree that the DGM is potentially a forward-looking model with a reasonable theoretical foundation.⁵⁶ However, our current assessment of the DGM is that it has a number of limitations that go to the reliability and suitability of the model:

- There are a large number of DGM constructions, with no consensus on the most appropriate formula for regulatory purposes.
- The DGM inputs themselves are also contentious, and the model outcomes are sensitive to relatively small input changes (in particular around growth rates).
- The permutations of different model options and different input assumptions produce a large range of materially different outcomes.
- Several of the known DGM issues lead to overestimates of the return on equity if no adjustment is made—but the nature of the correct adjustment is contentious.
 - For example, there is upward bias in analysts' dividend forecasts; and uncertainty around future equity contributions that will reduce return to current investors.
 - This goes to the nature of the forward-looking model, as there is uncertainty around these forecasts and estimates that makes it difficult to produce reliable estimates.

Overall, our current assessment is that there are substantial challenges to be overcome before the DGM could be used as an alternative or companion to the CAPM.

5.2.2 Forward looking CAPM inputs

We are interested in exploring Brattle's suggestion of employing a more forward looking approach in our implementation of the CAPM with respect to the market risk premium, risk free rate and equity beta.

Forward looking market risk premium

The Brattle report characterised the AER's current method as using a 'backwards-looking' market risk premium informed by historical outcomes, and suggested we should consider combining this approach with a more forwards-looking market risk premium as an input to the CAPM.

We do not consider our current estimate is backward looking. We estimate a consistent forward-looking market risk premium within a forward-looking rate of return.⁵⁷ We agree with Brattle that historical excess return data was given the most weight in our determination of the market risk premium in the 2018 instrument. But this occurred after careful consideration of the extent to which historical information could reliably contribute to a forward-looking estimate.⁵⁸

⁵⁶ There is also discussion of the strengths and limitations of the DGM in AER, *Explanatory statement, Rate of return instrument*, December 2018, pp. 253–267.

⁵⁷ See, for example, AER, *Rate of return instrument, Explanatory statement*, December 2018, pp. 41, 73–74, 89.

⁵⁸ Similarly, we considered the extent to which innately forward-looking approaches could contribute to a reliable estimate.

Brattle suggested we use the DGM to estimate a forward-looking market risk premium, and noted that three (out of seven) of the international regulators had at least some regard to this approach.⁵⁹ However, as noted in the prior section, the Partington and Satchell report does not recommend any use of the DGM (i.e. it should not be used to estimate the market risk premium, nor the overall return on equity).⁶⁰

There are many different specifications of 'the' DGM with different formulae and inputs. There is also variation in how the DGM output is used. For example, the Bank of England implements a relatively complicated DGM that (for example) incorporates share buybacks and allows for variation in risk-free interest rates across maturities.⁶¹ The Bank of England stated with regard to its DGM output:⁶²

Given the uncertainty associated with measuring the [market risk premium], the Bank's analysis tends to focus less on the precise level of the [market risk premium] and more on changes in the [market risk premium] over time or on the level of the [market risk premium] relative to historic averages.

In 2018 we also calculated the market risk premium using two DGM constructions and different input ranges, to assess the overall range of outcomes.⁶³ We had regard to several other forward-looking methods to estimate the market risk premium, including surveys of market participants' expectations. We also included market data on dividend yields, volatility and credit spreads, which were 'conditioning variables' used to provide directional information around changing market conditions and the forward-looking market risk premium.

We are interested in views on whether we could include a forward-looking perspective by using the DGM to inform our choice of market risk premium. This might include suggestions for the form of the DGM and range of inputs. We are also open to suggestions on how other forward-looking methods, such as surveys or conditioning variables, should be used in market risk premium estimation.

Relationship between risk free rate and market risk premium

Another area where Brattle suggested our current approach might not reflect forward-looking market conditions was with regard to the relationship between the risk free rate and market risk premium. The 2018 Instrument keeps the market risk premium constant, even when the updated risk free rate at the beginning of each regulatory control period might be lower (or higher) than the value when the market risk premium was first set.

⁵⁹ These regulators were FERC (DGM only), NZCC (DGM and historical) and Ofwat (DGM and total market return).

⁶⁰ One of Partington and Satchell's implementation concerns—the limited number of listed energy networks in Australia—would not apply to the DGM if used to estimate the market risk premium (MRP) (instead of the overall return on equity), but the majority would still be relevant.

⁶¹ The Bank uses the term dividend discount model (DDM) where we use the term DGM. Bank of England, *Quarterly Bulletin, An improved model for understanding equity prices*, 2017 Q2.

⁶² The Bank uses the term equity risk premium (ERP) where we use the term market risk premium (MRP). Bank of England, *Quarterly Bulletin, An improved model for understanding equity prices*, 2017 Q2, pp. 92–93.

⁶³ AER, *Rate of return instrument, Explanatory statement*, December 2018, pp. 89–94, 270–275.

The Brattle report contrasted this approach with the ARERA and the UK regulators (Ofgem and Ofwat) who calculate the market risk premium as the difference between the overall historical return on equity and the prevailing risk free rate.⁶⁴ This 'Wright approach' implies a perfect negative correlation (one for one) between the risk free rate and the market risk premium. The Partington and Satchell report considered this one for one movement to be implausible and likely to cause problems.⁶⁵

The relationship between the risk free rate and market risk premium was also of interest in our 2018 review.⁶⁶ We considered whether a model for estimating how the market risk premium depends on the risk free rate could be developed, but did not think such a model would be accurate and reliable.

Our current assessment is that the Wright approach is unlikely to reflect conditions in financial markets. The econometric evidence does not support a causal relationship of negative and perfect correlation between the risk free rate and market risk premium as posited under the Wright approach.

However, we would like to hear views on whether there is a relationship between movements in the risk free rate and market risk premium and, if so, how this might be reflected in our approach. Where possible, we request specific alternatives that stakeholders consider preferable, as well as the rationale for such a relationship.⁶⁷

Up-to-date beta

The Brattle report also suggested that we should adjust our method for estimating equity beta to ensure we give sufficient weight to current financial conditions. Brattle suggested that we should:

- Use a shorter series (two to five years) of more recent data with frequent (daily or weekly) return observations.
- Add international comparators instead of lengthening the estimation window, as done by four out of the seven international regulators surveyed.

As summarised in section 4.1, Partington and Satchell providing some contrasting advice:

- Use longer return periods (monthly or quarterly) as this would provide a more reliable estimate of equity beta, and this means the shorter data windows would not allow enough data points.

⁶⁴ The Brattle Group, *A Review of International Approaches to Regulated Rates of Return*, June 2020, p. 44

⁶⁵ Partington and Satchell, *Report to the AER: Alternative Asset Pricing Models*, June 2020, p. 23.

⁶⁶ AER, *Rate of return instrument, Explanatory statement*, December 2018, pp. 230–235, 255–257.

⁶⁷ Example specific relationships might be that the market risk premium moves inversely with the risk free rate but at a rate of one-for-two instead of one-for-one; or that the market risk premium is invariant while the risk free rate is within two per cent of its long run average, but then moves inversely one-for-one outside that band. For clarity, these are illustrative examples and not indicative of an AER position.

- Do not add international firms as comparators for a domestic regulated network without adjustments, noting that these adjustments might not be practical to implement.

We assessed many issues around the econometric methods for estimating beta when developing the 2018 Instrument.⁶⁸ This was also related to discussion on the accuracy of the CAPM in estimating the return for less risky stocks (stocks with equity beta below one).⁶⁹ The Partington and Satchell report notes recent academic work on beta that provides new evidence on the reliability of the CAPM estimates of expected return.

Our 2018 approach included a 'most recent five years' data window, and using this window with both weekly and monthly observations would appear to satisfy most of the advice from the two expert reports. However, when developing the 2018 Instrument we also had regard to longer data windows and the stability of regulated networks' equity beta across time, and whether the beta estimate would be affected by business cycles or large events (such as the global financial crisis and tech boom).

We invite submissions on how we should develop beta estimates that are representative of the risks associated with the regulated entities. Where stakeholders suggest that a number of approaches be undertaken, it would also be helpful to have a framework for how the set of evidence is to be evaluated.

5.3 Use of alternative models

Apart from the standard CAPM and DGM discussed above, we have also considered other candidate models (the Black CAPM, international CAPM, consumption CAPM, Fama-French factor models, and a fixed-rate-plus-margin model).

The Partington and Satchell report considered that each had substantial limitations such as:

- Issues with empirical implementation.⁷⁰
- Lack of use in practice.⁷¹
- Concerns with data mining and mixed results.⁷²
- Concerns with reliability, relevance and suitability.⁷³

The Brattle report found almost no use of these models by international regulators.⁷⁴

On the information available to us at this time, it is therefore not clear how these models could have a role in setting our regulated return on equity. Nevertheless, if

⁶⁸ AER, *Rate of return instrument, Explanatory statement*, December 2018, pp. 142–194, 195–219.

⁶⁹ AER, *Rate of return instrument, Explanatory statement*, December 2018, pp. 142–194, 195–219.

⁷⁰ Partington and Satchell, *Report to the AER: Alternative asset pricing models*, June 2020, p. 35.

⁷¹ Partington and Satchell, *Report to the AER: Alternative asset pricing models*, June 2020, pp. 33, 35, 49.

⁷² Partington and Satchell, *Report to the AER: Alternative asset pricing models*, June 2020, p. 47.

⁷³ Partington and Satchell, *Report to the AER: Alternative asset pricing models*, June 2020, pp. 34, 51.

⁷⁴ The exception is that the US FERC uses a risk premium model alongside the CAPM and DGM. The risk premium model could be considered a form of the fixed-rate-plus-margin approach. Its implementation of the CAPM also includes a size adjustment, which could be considered a step towards the Fama-French three factor model.

stakeholders are aware of new material that might support the use of these models, we would welcome submission of that material.

5.4 Use of single or multiple models

More broadly, if stakeholders are aware of new information on whether we should use multiple models, and if so how they might be combined to arrive at a rate of return, then we would welcome that material.

As noted in section 4, our expert reports provided contrasting positions on the merits of using multiple models.

Our current assessment is that using multiple models in combination appears difficult to justify:

- The models have conflicting conceptual bases and assumptions and are not compatible with each other.
- There is no agreed basis for establishing an optimal weighting scheme.
- CAPM appears to be the preeminent model for asset valuation and estimation of returns used in practice. As such it is most likely to best reflect the expectations of investors.
- We would need to carefully consider whether averaging the CAPM estimate with another model (or models) would be expected to lead to a more or less reliable and suitable return on equity.

If we were to primarily use one model, this would be compatible with retaining the 'foundation model' approach applied in the 2018 Instrument, though we would be able to make changes to other steps as appropriate.⁷⁵ A multiple model approach involving a weighted averaging of different models would require changes to our overall equity estimation process. Overall, there appear to be a number of significant challenges to be overcome before a multiple model approach could be employed.

We invite stakeholder submissions on these issues.

5.5 Use of international comparators

Our two expert reports provided somewhat contrasting views on the use of international comparators for estimating the rate of return (for example, equating market risk premium or beta between countries):

- Partington and Satchell advised against using international comparators and estimates without adjustment. The necessary adjustments are complex, as shown by their algebraic derivation of beta exposure for international firms.

⁷⁵ This working paper is focused on return on equity models, but the foundation model approach used in 2018 also included consideration of broader information relevant to the return on equity. We expect to examine these other sources of potential return on equity information later in the 2022 review. We will consult with stakeholders on what information might be relevant and how it might inform our estimate of the return on equity.

- Brattle considered that international comparators may be used if there is sufficient comparability with the firms being regulated and absence of substantial exchange risk.⁷⁶ Brattle acknowledged that the use of international comparators required careful consideration of both the comparability of these firms and the market in which they operated.⁷⁷ In its report, Brattle drew comparisons between rate of return parameters (such as equity beta) estimated in different countries without further adjustment.

Our current assessment is that, on balance, there continues to be a range of issues which makes use of international comparators difficult without adjustment. These include:

- Different underlying comparator firms. For example:
 - Ofwat's equity beta is based on comparator firms that also operate in the retail sector.
 - The Surface Transportation Board's comparator firms are rail businesses.
- Differences in the makeup of the economy and the business cycle.
- Different bond rates, the market return, currencies and interest rates.⁷⁸
- The use of a domestic CAPM does not align with use of international comparators.⁷⁹
- The international CAPM or the global CAPM require somewhat unrealistic assumptions about the world market.⁸⁰
- Different underlying methodological choices by regulators.

The above mentioned differences can drive a range of outcomes that make the comparison of parameters difficult. This in part comes down to the judgement applied by each regulator and the fact that setting the rate of return is a complex task with no one right answer.

⁷⁶ The Brattle Group, *A Review of International Approaches to Regulated Rates of Return*, June 2020, pp. 61–62; Partington and Satchell, *Report to the AER: Alternative Asset Pricing Models*, June 2020, pp. 30–34.

⁷⁷ The Brattle Group, *A Review of International Approaches to Regulated Rates of Return*, June 2020, p. 61.

⁷⁸ Partington and Satchell, *Report to the AER: Alternative asset pricing models*, June 2020, pp. 30–31.

⁷⁹ Partington and Satchell, *Report to the AER: Alternative asset pricing models*, June 2020, p. 30.

⁸⁰ Partington and Satchell, *Report to the AER: Alternative asset pricing models*, June 2020, p. 30

6 Glossary

Below are accessible explanations of the more specialised financial terms used in this draft working paper.

- **Commonwealth Government Securities (CGS)** – Bonds and notes issued by the Australian federal government to borrow money from investors.
- **Benchmark term** – This is the term to maturity of government bonds or debt we set that is used to calculate specific rate of return parameters. The term to maturity at issuance is the time between when an instrument is issued and its maturity date.
- **Capital Asset Pricing Model (CAPM)** – The CAPM is a model that estimates the required return on equity using three parameters: the risk free rate, equity beta and the market risk premium. It says that the required return on an investment will be related to the systematic risk of the investment. Here 'systematic risk' means risk that cannot be diversified away (by multiple investments in different companies across the market). An investment with higher risk will have a higher required return.
- **Comparator firms** – Comparator firms are firms considered to be sufficiently similar to the regulated energy businesses such that market data on the firm's performance (for example, movements in share prices) can be used to inform estimation of regulated rate of return parameters.
- **Debt raising costs** - These costs are the transaction costs incurred each time debt is raised or refinanced. These costs may include underwriting fees, legal fees, company credit rating fees and other transaction costs.
- **Dividend** – A sum of money paid (typically semi-annually or annually) by a company to its shareholders (equity investors) to compensate them for their ongoing investment of capital in the business.
- **Dividend Growth Model (DGM)** – The DGM is a valuation model which uses the share price, dividend (or cash flow) forecasts and the expected growth rate of the dividends to infer the required return on equity.
- **Equity beta** – This is a key parameter within the standard (Sharpe- Lintner) CAPM. It measures the 'riskiness' of a firm compared with that of the market and should only reflect the systematic risk. Systematic risk is risk that is inherent to the entire market and cannot be eliminated through holding a well-diversified portfolio (i.e. diversified away).
- **Gearing** – the proportion of debt in total financing.
- **Government securities** – Bonds and notes issued by governments to borrow money from investors.
- **Market risk premium (MRP)** – This is the difference between the expected return on a market portfolio and the return on the risk free asset. It compensates an investor for the systematic risk of investing in the market portfolio or the 'average firm' in the market.

- **Nominal Vanilla WACC** - The weighted average of the post-tax nominal return on equity and the pre-tax nominal return on debt.
- **Rate of return (or weighted average cost of capital)** – The rate of return on capital is a forecast of the additional return (above the initial investment amount) required to induce investment in its network. It is a combination of the return on debt and return on equity, weighted according to the proportions of debt and equity investment. In the current rate of return instrument, we estimate a make-up of 60% debt and 40% equity. As such, the WACC is formed of 60% return on debt and 40% return on equity. From the investor's perspective it is the return on the funds invested, but from the network's perspective this is the cost of obtaining the funds.
- **Rate of return instrument** – The Instrument is a binding document which sets out the way the AER will calculate the rate of return in regulatory determinations. Neither the AER nor the regulated businesses have the ability to depart from the instrument. The current instrument was published in December 2018 and its replacement is scheduled for December 2022.
- **Regulated network (or entity)** – a direct control network service for the purposes of the National Electricity Law or a reference service for the purposes of the National Gas Law. Essentially energy businesses that the AER sets revenue allowances for.
- **Regulated control period** – We set the revenues regulated businesses can earn over a certain timeframe in our regulatory determinations which is typically for a 5 year period. This period is called the 'regulatory control period' under the National Electricity Rules or an 'access arrangement period' under the National Gas Rules.
- **Regulatory determinations** – Regulatory determinations are decisions published by the AER and specify the amount of allowed revenue that network businesses can recover from customers during a regulatory control period.
- **Return on debt** – The return on debt is the AER's forecast of the interest costs of maintaining a debt portfolio for a regulated energy network.
- **Return on equity** – The return on equity is the AER's forecast of the return that equity investors (e.g. shareholders) require in order to induce them to invest in a regulated energy network.
- **Risk free rate** – This is a parameter within the CAPM which is a model for estimating the return on equity. The risk free rate measures the return an investor would expect from a 'riskless' investment where there is guaranteed return on the invested capital.
- **Total market return** – The total market return is the overall return expected by investors from investing in a diversified benchmark stock market index.
- **Weighted average cost of capital (WACC)** – See rate of return.