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

Lodged by email: rateofreturn@aer.gov.au

2 September 2022

Dear Mr Anderson

APA submission on the Draft Rate of Return Instrument 2022

In June 2022, the Australian Energy Regulator published the Draft Rate of Return Instrument 2022. This draft instrument was accompanied by an Explanatory Statement.

APA thanks you for the opportunity to comment on the draft instrument.

APA is an ASX listed owner, operator, and developer of energy infrastructure assets across Australia. Through a diverse portfolio of assets, we provide energy to customers in every state and territory on mainland Australia. As well as an extensive network of natural gas pipelines, we own or have interests in gas storage and generation facilities, electricity transmission networks, and over $750 million in renewable generation.

APA's submission is attached for your consideration.

This submission does not contain confidential information and may be published by the Australian Energy Regulator.

If you wish to discuss our submission in further detail, please contact Ignatius Chin on [redacted] or [redacted]

always powering ahead

Sincerely,

Peter Bolding

General Manager Economic Regulatory and External Policy

APA submission on Draft 2022 Rate of Return Instrument

2 September 2022

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Executive summary

APA Group (APA) has concerns about the Australian Energy Regulator's decision to change the term of the proxy for the risk-free asset of the Capital Asset Pricing Model (CAPM), but otherwise would expect to see much of the *2022 Draft Rate of Return Instrument* (2022 Draft Instrument) retained in the final 2022 Rate of Return Instrument.

Changing the term of the proxy for the risk-free asset

NPV = 0 does not require matching equity term to the regulatory control period

NPV = 0 does not specifically require that the equity term matches the length of the regulatory control period. If equity investors expect to receive cashflows over a longer period (because investments in regulated assets are seen as being long term investments) then, provided the regulator takes a long-term view of the allowed rate of return, NPV = 0.

The investment horizon of equity investors cannot be assumed to be the length of regulatory control period. The investment horizon must be established by reference to evidence of investor practice.

A 10-year term consistent with market practice?

Corporate finance theory and commercial evidence may indicate that investors' required returns vary with the length of the period over which those returns are expected to be recovered, but this does not establish that that period should match the length of the regulatory control period.

The conclusion of section 6.2.1.6 of the Draft Explanatory Statement, that the best estimate of a discount rate to be applied to cashflows extending over a period of five years is unlikely to be based on 10-year CGS yields, is unsupported.

No guidance on the setting of the term of the proxy for the risk-free asset of the CAPM is to be found in section 6.2.1.6 of the Draft Explanatory Statement.

Equity term and the role of the CAPM

Rate of return on equity may or may not have a term structure.

Even if rate of return on equity has a term structure:

- The rate of return on equity has no term structure under the CAPM. This is because CAPM is a single-period model. This means a term structure should

not be attributed to the risk-free rate of the CAPM. If a term structure is not to be attributed to the risk-free rate, then there is no reason for the proxy for the risk-free asset to have a term which matches the length of the regulatory control period.

- We cannot assume that that term structure follows the term structure of CGS.

Hence, the question of how the risk-free rate should be estimated under CAPM is left open. This means an alternative perspective for estimating risk-free rate is required. APA has sought advice from Professor Stephen Wright for such alternative perspective as discussed further below[1].

Where do we go from here?

NPV = 0 does not lead conclusively to the setting of the term for the proxy for the risk-free asset of the CAPM so that it matches the length of the regulatory period.

How, then, should the risk-free rate of the CAPM be estimated?

APA asked advisor to United Kingdom regulators, Professor Stephen Wright, this question. His response is attached to this submission.

Professor Wright advised:

- the term of the proxy for the risk-free asset should be set equal to the assumed investment horizon of equity investors since the return on even a default-free long term bond is only risk-free if the bond is held to maturity;
- establishing the investment horizon of equity investors is not clear-cut, but there is a strong case for assuming an investment horizon, and hence a term for the risk-free asset, that is distinctly longer than five years (the length of the regulatory control period);
- the preceding conclusions are consistent with well-established practice by regulators both in the United Kingdom and (until recently) in Australia; and
- the terms of the bonds used to estimate the risk-free rate of the CAPM in recent United Kingdom regulatory decisions are as follows:

Regulator	Price control	Term of bond (years)
CAA	RP3	10
Ofwat	PR19	15

[1] Under the heading of *"Where do we go from here?"*

CMA	RP3	10-20
Ofgem	GD2 & T2	20
CMA	PR19	20
Ofcom	WFTMR	10-15
UR	PR21	10 and 20
CAA	H7	20

The bond which provides a precise estimate of the risk-free rate for a chosen investment horizon will be a default-free zero-coupon bond with term equal to that horizon.

Given the current practical constraints, the appropriate pragmatic choice is the market practice of using CGS with terms of 10-years as a proxy for the risk-free asset of the CAPM.

The rules for risk-free rate estimation in the current (2018) Rate of Return Instrument, which reflect the market practice of using CGS with terms of 10 years as the proxy for the risk-free asset of the CAPM, should be retained in the 2022 Instrument.

Length of regulatory control period other than five years

There is no need to specify different procedures for setting the risk-free rate of return for regulatory control periods of different lengths. In the 2022 Rate of Return Instrument, clause 5 can take the form it currently takes in 2018 Instrument (including the current requirement to estimate the risk-free rate from daily yields on CGS with terms of 10 years).

In the 2022 Rate of Return Instrument, clause 4 can also take the form it takes in the current (2018) Instrument (or an appropriate modification of that form should the AER allow updating of the MRP using dividend growth model estimates).

Averaging period

Changes to the nomination window for the risk-free rate averaging period in the 2022 Draft Instrument should be incorporated in the 2022 Rate of Return instrument.

Consistency with other parameter estimates

APA notes that the AER intends to seek consistency with its earlier (2020) position on inflation expectations estimation.

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Consistency in the application of the AER's conceptual framework, including across regulatory decisions, is desirable.

However, a superficial requirement for consistency should not override the recognition of fundamental economic differences between different aspects of the regulatory task.

Other aspects of the 2022 Draft Instrument

APA's comments on other aspects of the 2022 Draft Instrument and on the accompanying *Explanatory Statement* (Draft Explanatory Statement) are summarised as follows.

Form of the rate of return

The form of the allowed rate of return, a nominal vanilla weighted average of returns on equity and debt, as set out in the 2022 Draft Instrument, should be retained in the 2022 Rate of Return Instrument.

Gearing

Gearing of 60 per cent continues to be appropriate for the 2022 Rate of Return Instrument.

Overall approach

The CAPM, properly applied, can be used to estimate equity returns.

Market risk premium

Use of the DGM provides an approach to MRP estimation. Such approach is very different compared to MRP estimation using HER.

Compared to HER, use of the DGM better captures the changes in asset risks and investor willingness to bear those risks that seem to underlie time variation in the MRP.

Issues with the ENA calibrated DGM are, we understand, being addressed by the ENA and model developer Frontier Economics.

For MRP estimation from HER, the longest - and most appropriate - series available is the Brailsford, Handley and Maheswaran series for 1958 to 2010, extended, using the Brailsford, Handley and Maheswaran methods, for 2011 to 2021.

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Estimation of the MRP as an average of HER has some validity only if a very long series of those HER is used: the series from 1958 (64 observations) might be long enough.

No evidence of a structural break around 1988 has been put forward to justify a focus on the series from 1988, which is simply too short for reliable estimation.

In estimation of the MRP for the Rate of Return Instrument, there is no forecasting of the HER series forward at a rate of return implied by the historical series available at the time. The unbiased estimator of the mean of the series is the arithmetic average. This is unaffected by any considerations of the presence of autocorrelation in the excess return series, or by variance volatility.

An estimate of the MRP for the 2022 Instrument, which is made from HER, should be made as the arithmetic average of those returns.

The AER should not move the HER estimate of the MRP, or provide an uplift to the risk-free rate, based on survey results.

The AER should not move the HER estimate of the MRP based on the observation of conditioning variables.

Equity beta estimation

The AER's decision on the value of the equity beta makes maximum use of the available Australian data and makes appropriate use, as a cross-check, of the data available from international comparators.

Many of the international energy firms which might be considered for inclusion in a comparator set are not directly comparable with the "pure play" electricity network or gas pipeline system of the Australian benchmark.

A closer examination of these international energy firms should be a major part of establishing equity beta values for future Rate of Return Instruments.

Although APA is of the view that equity beta estimates are rising, at least in part through investor assessment of the risks of carbon transition, insufficient data are available, at this time, to support a value of the equity beta of the CAPM which is substantially above the value in the current (2018) Rate of Return Instrument.

A beta estimate of at least 0.6 should be retained in the 2022 Rate of Return Instrument.

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Return on debt

The assumption of a benchmark term of 10 years for service provider debt should be retained in the 2022 Rate of Return Instrument.

The benchmark rate of return on debt calculated using the method of the 2018 Rate of Return Instrument uses the largest sample available at the time the rate of return on debt is to be estimated. The method of the 2018 Instrument should be adopted in the 2022 Rate of Return Instrument.

The Energy Industry Credit Spread Index is constructed from a sample of firms which is not sufficiently large to average out inefficiency in debt raising, or to reflect the wide range of contractual responses to risk management found in debt instruments. It should not be used to adjust the benchmark cost of debt.

The simple trailing average of the current approach to rate of return on debt estimation should be retained in the 2022 Rate of Return Instrument.

In proceeding to the 2022 Rate of Return Instrument, the AER should: continue to

- source the data required for rate of return on debt estimation from the Reserve Bank of Australia, the Bloomberg service and the Thompson Reuters service;
- use the methods of extrapolation and interpolation which are currently used, and which have been retained in the 2022 Draft Instrument; and
- convert rates published by the Reserve Bank, Bloomberg and Thompson Reuters to effective annual rates where that is required.

The return on debt contingencies, as set out in the 2022 Draft Instrument should be retained in the 2022 Rate of Return Instrument.

Changes to the provisions for debt averaging period proposed in the 2022 Draft Instrument should be incorporated into the 2022 Rate of Return Instrument.

Value of imputation credits

The value to be attributed to imputation credits in the 2022 Rate of Return Instrument should be set at 0.585, as indicated in paragraph 27 of the 2022 Draft Instrument.

Overall rate of return cross-checks

APA broadly agrees with this use of cross-checks in the way the AER proposes

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We would expect the AER to use whatever information is available to sense-check all aspects of its rate of return determination

Careful specification of the approach to rate of return determination, and careful application of the specified approach, which the AER has sought to achieve, limits the scope for cross-checks.

RAB multiples are unsuitable for use as cross-checks on the overall rate of return. Scenario testing has some limited value in cross-checking the rate of return. Assessments of financeability can provide a useful indicator of the appropriateness of the overall rate of return.

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Attachment

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1 This submission

APA Group (APA) is pleased to be able to provide, in this submission, comments on the *2022 Draft Rate of Return Instrument* (2022 Draft Instrument) and on the accompanying *Explanatory Statement* (Draft Explanatory Statement), which were published by the Australian Energy Regulator (AER) on 16 June 2022.

Our principal comments are on the risk-free rate of return, in section 3 of the submission.

APA thinks the AER's reasons for its decision to adopt a term of five years for the proxy for the risk-free asset of the Sharpe-Lintner Capital Asset Pricing Model (CAPM) are unsound. The AER should, we think, continue the practice of the current Rate of Return Instrument, and of earlier regulatory decisions, requiring estimation of the risk-free rate using yields on Commonwealth Government Securities (CGS) with terms of 10 years.

In addition to commenting on the risk-free rate, APA comments briefly on each of the other key aspects of the 2022 Draft Instrument. Those key aspects are:

- allowed rate of return: form, gearing and overall approach (section 2);
- market risk premium (section 4);
- equity beta estimation (section 5);
- return on debt (section 6);
- value of imputation credits (section 7); and
- overall rate of return cross checks (section 8).

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2 Allowed rate of return: form, gearing and overall approach

Subject to an over-riding requirement that the allowed rate of return contribute to the achievement of the national electricity and national gas objectives to the greatest degree, calculation of the allowed rate of return must include a weighted average of an allowed return on equity and an allowed return on debt.[2]

Paragraph 3 of the 2022 Draft Instrument retains the form and structure of the allowed rate of return - a nominal vanilla weighted average of returns on equity and debt - from the current (2018) Rate of Return Instrument which, in turn, incorporated prior regulatory practice.

2.1 Form of the allowed rate of return

Key point:

- The form of the allowed rate of return, a nominal vanilla weighted average of returns on equity and debt, as set out in the 2022 Draft Instrument, should be retained in the 2022 Rate of Return Instrument.

In earlier submissions, APA accepted the use of this nominal vanilla weighted average as a measure of the allowed rate of return, as did other stakeholders.[3]

The form and structure of the allowed rate of return, as set out in the 2022 Draft Instrument, should be retained in the 2022 Rate of Return Instrument.

2.2 Gearing ratio

Key point:

- Gearing of 60 per cent continues to be appropriate for the 2022 Rate of Return Instrument.

In the nominal vanilla weighted average used to estimate the allowed rate of return, debt is to be weighted by the benchmark gearing ratio. Paragraph 3(d) of the 2022 Draft Instrument sets this ratio to 0.6.

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2 National Electricity Law, s. 18I(4); National Gas Law, s. 30D(4).
3 Draft Explanatory Statement, page 69.

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The gearing ratio, the Draft Explanatory Statement advises, was estimated primarily from market data for listed Australian electricity network and gas pipeline service providers.

In earlier submissions APA agreed with estimation of the gearing ratio using, primarily, market data. Market data, and not historical book values, provide the conceptually correct measure of gearing to be used in calculating the forward-looking allowed rate of return of the Rate of Return Instrument.

The data used for estimation were series to 2021, and were for longer periods (10 years, and from 2006), and for a shorter period of five years with fewer listed service providers. There is, as the Draft Explanatory Statement notes, some variability in these series, and a possible indication of a downward change in the data for the shorter period. Nevertheless, the data indicate a gearing ratio close to 0.6.

In APA's March 2022 submission, we noted that there was no simple method whereby specific hybrid securities could be allocated between equity and debt, and did not see those securities as forming part of the portfolio of financing instruments used by a benchmark service provider. The Draft Explanatory Statement advises that AER has decided to exclude hybrid securities when making its empirical estimates of gearing.

A gearing ratio of 0.6 is used in the current Rate of Return Instrument and, in APA's view, continues to be appropriate for the 2022 Rate of Return Instrument.

2.3 Overall approach

Key point:

- The CAPM, properly applied, can be used to estimate equity returns.

Paragraph 4 of the 2022 Draft Instrument requires estimation of the allowed rate of return on equity using the AER's foundation model, the CAPM.

In earlier submissions APA noted the limitations of the CAPM, but has acknowledged that, properly applied, the model can be used to estimate equity returns.

Our comments on the required method of estimation of an allowed rate of return on debt for the nominal vanilla weighted average of returns are in section 6 of this submission.

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3 Risk-free rate

Paragraph 5(a) of the 2022 Draft Instrument requires, for a business with an expected regulatory control period of five years and one month or less, a risk-free rate of return estimated as a simple average of daily yields on CGS with terms of five years. Paragraphs 5(b) to 5(f) set out rules for estimation of the risk-free rate for businesses with regulatory control periods longer than five years and one month.

APA's comments focus, initially, on the requirement to estimate the risk-free rate for a business with a regulatory control period of five years and one month or less. (The regulatory control period is typically five years.) We note, later, our views on risk-free rate estimation for businesses with longer regulatory control periods.

The current (2018) Rate of Return Instrument requires estimation of the risk-free rate using yields on CGS with terms of 10 years, and this was also earlier regulatory practice. The 2022 Draft Instrument continues to require risk-free rate estimation using yields on CGS, but the term is reduced to five years. The reasons for the change are set out in the Draft Explanatory Statement.

APA agrees with using yields on CGS for risk-free rate estimation but thinks the AER's reasons for changing from the 10-year term to a term of five years are unsound.

As we explain, the AER should continue to estimate the risk-free rate using yields on CGS with terms of at least 10 years.

In the following subsections of this section of our submission:

- we examine the way in which the principles of financial economics have led the AER to the view that the equity term should match the length of the regulatory control period: we explain why the AER's reasoning is inconclusive;
- we review the AER's assessment of the view that a 10-year term is consistent with market practice: we find no support for the AER's principal conclusion that the best estimate of a discount rate to be applied to cashflows extending over a period of five years is unlikely to be based on 10-year CGS yields;
- we consider section 6.2.1.9 of the Draft Explanatory Statement, which links the equity term and the CAPM: we find that Professor Partington's advice is acknowledged but no consideration is given to its implications beyond the need for alignment of the risk-free rate estimate of the CAPM with the risk-free rate used in MRP estimation;

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- we agree that consistency in the application of the AER's conceptual framework, including across regulatory decisions, is desirable, but caution that a superficial requirement for consistency should not override fundamental economic differences between different aspects of the regulatory task;
- we summarize, and conclude that no case has been made for changing the term of the proxy for the-risk free asset of the CAPM from 10 years to five years, and we present strong arguments for continuing estimation of the risk-free rate using yields on CGS with terms of at least 10 years; these arguments draw on advice we have received from advisor to United Kingdom regulators, Professor Stephen Wright;
- we note the implications of our conclusion for regulatory periods other than five years; and
- we comment briefly on the risk-free rate averaging period.

3.1 NPV = 0 does not require matching equity term to the regulatory control period

Key points:

- NPV = 0 does not specifically require that the equity term matches the length of the regulatory control period. If equity investors expect to receive cashflows over a longer period (because investments in regulated assets are seen as being long term investments) then, provided the regulator takes a long-term view of the allowed rate of return, NPV = 0.
- The investment horizon of equity investors cannot be assumed to be the length of regulatory control period. The investment horizon must be established by reference to evidence of investor practice.

On page 102 of the Draft Explanatory Statement, the AER advises that the NPV = 0 principle is central to its rate of return work because it contributes to achievement of the national electricity objective and the national gas objective.

In its *Term of the rate of return final working paper* the AER concluded that one of the merits of matching the equity term to the length of the regulatory control period was that, unlike the 10-year equity term, this satisfied the NPV = 0 principle.[4]

In arriving at this conclusion, the AER had relied on a simple mathematical model prepared by Dr Martin Lally, which the regulator had found to be “compelling”.

[4] Draft Explanatory Statement, page 102.

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However, the model had been questioned by stakeholders and some experts.[5] The AER therefore sought to explore what conclusions could be drawn using the NPV = 0 principle if it did not rely on Dr Lally's work.[6]

Applying the standard corporate finance mathematics underlying discounted cashflow modelling to a 100% equity-financed business, the AER expressed the expected return on equity, $E[r_1]$, over a period as:

$$E[r_1] = \frac{E[V_1] - V_0 + E[CF_1]}{V_0}.$$

V_0 is the beginning-of-period market value of regulated assets, $E[V_1]$ is the expected market value of those assets at the end of the period, and $E[CF_1]$ is the expected free cashflow over the period.

Rearranging this formula:

$$V_0 = \frac{E[CF_1] + E[V_1]}{1 + E[r_1]}.$$

This is equation (1) of the Draft Explanatory Statement.[7]

The Draft Explanatory Statement notes that, although Dr Lally had made a number of simplifying assumptions, the AER did not consider these to limit the generality of his conclusion. Furthermore, equation (1), which is obtained without reliance on Dr Lally's work, is also derived by making a number of simplifying assumptions. These, the Draft Explanatory Statement advises, were made "without loss of generality".[8]

From equation (1), the AER concludes that if the length of the regulatory control period is five years, then the discount rate, $E[r_1]$, is the expected return over the 5-year regulatory control period.[9] Dr Lally's result is re-established.

From Dr Lally's work, and from its own exploration of the application of the NPV = 0 principle, the AER concludes that the equity term should match the length of the regulatory control period.

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5 Dr Martin Lally (Capital Financial Consultants), *The appropriate term for the allowed cost of capital*, April 2021.
6 Draft Explanatory Statement, page 103.
7 Draft Explanatory Statement, page 104.
8 Draft Explanatory Statement, page 104.
9 Draft Explanatory Statement, page 105.

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We note that, in this conclusion, it is the equity term which should match the length of the regulatory control period. Nothing is said about the requirement of the 2022 Draft Instrument that the rate of return on equity be estimated using the CAPM, or about how the term of a proxy for the risk-free asset of that model should be established. The equity term and the term of the proxy for the risk-free asset are not interchangeable, although in many places in the Draft Explanatory Statement their interchangeability seems to be assumed. We further consider the issue of the equity term and the term of the proxy for the risk-free asset of the CAPM in section 3.3 below.

In its earlier submissions, APA accepted that Dr Lally had made simplifying assumptions, and now accepts that the AER's "exploration" not relying on Dr Lally's modelling has also made simplifying assumptions. We accept that, in each case, this has been "without loss of generality".

However, the conclusion - that the equity term should match the length of the regulatory control period - is invalid.

This is most clearly seen from the AER's exploration of the application of the NPV = 0 principle. Equation (1) of the Draft Explanatory Statement is valid for any period over which the expected free cashflows $E[CF_1]$ are specified, and at the end of which the expected market value of assets is $E[V_1]$. Equation 1 requires only that, for NPV = 0, the term of the discount rate, $E[r_1]$, must be consistent with the term of the free cashflows. Nothing in the AER's exploration of the application of NPV = 0 requires the term of the discount rate - the equity term - to match the length of the regulatory control period.

Similarly, Dr Lally's simple mathematical model does not lead to the conclusion that the NPV = 0 principle imposes a requirement that the equity term match the length of the regulatory control period. Rather, the conclusion which should be drawn from Dr Lally's model is that the equity term must match the horizon over which equity investors expect to receive cashflows from their investments. If the horizon over which equity investors expect to receive cashflows is the length of the regulatory control period, then provided the regulator sets the allowed rate of return on equity consistent with that horizon (that is, matches the equity term with the length of the regulatory control period) NPV = 0. If, however, equity investors expect to receive cashflows over a longer period (because investments in regulated assets are seen as

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being long term investments) then, provided the regulator takes a long-term view of the allowed rate of return, NPV = 0.[10]

That the equity term matches the length of the regulatory control period is not a necessary condition for NPV = 0.

APA has shown this in its earlier submissions. A similar conclusion was reached by the Consumer Reference Group (CRG) in the submission to which the AER refers on page 105 of the Draft Explanatory Statement. The CRG concluded (among other things):

- *Lally's report does not 'prove' the term of the regulatory allowance for equity should match the length of the regulatory period;*
- *The report's mathematical model demonstrates that the regulatory allowance must match the regulator's estimate of the investor's true discount rate for the NPV = 0 principle to be satisfied. This is true by construction rather than a proof. It does not explain how the regulator should estimate investors' true discount rate.*[11]

Neither Dr Lally's model, nor the AER's alternative exploration of NPV = 0, requires that the equity term match the length of the regulatory control period. The equity term might match the length of that period, with the implication that NPV = 0, if the investment horizons of equity investors – the periods over which those investors expect cashflows from their investments in regulated assets – were to match the length of the regulatory control period. However, any matching of the investment horizons of equity investors and the length of regulatory control period must be demonstrated. It cannot be assumed.[12]

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10 The issue of the period over which investors expect to receive cashflows, and its implications, are considered further in section 3.5.2 below.

11 AER Consumer Reference Group, *Advice to the Australian Energy Regulator: CRG Response to the AER's December 2021 Information Paper*, March 2022, page 57.

12 Both the National Electricity Law (NEL) and the National Gas Law (NGL) preclude, in the setting of the allowed rate of return, simply assuming that the investment horizons of equity investors match the length of the regulatory control period.

In making the rate of return instrument, the AER must:

- have regard to the revenue and pricing principles (NEL s. 18I(5) and NGL s. 30D(5)); and
- ensure the instrument contributes to achievement of the national electricity and national gas objectives to the greatest degree (NEL s. 18I(3) and NGL s. 30D(3)).

An allowed rate of return which does not, among other things, deliver the returns equity investors require, because its determination has not taken into account the periods over which those returns are required, cannot meet the requirement of the revenue and pricing principles (NEL s. 7A(3) and NGL s. 24(3)) that a service provider be provided with effective incentives to promote economic efficiency.

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If the matching of the investment horizons of equity investors and the length of regulatory control period cannot be assumed and must be demonstrated, the starting point for such a demonstration might be an examination of investor, or market, practice.

3.2 A 10-year term consistent with market practice?

Key points:

- Corporate finance theory and commercial evidence may indicate that investors' required returns vary with the length of the period over which those returns are expected to be recovered, but this does not establish that that period should match the length of the regulatory control period.
- The conclusion of section 6.2.1.6 of the Draft Explanatory Statement, that the best estimate of a discount rate to be applied to cashflows extending over a period of five years is unlikely to be based on 10-year CGS yields, is unsupported.
- No guidance on the setting of the term of the proxy for the risk-free asset of the CAPM is to be found in section 6.2.1.6 of the Draft Explanatory Statement.

A common market practice, section 6.2.1.6 of the Draft Explanatory Statement advises, is:

- use of the same discount rate to discount the net cashflows of business valuations even though those cashflows extend over different periods; and

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Equity investors bear both regulatory and commercial risks. Investor assessments of those risks take into account the periods over which investors expect to be exposed to them. An allowed rate of return determined in a way which has not taken into account the periods over which equity investors are exposed to regulatory and commercial risks cannot lead to a reference tariff which, as required by NEL s.7A(5) and NGL s. 24(5), allows for a return commensurate with the regulatory and commercial risks of providing the service to which that tariff relates.

To assume that equity investors expect to be exposed to risk only over the regulatory control period, and to not consider the period over which those investors perceive that they are exposed to risk, is a failure to have regard for the economic costs and risks of under and over investment by a service provider (required by NEL s. 7A(6) and NGL s. 24(6)).

To assume that equity investors expect to be exposed to risk only over the regulatory control period, and to not consider the period over which investors perceive that they are exposed to risk, is a failure to have regard for the economic costs and risks of under and over utilisation of service provider assets (as required by NEL s. 7A(7) and NGL s. 24(7)).

A rate of return instrument made without regard for each of the principles of NEL ss. 7A(3), 7A(5), 7A(6) and 7A(7), and without regard for each of the principles of NGL ss. 24(3), 24(5), 24(6) and 24(7), cannot contribute to the greatest degree to promoting efficient investment in, and efficient operation and use of, electricity network and gas pipeline assets. It cannot contribute to achieving the national electricity objective and the national gas objective to the greatest degree.

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- the setting of that discount rate using the yields on long-term government bonds.

Section 6.2.1.6 notes:

In the context of valuing going concern businesses and long-term investments, use of long term government bonds as the risk-free security and estimating the equity risk premium in relation to those 'represents a realistic, simplifying assumption and is consistent with the CAPM'.[13]

In Australia, the relevant long-term government bonds are 10-year CGS.[14]

This market practice, the Draft Explanatory Statement notes, has been one of the main arguments advanced in favour of a 10-year term:

Investments in regulated infrastructure are long term, and the standard practice of valuation professionals and market practitioners is to use a 10-year risk free rate as an input to the CAPM when valuing such investment projects. Therefore, the return real-world investors require is based on a 10-year term.[15]

Other Australian regulators have adopted a 10-year term for the return on equity with the rationale generally to reflect the long economic lives and investment horizons of regulated assets. As the Draft Explanatory Statement notes, the AER itself, in justifying the requirement of the current Rate of Return Instrument for use of 10-year CGS as the proxy for the risk-free asset of the CAPM, had used a similar argument in 2018.[16]

The estimation of a discount rate using long term (10-year) government bonds, and the use of that discount rate to discount cashflows extending over different periods of time, the Draft Explanatory Statement explains, is a practical compromise rather than the theoretically more accurate solution of matching the discount rate to the timing of cashflows.[17] Moreover, that it is a practical compromise is recognized by practitioners themselves, as shown by the paragraphs from reports by Grant Samuel and KPMG reproduced on page 108 of the Draft Explanatory Statement.

Dr Boyle, the Draft Explanatory Statement continues, commented on this market practice during the concurrent expert evidence sessions. Dr Boyle saw the use of

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13 Draft Explanatory Statement, page 106.
14 Draft Explanatory Statement, page 107.
15 Draft Explanatory Statement, page 105.
16 Draft Explanatory Statement, page 106.
17 Draft Explanatory Statement, page 106.

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10-year CGS yields regardless of the timing of cashflows as a heuristic. Corporate finance research, Dr Boyle advised, had repeatedly demonstrated that firms regularly use simplified heuristics as approximations to more complex approaches. He concluded:

It certainly doesn't imply that a set of year 1-5 cash flows alone should be discounted at a 10-year rate.[18]

We agree. But Dr Boyle is saying nothing more than:

Practitioners sometimes applied a 10-year rate to all future cash flows as an approximation to using matched-year discount rates.[19]

He had nothing to say about why the period of the cashflows which might be relevant to investors in regulated assets should be five years.

Section 6.2.1.6 of the Draft Explanatory Statement concludes:

- based on corporate finance theory and commercial evidence, it appears unlikely that investors' required returns would be invariant to the length of the period over which those returns were expected to be recovered; and
- it appears unlikely that the best estimate of the required return on equity over a regulatory control period (typically 5 years) would be based on 10-year CGS yields.[20]

Corporate finance theory and commercial evidence may indicate that investors' required returns vary with the length of the period over which those returns are expected to be recovered, but this does not establish that that period should match the length of the regulatory control period.

There is no support in section 6.2.1.6 of the Draft Explanatory Statement for the conclusion that the best estimate of a discount rate to be applied to cashflows extending over a period of five years is unlikely to be based on 10-year CGS yields. Section 6.2.1.6 provides neither reasons for why the relevant period of cashflows to be discounted is five years, nor for why an appropriate discount rate is unlikely to be based on 10-year CGS yields.

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18 Draft Explanatory Statement, page 107.
19 Draft Explanatory Statement, page 107.
20 Draft Explanatory Statement, page 109.

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Section 6.2.1.6 of the Draft Explanatory Statement provides no guidance on the setting of the term of the proxy for the risk-free asset of the CAPM.

Indeed, in section 6.2.1.6 and the sections of the Draft Explanatory Statement which precede it, there is little mention of the CAPM even though that model is to be used to estimate the rate of return on equity. The foundation model makes its appearance only when we reach section 6.2.1.9.

3.3 Equity term and the role of the CAPM

Key points:

- Rate of return on equity may or may not have a term structure.
- Even if rate of return on equity has a term structure:
  - The rate of return on equity has no term structure under the CAPM. This is because CAPM is a single-period model. This means a term structure should not be attributed to the risk-free rate of the CAPM. If a term structure is not to be attributed to the risk-free rate, then there is no reason for the proxy for the risk-free asset to have a term which matches the length of the regulatory control period.
  - We cannot assume that that term structure follows the term structure of CGS.
- Hence, the question of how the risk-free rate should be estimated under CAPM is left open.
- This means an alternative perspective for estimating risk-free rate is required. This is discussed under section 3.5 of this submission.

Section 6.2.1.9 of the Draft Explanatory Statement begins with a short discussion of certain submissions the AER has received, and debate, during the concurrent evidence sessions, about use of the single-period CAPM in the valuation of multi-period projects.[21]

The Draft Explanatory Statement then advises:

Having considered the submissions and evidence before us, we consider it reasonable to use 5-year CGS yields to estimate the discount rate for the cashflows

[21] We comment further on this important issue later in this submission.

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arising within a 5-year regulatory control period and to use 10-year (or longer) CGS yields to estimate the discount rate for the cashflows arising in the long term.[22]

The arguments in favour of a 5-year equity term, the Draft Explanatory Statement continues, rely on such concepts as the time value of money and asset valuation by means of discounting uncertain cashflows, and these concepts pre-date the development of the CAPM. The case for a 5-year equity term, the Draft Explanatory Statement advises, does not depend on whether or not we use the CAPM to estimate discount rates.

Reference is then made to a note in which one of the experts, Professor Partington, advises that we are ultimately interested in the term structure for equity returns rather than term of CGS yields, and these may not be the same.[23] Professor Partington's view, that 'to accept that the equity term structure follows the term structure of government bonds is a strong assumption', is noted.[24] The Draft Explanatory Statement continues:

We acknowledge this point and note that the equity term structure could only exactly follow the CGS term structure if we do not re-estimate the MRP when moving from one term to another. . . . As we decided to adopt a shorter benchmark equity term, we need to re-estimate the MRP using the relevant shorter-term CGS yields.[25]

APA finds, in section 6.2.1.9 of the Draft Explanatory Statement essentially, three points addressing the equity term, the role of the CAPM, and the key question of how the risk-free rate of the model is to be estimated.

The first is an observation that a well-known textbook suggests that the proxy for the risk-free asset should be chosen keeping in mind how far into the future one wants to discount cash flows.[26] This is a view with which we might agree (but we are unsure of the reasons why the textbook in question makes the suggestion). However, it tells us nothing about how to decide how far into the future the cashflows to be discounted should extend.

Second, having considered the evidence available and the submissions received, the AER concludes that the use of 5-year CGS yields to estimate the discount rate for the cashflows arising within a 5-year regulatory control period is reasonable. In

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22 Draft Explanatory Statement, page 112.
23 Draft Explanatory Statement, page 112.
24 Draft Explanatory Statement, page 112.
25 Draft Explanatory Statement, pages 112-113.
26 Draft Explanatory Statement, page 112.

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reaching this conclusion, the AER does not take into account the fact that, within the context of the argument of section 6 of the Draft Explanatory Statement, it is an estimate of rate of return on equity which is used as the discount rate. In the broader context of the AER's total revenue modelling, it is the nominal vanilla weighted average cost of capital, determined using the CAPM to estimate the rate of return on equity, which is used as the discount rate. No reason or evidence is provided for why 5-year CGS yields should be used in estimation of the rate of return on equity and, in particular, in estimation of the rate of return on equity using the CAPM.

Third, relying on Dr Lally's model and its own exploration of the application of the NPV = 0 principle, the AER concludes that the equity term should match the length of the regulatory control period, implying that a term structure can be attributed to the rate of return on equity.

Professor Partington's note (referred to above) supports such a view:

There is both theoretical and empirical support for equity term structures that are rising, falling, or flat.[27]

However, in the financial economics literature, the issue of an equity term structure is, as Professor Partington notes, very much an open question. It is in this context that he expresses doubt about the equity term structure following the term structure of government bonds.

Equity may have a term structure, but we cannot assume that that term structure follows the term structure of CGS. Furthermore, even if equity has a term structure, that term structure will not be incorporated into equity returns estimated using the CAPM. Professor Partington advised:

If we seek guidance from the CAPM about the term structure of equity, we find that there is no term structure for either equity returns, or interest rates, since the CAPM is a single period model. The duration of the single period is undefined in the CAPM, it is the investment horizon assumed to be homogeneous across investors.[28]

As we have noted above, Professor Partington's advice is acknowledged on page 112 of the Draft Explanatory Statement. After acknowledging the advice, the Draft Explanatory Statement advises that, if the AER were to adopt, as a proxy for the risk-free asset of the CAPM, CGS with a term shorter than 10 years, then the regulator

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27 Partington, Graham, Concurrent Evidence Session: Commentary on Lally's Term Analysis, 7 February 2022, page 4.

28 Partington, Graham, Concurrent Evidence Session: Commentary on Lally's Term Analysis, 7 February 2022, page 4.

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would re-estimate the MRP using the relevant shorter-term CGS yields. This seems, to us, to be reasonable. It would achieve consistency in the application of the CAPM, which requires (1) an estimate of the risk-free rate in its own right, and (2) use of estimates of the risk-free rate in estimation of the MRP. However, achieving consistency in the estimates of the risk-free rate and the MRP does not address the issue which Professor Partington raises about the term structure of equity. In particular, it does not address Professor Partington's advice that the rate of return on equity estimated using the CAPM has no term structure since the CAPM is a single period model.

If the rate of return on equity estimated using the CAPM has no term structure, then a term structure should not be attributed to the risk-free rate of the CAPM. If a term structure is not to be attributed to the risk-free rate, then there is no reason for the proxy for the risk-free asset to have a term which matches the length of the regulatory control period.

This leaves open the question of how the risk-free rate should be estimated under CAPM. Before we address this question, we turn to the issue of consistency.

3.4 Consistency with other parameter estimates

Key points:

- APA notes that the AER intends to seek consistency with its earlier (2020) position on inflation expectations estimation.
- Consistency in the application of the AER's conceptual framework, including across regulatory decisions, is desirable.
- However, a superficial requirement for consistency should not override the recognition of fundamental economic differences between different aspects of the regulatory task.

Several submissions, section 6.2.1.10 of the Draft Explanatory Statement notes, commented on the importance of using a consistent conceptual framework for the estimation of rate of return parameters,.

The Draft Explanatory Statement also notes that aligning the rate of return on equity and the term of expected inflation would mitigate the mismatch between inflation

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expectations embedded in the allowed nominal return on equity and the estimate of expected inflation used in the PTRM.[29]

In addition, the CRG had raised the issue of consistency between the equity term and expected inflation.

The AER has relied on application of the NPV = 0 principle to guide its earlier (2020) position that inflation expectations be estimated over a term of five years. Consistently, the AER is now using the NPV = 0 principle to guide a decision that the equity term should match the length of the regulatory control period.

In its submissions, the ENA had argued that there was no link between the efficient cost of capital as determined in financial markets and the treatment of inflation within the AER's Post-tax Revenue Model (PTRM) and Roll Forward Model (RFM); the terms for regulatory inflation and equity were independent.[30]

The AER seems to agree with the ENA's view that the terms for expected inflation and the proxy for the risk-free asset of the CAPM are separate matters. Despite this apparent agreement, as the Draft Explanatory Statement notes, the AER still thinks that the underlying logic across regulatory decisions should be consistent. That is, the AER is still of the view that (a) it should promote consistency with the its earlier decision on a term of five years for the estimation of expected inflation and (b) it should promote such consistency by following the NPV = 0 principle and matching the equity term to the length of the regulatory control period.[31]

We agree that consistency in the application of the AER's conceptual framework, including across regulatory decisions, is desirable. A superficial requirement for consistency should not, though, override the recognition of fundamental economic differences between different aspects of the regulatory task.

3.5 Where do we go from here?

Key points:

- NPV = 0 does not lead conclusively to the setting of the term for the proxy for the risk-free asset of the CAPM so that it matches the length of the regulatory period.
- How, then, should the risk-free rate of the CAPM be estimated?

29 Draft Explanatory Statement, page 114.
30 Draft Explanatory Statement, page 113.
31 Draft Explanatory Statement, page 113.

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- APA asked advisor to United Kingdom regulators, Professor Stephen Wright, this question. His response is attached to this submission.
- Professor Wright advised:
    - the term of the proxy for the risk-free asset should be set equal to the assumed investment horizon of equity investors since the return on even a default-free long term bond is only risk-free if the bond is held to maturity;
    - establishing the investment horizon of equity investors is not clear-cut, but there is a strong case for assuming an investment horizon, and hence a term for the risk-free asset, that is distinctly longer than five years (the length of the regulatory control period); and
    - the preceding conclusions are consistent with well-established practice by regulators both in the United Kingdom and (until recently) in Australia.
- The bond which provides a precise estimate of the risk-free rate for a chosen investment horizon will be a default-free zero-coupon bond with term equal to that horizon.
- Given the current practical constraints, the appropriate pragmatic choice is the market practice of using CGS with terms of 10-years as a proxy for the risk-free asset of the CAPM.
- The rules for risk-free rate estimation in the current (2018) Rate of Return Instrument, which reflect the market practice of using CGS with terms of 10 years as the proxy for the risk-free asset of the CAPM, should be retained in the 2022 Instrument.

Beyond an argument for consistency, we do not find in the Draft Explanatory Statement, any strong reason for the AER's conclusion that the term of the proxy for the risk-free asset of the CAPM should match the length of the regulatory control period. Imposing the requirement that NPV = 0 does not lead conclusively to the setting of the term for the proxy for the risk-free asset of the CAPM so that it matches the length of the regulatory period.

How, then, should the risk-free rate of the CAPM be estimated?

APA asked this question of Professor Stephen Wright who has, for the last two decades, advised economic regulators in the United Kingdom on rate of return issues. Professor Wright's response to our question is attached to this submission.

In the following subsections of the submission, we:

- note Professor Wright's response to APA;
- consider further two issues which have been raised by Dr Lally:
  - there is no investment horizon common to all equity investors; and
  - even if there were, the relevant horizon is the length of the regulatory control period;
- conclude, and address a number of implementation issues.

3.5.1 Professor Wright's response to APA

Professor Wright notes in his response that any practical implementation of the CAPM faces the immediate problem of the time period of the model not being specified. (This issue, as we noted in section 3.3 above, was also raised by Professor Partington, but it was not considered by the AER.)

In the derivation of the CAPM, investors, having made decisions on consumption in current period t, are assumed to buy and sell assets to form portfolios which will transfer remaining wealth to a time one period in the future (period t + 1). Each investor faces the problem of allocating her or his wealth remaining after the period t decision to consume among N + 1 assets available so as to maximize end of period t + 1 wealth. All except one of the N + 1 assets available is risky. The rate of return on each of the N risky assets is not known with certainty at the end of period t when portfolio decisions are being made. One of the assets is risk-free. The rate of return on the risk-free asset is known with certainty at the end of period t.

An investor's period t + 1 wealth, W_{t+1}, is determined by the proportion, θ_i, of wealth allocated to each of the N + 1 assets and the return, R_i, expected on each asset at the end of period t + 1. Each investor's wealth at the end of period t + 1, $\hat{W}_{t+1}$, is, then:

$$\hat{W}_{t+1} = \theta_0 W_t(1 + R_{F,\,t+1}) + \sum_{i=1}^{N} \theta_i W_t(1 + R_{i,\,t+1}) \ .$$

W_t is the remaining wealth available at the end of period t for investment in a portfolio to transfer that wealth to the end of period t + 1.

Each investor invests a proportion of wealth θ_i, i = 1, 2, . . . , N, in each of the N risky assets, and expects, at the end of period t + 1, a return of $R_{i,\,t+1}$, i = 1, 2, . . . , N, on each of those assets. The total return on the investment in risky assets at the end of period t + 1 is:

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$$\sum_{i=1}^{N} \theta_i W_t(1 + R_{i,\, t+1}) \ .$$

Each investor invests a proportion of wealth θ_0 in the risk-free asset, and expects a return $R_{F,\, t+1}$ on that investment. The total return on the investment in the risk-free asset at the end of period t + 1 is:

$$\theta_0 W_t(1 + R_{F,\, t+1}) \ .$$

θ_i, i = 0, 1, . . ., N, W_t and $R_{F,\, t+1}$ are known with certainty. However, the returns on the N risky assets, $R_{i,\, t+1}$, i = 1, 2, . . . , N, are uncertain and, in consequence, $\widehat{W}_{t+1}$ is uncertain.

Professor Wright notes, in his response to APA, that a specification of the CAPM more precise than is usually found in textbooks is, then:

$$E_t(R_{i,\, t+1}) \ = \ R_{F,\, t+1} + \beta_i(E_t(R_{M,\, t+1}) - R_{F,\, t+1}) \ .$$

This specification makes clear that:

- the rates of return R_i, i = 1, 2, . . . , N, on the N individual risky assets, and the rate of return R_M on the market portfolio of the N risky assets, are uncertain at the end of period t, and this uncertainty is reflected by the fact that these rates of return enter the CAPM as expectations at the end of period t + 1 which are to be forecast by investors at the end of period t; and
- the risk-free rate of return is the risk-free rate at the end of period t + 1.

The risk-free rate of return is the rate of return on an asset which is risk-free. By its very nature, the risk-rate of return at the end of period t + 1, $R_{F,\, t+1}$, must be known to investors with certainty at the end of period t. (If it were not known, the rate would not be risk-free.) Investors, then, do not have to forecast $R_{F,\, t+1}$ at the end of period t; $R_{F,\, t+1}$ is known at the end of period t.

That the risk-free rate is known with certainty from the end of period t to the end of period t + 1, Professor Wright advises, guides the choice of a proxy for the risk-free asset of the CAPM. The proxy for the risk-free asset must have the property that its rate of return at the end of period t + 1 is known at the end of period t.

But, as we have noted above, the time period of the CAPM - the time elapsed between the end of period t and the end of period t + 1 - is not specified by the

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model. Before a proxy for the risk-free asset can be chosen, this period - the investment horizon - must be established.

The term of the proxy for the risk-free asset must match exactly the established investment horizon.

Suppose the proxy chosen for the risk-free asset has a term which is shorter than the investment horizon. To span the investment horizon, the proxy will need to be replaced on its maturity. The price of the replacement asset, and hence its rate of return, will be uncertain at the beginning of the investment horizon. The price and the rate of return will be known only later, at the time of replacement. A proxy for the risk-free asset which has a term shorter than the investment horizon will not be risk-free.

Suppose that the proxy chosen for the risk-free asset has a term which is longer than the investment horizon. To span the investment horizon, the proxy will need to be sold at the end of the horizon. The price at which the proxy can be sold prior to its maturity, and hence its rate of return, will be uncertain at the beginning of the of the investment horizon. The price and the rate of return will be known only at the end of the investment horizon. A proxy for the risk-free asset which has a term longer than the investment horizon will not be risk-free.

If the proxy for the risk-free asset is to deliver a risk-free rate of return, the term of the proxy must match exactly the investment horizon. The investment horizon must, therefore, be established before a proxy for the risk-free asset of the CAPM can be chosen.

What, then, is the investment horizon of investors who invest in regulated assets?

Professor Wright considers three alternative investor perspectives on horizon, recognizing that each perspective may describe the investment horizon of at least some investors. His three alternative perspectives are:

- Investor Perspective 1: the investment horizon is, as the AER assumes, the length of the regulatory control period;
- Investor Perspective 2: the investment horizon is a distinctly longer period, of around 20 years; and
- Investor Perspective 3: the investment horizon is a long period, recognizing that the investment is in long-lived electricity network or gas pipeline assets.

Some investors in regulated assets may invest for the length of the regulatory control period (Investor Perspective 1), which implies that those investors liquidate their investments after five years. Professor Wright acknowledges the existence of such

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investors but considers their behaviour to be "essentially arbitrary". Why would investors adopt an investment horizon simply because it matches the length of the regulatory control period, and liquidate their investments at the end of that period?

A distinctly longer horizon (Investor Perspective 2), Professor Wright advises, can be justified on grounds of both principle and practice. Investors in equities are engaged in the smoothing of consumption over their lifetimes (this is the perspective of the CAPM). With a working life, during which income is earned and wealth accumulated, of around 40 years, the average investment horizon of such investors is around 20 years. In practice, many of these investors will not invest directly in the equities of the firms which own electricity network and gas pipelines assets. They will invest in financial intermediaries - in particular, in pension funds - which take a similar long-term perspective and invest directly in the equities of the firms which own electricity network and gas pipelines assets.

These longer-term investors, Professor Wright notes, could, in principle, liquidate their investments after periods of five years (the length of the regulatory control period), and reinvest the proceeds, so that they invest over a horizon of around 20 years. This would, however, be risky, and inconsistent with the lifetime smoothing of consumption. The values of the investments at liquidation would be uncertain until realized, and the opportunities for reinvestment would similarly be uncertain until reinvestment occurred.

Professor Wright's Investor Perspective 3 is that of investors who invest directly in electricity network and gas pipeline assets. These investors have long investment horizons which correspond to the long economic lives of the assets in which they invest. They also have the "outside option" of investing in the traded equities of firms which have previously invested in electricity network or gas pipeline assets. Direct investment must therefore be expected to yield returns at least as high as investment in traded equities at a matching horizon. Consideration of direct investment in the underlying assets, rather than investment in traded equities, introduces at least two complications, which Professor Wright examines in his response to APA.

Professor Wright concludes that for a company with long-lived assets, some combination of Investor Perspectives 2 and 3 is the appropriate benchmark. Neither Perspective 2 nor Perspective 3 specifies a precise investment horizon, but both indicate that the relevant investment horizon when applying the CAPM is longer than five years.

Professor Wright notes that when he, and others, have provided advice to UK regulators, they have recommended choosing fairly long investment horizons. This has then been the practice of those regulators. Table 1 of Professor Wright's

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response to APA lists the terms of the bonds used to estimate the risk-free rate of the CAPM in recent UK regulatory decisions. Table 1 is reproduced below.

Bond terms used in estimating the risk-free rate in recent UK regulatory decisions

Regulator	Price control	Term
CAA	RP3	10
Ofwat	PR19	15
CMA	RP3	10-20
Ofgem	GD2 & T2	20
CMA	PR19	20
Ofcom	WFTMR	10-15
UR	PR21	10 and 20
CAA	H7	20

Professor Wright concludes his response to APA as follows:

- the term of the proxy should be set equal to the assumed investment horizon of equity investors since the return on even a default-free long term bond is only risk-free if the bond is held to maturity;
- establishing the investment horizon of equity investors is not clear-cut, but there is a strong case for assuming an investment horizon, and hence a term for the proxy for the risk-free asset, that is distinctly longer than five years (the length of the regulatory control period);
- the preceding conclusions are consistent with well-established practice by regulators both in the UK and (until recently) in Australia.

3.5.2 Choice of the investment horizon is not clear-cut

Professor Wright's response points us to the choice of a proxy for the risk-free asset of the CAPM which has a term longer than the length of the regulatory control period. However, beyond the term of the proxy being longer than the length of the regulatory control period, the choice is not clear-cut because establishing the investment horizon of equity investors is not clear-cut.

In advice recently provided to the Economic Regulation Authority (ERA) in Western Australia, Dr Lally commented on this issue in the context of a submission from APA company Goldfields Gas Transmission Pty Limited (GGT) which proposed that the proxy for the risk-free asset have a term of 10 years or longer. Dr Lally's advice was:

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The version of the CAPM used by the ERA (Officer, 1994) is a single period model, which assumes that investors invest for some period common to all investors, and therefore the term of the risk-free rate should be this common period. Investors desire wealth to finance consumption over their lives, and therefore the appropriate choice for this common period is long-term, and therefore the appropriate choice of the risk free asset in the single period CAPM is a long-term government bond (at least ten years). However, as noted by Partington (2022, page 4) and quoted by ATCO (2022, section 3.1), the assumed common period in question here (the investment horizon of investors) varies across investors and therefore matching the term of the risk free rate to this "common" investment horizon is impossible. Even if it were true that most investors had a horizon of at least 10 years, the consequence of choosing to apply the CAPM with a ten-year risk-free rate to a particular valuation problem would be to elevate this issue above all considerations relating to the specific valuation problem being examined. [32]

The AER is, in our view, appropriately, cautious about the approaches and methods of other regulators, which may be shaped by considerations not relevant to the AER's regulatory task. However, we see the version of the CAPM used by the ERA as being the same as the version being used by the AER. Furthermore, Dr Lally's characterisation of the CAPM as single period model derived from a view that investors desire wealth to finance consumption over their lives, and therefore the appropriate choice for this single period is long-term, is, we think, entirely consistent with Professor Wright's characterisation of the model. Dr Lally's points of contention are then:

- the investment horizon varies across equity investors, and therefore matching the term of the risk-free rate to a common investment horizon is impossible; and
- even if a common investment horizon could be established, the use of that horizon to guide the setting of the term of the proxy for the risk-free asset would accord primacy to the issue of the investment horizon and ignore the specific valuation problem being examined (that is, the valuation of cashflows over the regulatory control period).

Dr Lally's second point of contention is, we think invalid. As we explained in section 3.1 above, neither Dr Lally's model, nor the AER's alternative exploration of NPV = 0, specifically requires that the equity term match the length of the regulatory control period. If the horizon over which equity investors expect to receive cashflows is the

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[32] Dr Martin Lally, *The Appropriate Term for the Allowed Cost of Equity*, 20 April 2022, pages 30-31.

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length of the regulatory control period, then provided the regulator sets the allowed rate of return on equity consistent with that horizon (that is, matches the equity term with the length of the regulatory period) NPV = 0. If, however, equity investors expect to receive cashflows over a longer period (because investments in regulated assets are seen as being long term investments) then, provided the regulator takes a long-term view of the allowed rate of return, NPV = 0.

Professor Wright, in explaining his views on estimating the risk-free rate of the CAPM, also considered Dr Lally's argument that the valuation problem required the setting of the term of the proxy with reference to the length of the regulatory control period. Dr Lally's argument, Professor Wright advised rested on two assumptions specific to a regulated business:

- once an item of capital expenditure is accepted into the regulatory asset base (RAB), its depreciated value at any horizon is known with certainty; and
- within a regulatory control period, the regulator sets expected revenues on the asset base until the end of the regulatory control period.

These two assumptions were, in Professor Wright's view, uncontentious. However, the argument which followed from them was open to question. Dr Lally reasoned that it was possible to value the RAB only in terms of expected cashflow over the regulatory control period, and the known value of the RAB at the end of that period. In these circumstances, the yield to maturity on a bond with a term of five years (the length of the regulatory control period) becomes the appropriate measure of the risk-free rate.

There were, Professor Wright advised, a number of weaknesses, not in the logic of Dr Lally's argument, but in Dr Lally's approach to the valuation problem he was considering. Professor Wright summarised these in his response to APA and provided further details in an appendix. The weaknesses in Dr Lally's approach to the valuation problem were:

- an implicit assumption that investment in the RAB at the beginning of the regulatory control period could be entirely liquidated at the end of that period: this liquidation might be feasible, but the market for the RAB was likely to be thin, and this would add an illiquidity premium to the return on equity;
- there is evidence of persistent and time varying RAB multiples (Draft Explanatory Statement, pages 24-25) which, if they are systematic, would imply a higher systematic risk for notional liquidation at the end of the regulatory control period than for a strategy of "buy-and-hold" the RAB over multiple regulatory control periods;

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- if the primary element of value were the terminal value of the RAB, and that terminal value was known with certainty, then the allowed return on equity should be the risk-free rate; however, neither Dr Lally, nor the AER, takes this to be the case - a significant risk premium is assumed (that premium, APA, would add, is also recognised by financial market participants as shown by the AER's estimates of the relevant equity beta);
- to the extent that the future depreciated value of the RAB is perfectly predictable, this applies at any horizon up to the end of the life of the regulated asset; taking the view that the appropriate horizon is the regulatory control period assumes that regulatory price control sets expected cashflows only until the end of the regulatory control period, which is inconsistent with an underlying view that the NPV = 0 principle is expected to hold in future regulatory control periods; and
- the future depreciated value of the RAB cannot be perfectly predicted if the regulated business makes further investments in regulated assets when required by changes in the market for its services, and must invest in replacement assets to maintain its capability to provide service even if service demand is unchanging; the requirements for future new and replacement investment are not known with certainty at the end of any particular regulatory control period and, even if they could be forecast, they are subject to review and assessment by the regulator, who may or may not allow the forecast CAPEX to be included in the RAB.

These weaknesses in the argument, and in particular Professor Wright's fourth point, are consistent with the APA's earlier view, in section 3.1 above, that application of NPV = 0 does not lead conclusively to a requirement that the equity term match the length of the regulatory control period.

If consideration of the specific valuation problem being examined does not lead conclusively to the view that the length of the regulatory control period guides the setting of the term of the proxy for the risk-free asset, we are returned to the question of how the term of the proxy should be chosen, and to Professor Wright's response that the primacy must be accorded to the investment horizon of equity investors.

But then Dr Lally contends that the investment horizon varies across equity investors, and therefore matching the term of the proxy for the risk-free asset to a common investment horizon is impossible.

In an absolute sense such matching may be impossible, but a qualitative assessment can be made. As Professor Wright explains (as we noted above), investors in regulated assets will have different horizons. Typically though, those investors,

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whether they are buyers of equities on their own accounts, whether they hold equities indirectly through financial intermediaries (principally pension funds), or whether they are direct investors in, and owners of, electricity network or gas pipeline assets, have investment horizons longer than the regulatory control period. Taking a lifetime perspective on consumption and investment, buyers of equities on their own account, and those who hold equities indirectly through financial intermediaries, are likely to have horizons of around 20 years given an average working life of around 40 years. Investors in the physical infrastructure have long investment horizons which correspond to the long economic lives of the assets in which they invest. For most equity investors, the investment horizon will be a period considerably longer than the regulatory control period.

However, even if we were able to specify, exactly, that longer investment horizon, a practical problem arises: there may not be a default-free bond with a term which matches the horizon.

3.5.3 Choosing a proxy for the risk-free asset of the CAPM

Choice of the proxy for the risk-free asset can be guided by the theory - the CAPM - but must also recognise the constraints imposed by context in which the theory - a necessarily simplified description of a much more complex reality - must be applied. In this respect, application of the CAPM is no different from any other application of financial or economic theory.

Two issues arise.

First, as Professor Wright points out in his response to APA, a coupon bond has an average maturity, or duration, which is the average maturity of all of its coupon payments and its principal, with each component weighted by its market value. The duration of a coupon bond will therefore be strictly less than the bond's designated maturity. If there are no coupon payments - if the bond is a zero coupon bond - its duration will equal its designated maturity. The bond which provides a precise estimate of the risk-free rate for a chosen investment horizon will be a default-free zero coupon bond with term equal to that horizon.

Second, in Australia we currently have a number of CGS issues with terms longer than 10 years, but the longest term for which the Reserve Bank of Australia estimates zero coupon yields is 10 years.

Conceptual arguments, APA contends, lead us to the view that, when choosing a risk-free asset for application of the CAPM, we should be consider a default-free bond with a term corresponding to a long investment horizon. However, we are

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practically constrained: we might choose a specific long investment horizon - say, twenty years - but find that there are no zero coupon yields for that term. We may also find that there are no coupon bonds (CGS) on issue which have that term.

When choosing a proxy for the risk-free asset of the CAPM, do we choose:

- the notional zero coupon bond with a term of 10 years for which daily yields are estimated and published by the Reserve Bank;
- one of the CGS issues with a term longer than 10 years (for example, Treasury Bond 156, which matures on 21 May 2041); or
- CGS with terms around 10 years, with the yield for a 10-year term estimated from daily yields in the way currently prescribed by the 2018 Rate of Return Instrument?

As with the choice of investment horizon, the question of what bond should be chosen as the proxy for the risk-free asset of the CAPM has no clear-cut answer.

However, Dr Boyle's comments on market practice during the concurrent expert evidence sessions (which we noted above) provide us with a way forward. Dr Boyle saw market practice - the use of 10-year CGS yields - as a "heuristic", an approximation to the more complex approach (matching the term of the discount rate to the time horizon of the cash flows being discounted) established by corporate finance theory.

The decision theorists who initially used the term did not see a heuristic being an approximation to a more complex, but known, approach. They saw a heuristic as a principle or process concerned with identifying search procedures that enable individuals, subject to cognitive constraints, to make complex decisions and solve difficult problems when all that is known are broad patterns in the context of the decision or the problem to be solved.[33]

When we come to choice of an investment horizon, and choice of a proxy for the risk-free asset of the CAPM, there is no issue of approximation to a more complex (and correct) approach established by finance theory, or by economic theory more generally. Referral to theory (principally the theory of the CAPM), as we have seen, guides, but cannot specifically inform decisions on the investment horizon of equity

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[33] See Simon, Herbert A, (1978), "Rationality as Process and as Product of Thought", American Economic Review, Papers and Proceedings, 68(2), page 12, and March, James G (1994), *A Primer on Decision Making: How Decisions Happen*, New York: The Free Press, pages 11-15. The essence of "heuristic" is "search", and not "simplification" or "approximation", as indicated by the origin of the word in the classical Greek verb "to find".

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investors and on the proxy for the risk-free asset. A situation such as this is, precisely, one which calls for the use of a heuristic.

The appropriate heuristic is the market practice of using CGS with terms of 10-years as a proxy for the risk free asset of the CAPM.

We note again, section 6.2.1.6 of the Draft Explanatory Statement:

Investments in regulated infrastructure are long term, and the standard practice of valuation professionals and market practitioners is to use a 10-year risk free rate as an input to the CAPM when valuing such investment projects.[34]

There is, we think, more which might be done to investigate the horizons of investors in regulated Australian electricity network and gas pipeline assets. Further consideration might also be given to the use, in risk-free rate estimation, of the yields on zero coupon bonds published by the Reserve Bank. We believe the use of those yields in establishing rates of return to be allowed by regulation has not been previously examined.

However, at this time, less than four months before the 2022 Rate of Return Instrument is to come into effect, the rules for risk-free rate estimation in the current (2018) Instrument, which reflect the market practice of using CGS with terms of 10 years as the proxy for the risk-free asset of the CAPM, should be retained.

There is no strong argument for estimation of the risk-free rate using yields on CGS which match the length of the regulatory control period.

3.6 Length of regulatory control period other than five years

Key points:

- There is no need to specify different procedures for setting the risk-free rate of return for regulatory control periods of different lengths. In the 2022 Rate of Return Instrument, clause 5 can take the form it currently takes in 2018 Instrument (including the current requirement to estimate the risk-free rate from daily yields on CGS with terms of 10 years).
- In the 2022 Rate of Return Instrument, clause 4 can also take the form it takes in the current (2018) Instrument (or an appropriate modification of that

[34] Draft Explanatory Statement, page 105.

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form should the AER allow updating of the MRP using dividend growth model estimates).

The investment horizon, and hence the term of the proxy for the risk-free rate of the CAPM are, as we have explained above, not linked to - are independent of - the length of the regulatory control period.

There is, these circumstances, no requirement to specify different procedures for setting the risk-free rate of return for regulatory control periods of different lengths as we find in clauses 5(a), (b), (c), (d), (e) and (f) of the 2022 Draft Instrument. Clause 5 can take, in the 2022 Rate of Return Instrument, the form it currently takes in 2018 Instrument (including the current requirement to estimate the rate from daily yields on CGS with terms of 10 years).

Clause 4 of the 2022 Draft Instrument similarly varies the MRP for different risk-free rate estimates associated with regulatory control periods of different lengths. In the 2022 Rate of Return Instrument, clause 4 can also take the form it takes in the current (2018) Instrument (or an appropriate modification of that form should the AER allow updating of the MRP using dividend growth model estimates).

3.7 Averaging period

Key point:

- Changes to the nomination window for the risk-free rate averaging period in the 2022 Draft Instrument should be incorporated in the 2022 Rate of Return instrument.

Clause 8 of the 2022 Draft Instrument retains the current length of the averaging period to be used when setting the risk-free rate (between 20 and 60 business days), but makes two changes to the averaging period nomination window. The two changes are:

- the averaging period must start no earlier than 8 months before commencement of the regulatory control period; and
- the averaging period must finish no later than 4 months prior to commencement of the regulatory control period.

In the current (2018) Instrument these timings for the nomination window are 7 months and 3 months, respectively.

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The Draft Explanatory Statement advises that, when the changes to the nomination window were proposed in the AER's July 2021 *Equity omnibus draft working paper*, stakeholders accepted the practical reasons for making the changes.[35]

In APA's view, the changes do not depart significantly from current requirements and practice, and should facilitate the AER's regulatory decision making.

The changes to the nomination window for the risk-free rate averaging period in the 2022 Draft Instrument should be incorporated in the 2022 Rate of Return instrument.

[35] Draft Explanatory Statement, page 121.

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4 Market risk premium

The AER's (draft) decision in respect of the market risk premium (MRP), the Draft Explanatory Statement advises, is to maintain the approach of the current (2018) Rate of Return Instrument, which is to estimate the premium from historical excess returns (HER), and to fix the estimate for the duration of the 2022 Instrument.

Consistent with its decision on "term of the risk-free rate", the AER has decided to determine the MRP using a proxy for the risk-free asset which has a term matching the term of the regulatory control period (typically five years).[36]

There are different views on the way in which the MRP can be estimated. After an examination of the options, the AER has set out, in the Draft Explanatory Statement, an alternative to its current approach for further consideration by stakeholders. Under this alternative approach, the estimate of the MRP required by the Rate of Return Instrument (alternative estimate) would be the average of:

- an average of HER; and
- an estimate of the MRP made using a dividend growth model (DGM).

This alternative estimate would be updated during the period of the 2022 Rate of Return Instrument at each time an MRP estimate was required for a regulatory determination.[37]

The alternative approach, the Draft Explanatory Statement notes, has two desirable characteristics:

- it can capture market information available at the time equity returns are to be estimated; and
- it can be applied mechanically.[38]

In its earlier submissions, APA indicated a preference for the alternative approach, and noted its support for the development of the Energy Networks Australia (ENA) calibrated DGM for use with that approach.

The Draft Explanatory Statement reports a number of problems with the ENA's calibrated DGM and advises that the AER has decided not to use the model at this

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36 Draft Explanatory Statement, page 124.
37 Draft Explanatory Statement, page 125.
38 Draft Explanatory Statement, page 125.

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point in time.[39] The AER is, however, open to further information on the relative advantages (and disadvantages) of the model, and how it might be used.

In the following subsections of this submission, we briefly comment on:

- use of the DGM in MRP estimation;
- data issues arising in the context of MRP estimation from HER,
- the use of arithmetic versus geometric averages in MRP estimation from HER; and
- the roles for survey findings and conditioning variables in MRP estimation.

4.1 Use of the DGM

Key points:

- Use of the DGM provides an approach to MRP estimation. Such approach is very different compared to MRP estimation using HER.
- Compared to HER, use of the DGM better captures the changes in asset risks and investor willingness to bear those risks that seem to underlie time variation in the MRP.
- Issues with the ENA calibrated DGM are, we understand, being addressed by the ENA and model developer Frontier Economics.

APA's view, advanced in our earlier submissions, was that the MRP is time-varying. This was also the view of the experts at the AER's third expert evidence session.

However, a brief review of the relevant academic literature, which we undertook for our March 2022 submission, indicated that there is, at the present time, no consensus on how a time varying MRP might be estimated. We understood this to be the view of the experts at the third expert evidence session, who advised that multiple methods of MRP estimation should be considered.

One method would be a continuation of the earlier practice of estimating the MRP using an average of a series of historical excess returns (HER). But estimation using an average of a long series of HER embeds an assumption that the MRP is constant, and may not capture the changes in asset risks and investor willingness to bear those risks that seem to underlie time variation in the MRP.

[39] Draft Explanatory Statement, page 146.

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Another method, broadly accepted in principle but less well accepted in practice, would be use of the DGM.[40] The practical problems of using the DGM have previously been recognised, and were again noted by Professor Partington in his presentation at the third expert evidence session. There was, however, considerable agreement among the experts at that session that the DGM should be used as part of an approach to MRP estimation.

A key issue when using the DGM to estimate the MRP is estimation of the dividend growth rate forecasts required by the model. Model results are sensitive to the dividend growth rates chosen.

The AER's three-stage DGM, which would be used if the AER were to adopt the alternative approach to MRP estimation set out in the Draft Explanatory Statement, is not immune to this problem of model results being sensitive to the assumptions made about dividend growth rates.

The ENA sought to avoid the problem in its implementation of the DGM by imposing the condition that the terminal dividend growth rate of the model would lead to an MRP estimate which was the same as the MRP estimate obtained as an average of HER over a specified period.

APA supported the ENA's development of the calibrated DGM as a way of addressing a major concern with the DGM which would then allow the model's use in setting the value of the MRP of the Rate of Return Instrument.

APA remains of the view that use of the DGM provides an approach to MRP estimation very different from reliance on HER, and better captures the changes in asset risks and investor willingness to bear those risks that seem to underlie time variation in the MRP.

However, APA is unable to comment further on the problems with the calibrated DGM which the AER has identified. We understand that ENA and the model developer, Frontier Economics, will be addressing the AER's concerns.

4.2 Data issues

Key points:

- For MRP estimation from HER, the longest - and most appropriate - series available is the Brailsford, Handley and Maheswaran series for 1958 to

[40] See Draft Explanatory Statement, page 142.

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2010, extended, using the Brailsford, Handley and Maheswaran methods, for 2011 to 2021.

- Estimation of the MRP as an average of HER has some validity only if a very long series of those HER is used: the series from 1958 (64 observations) might be long enough.
- No evidence of a structural break around 1988 has been put forward to justify a focus on the series from 1988, which is simply too short for reliable estimation.

APA is concerned with the AER's truncation of the series of HER used for MRP estimation.

We agree with use of the HER series initially developed by Brailsford, Handley and Maheswaran, and we accept their advice that the data for the years before 1958 are unreliable.[41]

We note that if the proxy for the risk-free asset of the CAPM is to have a term of 5 years as the AER, in our view incorrectly, proposes, risk-free rate estimation is limited to a series from 1972 onwards (the earliest published yields on CGS with a term of five years are for 1972).

The AER, however, has decided that a period from 1988 onwards is the most relevant to its task of estimating a forward-looking MRP because it reflects the introduction of imputation credits and is more likely to represent current market conditions.[42]

As we discussed in our March 2022 submission, estimation of a forward-looking MRP from HER assumes the MRP is constant. Unfortunately, extraction of an underlying constant MRP from a series of HER with large variance (see Draft Explanatory Statement, Tables 7.2 and 7.3) is problematic. Estimation of the MRP as an average of HER has some validity only if a very long series of those HER is used. The series from 1958 (64 observations) might be long enough. The series from 1988 is simply too short for reliable estimation.

The series from 1988 might be more likely to provide information on current market conditions, but that is not relevant in the context of an underlying model which assumes a constant MRP. The series from 1988 certainly incorporates the effects of

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41 The original Brailsford, Handley and Maheswaran series was for 1883 to 2010. It has subsequently been extended by the AER and others to 2021.

42 Draft Explanatory Statement, page 131.

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the introduction of dividend imputation, but the introduction of dividend imputation has not previously been seen as leading to a significant shift in the series requiring its truncation. In the current review of rate of return determination, no evidence of a structural break around 1988 has been put forward.

If the MRP is to be estimated from HER, the longest - and most appropriate - series available is the Brailsford, Handley and Maheswaran series for 1958 to 2010, extended, using the Brailsford, Handley and Maheswaran methods, for 2011 to 2021.

4.3 Arithmetic vs geometric averages

Key points:

- In estimation of the MRP for the Rate of Return Instrument, there is no forecasting of the HER series forward at a rate of return implied by the historical series available at the time. The unbiased estimator of the mean of the series is the arithmetic average. This is unaffected by any considerations of the presence of autocorrelation in the excess return series, or by variance volatility.
- An estimate of the MRP for the 2022 Instrument, which is made from HER, should be made as the arithmetic average of those returns.

There has been debate over the issue of whether arithmetic averages, or geometric averages, or combinations of both, should be used when calculating the average of HER to be used as an estimate of the MRP.

The AER, the Draft Explanatory Statement advises, has re-examined the issue, and has found that the arithmetic mean is likely to produce a result that is most consistent with its task.[43]

APA agrees. In our earlier submissions we explained why statistical theory requires use of the arithmetic average, and not the geometric average as the estimator of the mean of HER.

That both the arithmetic average and the geometric average should have a role in estimation of the mean of HER seems to have arisen from consideration of a series of academic papers beginning with work by Blume (1974) and including more recent

[43] Draft Explanatory Statement, page 134

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work by, among others, Indro and Lee (1997) and Jacquier, Kane and Marcus (2003).[44]

In these papers, a quantity, the value of a portfolio of shares, accumulates over time as the portfolio generates returns period by period. The process by which the returns are generated is "noisy" (stochastic). The question being addressed is: given observations on the accumulation over the previous T periods, what is the appropriate way to forecast accumulation a further H periods ahead? Should the arithmetic average of the observed returns over the previous T periods be used, should it be the geometric average of those previous returns, or should it be some combination of the arithmetic and geometric averages?

Indro and Lee, and Jacquier Kane and Marcus, show, using different statistical methods, that an unbiased estimate of the value of the portfolio at the end of the forecast horizon H is a weighted average of the arithmetic and geometric averages of the rates of return observed during the previous T periods. That weighting depends on the ratio of the length of the forecast horizon H to the period T over which returns have been observed. Even with autocorrelation in the data, and variance volatility, if H is close to zero, the unbiased estimate of the rate of return is approximately equal to the arithmetic average, and the geometric average has no role to play.

Over what period are historical excess returns to be forecast when estimating the MRP? Using the annual data used by the AER, the length of that period is close to zero, if not zero. The MRP is estimated from the series of historical excess returns which ends in the year preceding promulgation of the Rate of Return Instrument. The most recent data in this series could precede promulgation of the instrument by up to one year but, in the process of estimating the MRP from HER, no attempt is made to forecast the historical returns series forward one year (or more).

Even if the AER were to adopt annual updating of the MRP, there would still be no forecast made of the HER series using the excess returns observed in previous years. MRP estimation would use only the series of HER available at the time of updating.

If there is no forecasting of the excess returns series forward at a rate of return implied by the historical series available at the time, the formulae of Jacquier, Kane and Marcus, and of Indro and Lee, collapse so that the unbiased estimate of the

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[44] Blume, Marshall E (1974) ; "Unbiased Estimators of Long-Run Expected Rates of Return", Journal of the American Statistical Association, 69(347): pages 634-638; Daniel C Indro and Wayne Y Lee (1997), "Biases in Arithmetic and Geometric Averages as Estimates of Long-Run Expected Returns and Risk Premia", Financial Management, 26(4): pages 81-90; Jacquier, E, A Kane and A J Marcus (2003), "Geometric or Arithmetic Mean: A Reconsideration", Financial Analysts Journal, 59(6): pages 46-53.

mean of return in the series is the arithmetic average of the HER. This is unaffected by any considerations of the presence of autocorrelation in the return series, or by variance volatility.

This was the conclusion reached by APA in its earlier submissions by applying standard time series estimation methods in the absence of any issue of forecasting future value.

This is the view in well-known finance textbooks as noted in our earlier submissions, and in submissions to the AER made by others.

This was the view of Dr Lally in advice he provided to the AER in 2012. Dr Lally summarised:

The AER's belief that geometric averages are useful apparently arises from a belief that there is a compounding effect in their regulatory process (AER, 2012, Appendix A.2.1), and therefore the analysis of Blume (1974) and Jacquier et al (2003) applies. However, I do not think that there is any such compounding effect in regulatory situations and the absence of a compounding effect leads to a preference for the arithmetic mean over the geometric mean.[45]

An estimate of the MRP for the 2022 Rate of Return Instrument, which is made from HER, should be made as the arithmetic average of those returns.

4.4 Roles for surveys and conditioning variables

Key points:

- The AER should not move the HER estimate of the MRP, or provide an uplift to the risk-free rate, based on survey results.
- The AER should not move the HER estimate of the MRP based on the observation of conditioning variables.

Once a careful process of MRP estimation from the available data is undertaken (and APA does not have any concerns about the care with which the AER has undertaken the task), then any adjustment of the results by reference to survey findings or by reference to so-called "conditioning variables", would amount to arbitrary change.

APA agrees with the AER's decisions:

[45] Martin Lally, The Cost of Equity and the Market Risk Premium, 25 July 2012, page 31.

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- not to move the HER estimate of the MRP, or to provide an uplift to the risk-free rate, based in survey results;[46] and
- not to move the HER estimate of the MRP based on the observation of conditioning variables.[47]

46 Draft Explanatory Statement, page 153.
47 Draft Explanatory Statement, page 156.

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5 Equity beta estimation

The AER's (draft) decision is to set the value of the equity beta of the CAPM to 0.6.

This, the Draft Explanatory Statement advises, is an outcome of the AER continuing the overall approach to beta estimation from the current (2018) Rate of Return Instrument, including:

- placing most weight on the longest period estimates, while being informed by 5-year estimates;
- maintaining the existing comparator set of nine Australian firms, and not including international energy firms or other Australian (non-energy) infrastructure firms in the comparator set;
- setting a single beta for regulated electricity network and gas pipeline assets;
- not making any adjustment for low beta bias; and
- not using equity beta values from the decisions of other regulators to directly inform beta estimation leading to the value of beta set in the Rate of Return Instrument.

Key factors in the AER's decision to set the value of the equity beta to 0.6 were:

- the 2022 beta estimates continue to cluster around 0.5 to 0.6, and an estimate in this range seems to best reflect the data;
- the estimates for the longest period for which data are available, estimates to which the AER has given most weight, have remained relatively stable since the 2018 Instrument, and this stability suggests continuing the value (0.6) from 2018;
- the estimates for the most recent five years for which data are available, estimates to which the AER has given limited weight, have declined significantly since 2020, and this gives some support for a beta value below 0.6;
- the betas of international comparators provide a cross-check on the AER's estimates of beta for Australian electricity network and gas pipelines:
    - for the longest period for which data are available, the "international betas" cluster in the range 0.7 to 0.9;
    - estimates made using data for the most recent five years have increased substantially, suggesting a beta value above 0.6; and

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- a value of 0.6 is consistent with conceptual analysis which indicates that the equity beta for a regulated Australian electricity network or gas pipeline is likely to be below 1.0.[48]

APA is of the view that the AER's decision on the value of the equity beta makes maximum use of the available Australian data and makes appropriate use (as a cross-check) of the data available from international comparators. However, whether the value chosen for the equity beta is the "forward-looking" value required by the 2022 Rate of Return Instrument is, we think, still an open question.

In the following subsections of this submission, we comment briefly on:

- the use, in equity beta estimation, of data from international energy firms; and
- placing most weight on the beta estimates made using Australian data for the longest period those data are available (and thereby placing less weight on beta estimates made for the most recent five years).

At this time, APA:

- considers conceptual analysis, which indicates that an equity beta for a regulated Australian electricity network or gas pipeline system is likely to be below 1.0, places a very loose, and hence not very informative, constraint on what might be an appropriate beta value for the Rate of Return Instrument;
- has nothing further to contribute to the debate over the low beta bias of the CAPM; and
- concurs with the AER's decision to not directly use other regulators' beta estimates in setting its own value for the equity beta, because the estimates of those other regulators have been based on different approaches and methods.

5.1 International energy firms

Key points:

- The AER's decision on the value of the equity beta makes maximum use of the available Australian data and makes appropriate use, as a cross-check, of the data available from international comparators.
- Many of the international energy firms which might be considered for inclusion in the comparator set are not directly comparable with the "pure play" electricity network or gas pipeline system of the Australian benchmark.

[48] Draft Explanatory Statement, pages 164-165.

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- A closer examination of international energy firms should be a major part of establishing equity beta values for future Rate of Return Instruments.

The declining number of listed electricity network and gas pipeline businesses limits the use of current Australian data in equity beta estimation. The need to understand the current levels of estimated betas and the directions of recent movements in those estimates were, APA contended in earlier submissions, reasons for considering ways to expand the set of comparator firms used for beta estimation.

APA was of the view that technological, market and regulatory differences between energy networks and other (non-energy) Australian infrastructure businesses precluded the inclusion of any of those businesses in the comparator set.

The AER, the Draft Explanatory Statement advises, has decided not to augment its comparator set with other Australian (non-energy) infrastructure businesses because there are significant differences between them and the regulated electricity networks and gas pipelines which are difficult to quantify.[49]

Use might then be made of data for international energy firms to augment the data available from the currently very short list of Australian comparators. The AER, the Draft Explanatory Statement advises, has therefore reviewed the international energy firms which have been used to provide data for decisions on beta by the New Zealand Commerce Commission and by the Western Australian Economic Regulation Authority. However, the AER has found that many of the international energy firms which might be considered for inclusion in the comparator set have substantial energy generation, energy retail or non-energy operations. They are not directly comparable with the "pure play" electricity network or gas pipeline system of the Australian benchmark. APA agrees.

In APA's view, a closer examination of these international energy firms should be a major part of establishing equity beta values for future Rate of Return Instruments. However, at this stage of the development of the 2022 Instrument, the AER is prudent in making its decision on beta on the basis of estimates for its Australian comparator set, using international beta estimates only as a cross-check on the estimates obtained from the Australian data.

[49] Draft Explanatory Statement, page 182.

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5.2 Placing most weight on the longest period estimates

Key point:

- Although APA is of the view that equity beta estimates are rising, at least in part through investor assessment of the risks of carbon transition, insufficient data are available, at this time, to support a value of the equity beta of the CAPM which is substantially above the value in the current (2018) Rate of Return Instrument.

The AER has, the Draft Explanatory Statement advises, maintained its approach to beta estimation, including:

- using Ordinary Least Squares regression;
- using weekly data; and
- using multiple estimation periods, placing most weight on the longest period for which data are available, but being informed by the most recent periods of five years.[50]

APA is of the view that this is a reasonable approach for the reasons given in the Draft Explanatory Statement. Over a long period, more observations (share prices, market returns) are available, and this leads to statistically more robust estimates of equity betas. Data for shorter periods may be more up to date, but those data may be biased by statistical "noise".[51]

However, as we have said in earlier submissions, we are not confident of the long term stability in beta which the AER assumes. We reproduced, in our March 2022 submission, the graph below, which was presented by Mr Kumareswaran at the AER's first expert evidence session on 10 February 2022.

[50] Draft Explanatory Statement, page 166.
[51] Draft Explanatory Statement, pages 162-163.

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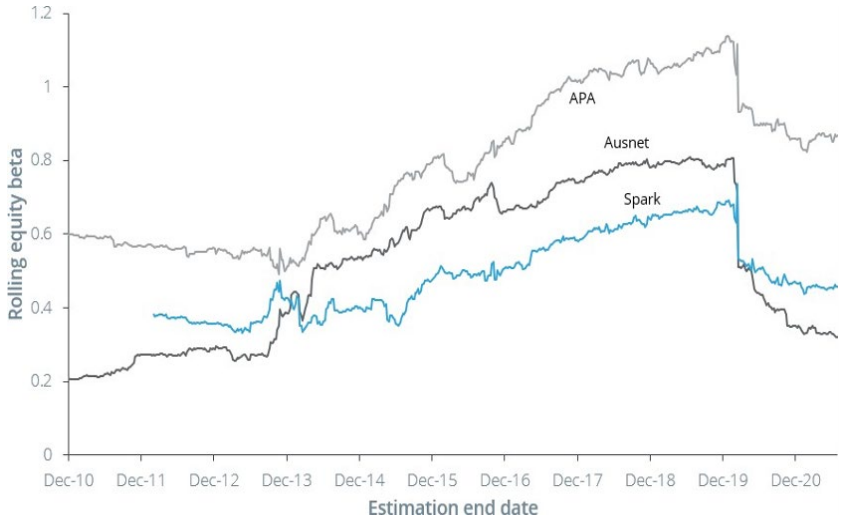
Figure 1: Rolling OLS beta estimates for the live domestic comparators



We saw, in the graph, some convergence of the betas for APA, AusNet Services and Spark Infrastructure to a similar level around 2013, but then they diverge again. The betas for all three companies rise between December 2013 and December 2019. After December 2019, they drop sharply. In his presentation, Mr Kumareswaran attributed the drop to the onset of the Covid-19 pandemic.

A similar graph (Figure 9, which also includes a rolling beta for DUET Group for the period the group was listed) can be found in the ERA's *Explanatory statement for the 2022 draft gas rate of return instrument*. The Western Australian regulator advised:

The ERA has analysed equity beta stability for the domestic sample by examining rolling beta estimates. Realised equity betas have generally not been stable for the last decade, but the impact of the COVID-19 pandemic is obvious and has resulted in observed betas dropping significantly.[52]

APA is of the view that betas, particularly for gas pipeline businesses, have risen, from around 2015. Clearly, there has been a drop in beta as a consequence of the economic disruption caused by the Covid-19 pandemic. This is obvious from the graph we reproduced above, from the ERA's Figure 9, and from the AER's beta estimates which are summarized Tables 8.3, 8.4, 8.5 and 8.6 of the Draft Explanatory Statement.

Does that drop associated with the pandemic mean that betas are reverting to a stable long term average? All of the data needed to answer this question are not yet

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[52] Western Australian Economic Regulation Authority, *Explanatory statement for the 2022 draft gas rate of return instrument*, 17 June 2022, paragraph 1015.

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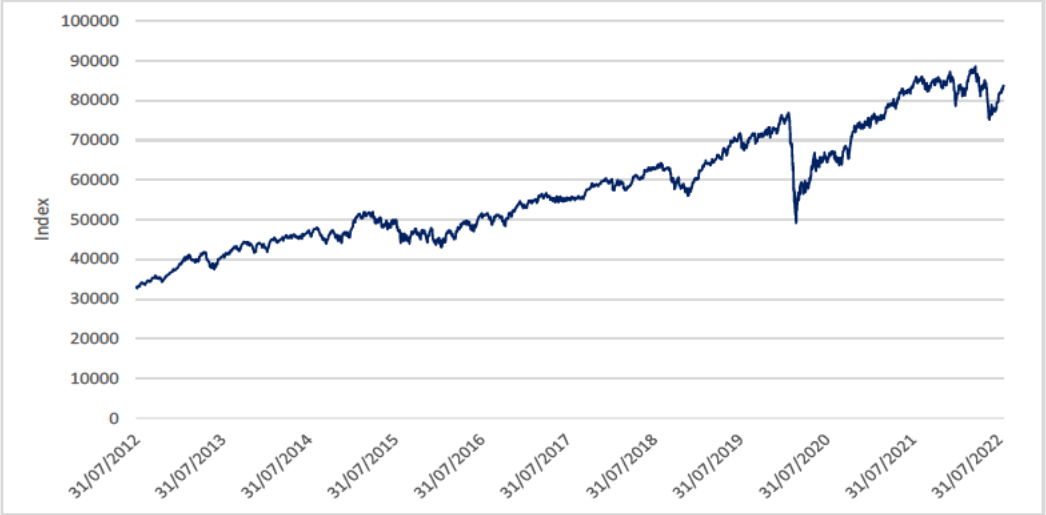
available. What we do see from data which are available (see Figure 2 below) is a sharp downturn in the return from equity investment in March 2020, and a return to long term growth in returns in the period which follows.

Figure 2: S&P/ASX 300 total return index



Beta estimates for the longest period for which data are available may, as the Draft Explanatory Statement advises, have remained relatively stable since the 2018 Instrument, suggesting continued use of the 2018 value of 0.6, and, certainly, beta estimates for the most recent five years have declined significantly since 2020. This decline should, however, be considered carefully. Do share prices over a short period of high uncertainty (March 2020) give support to a beta value below 0.6? If these apparently aberrant data are removed, do the beta estimates for the most recent five years continue to signal an Australian beta now above 0.6 and more closely aligned with the betas of the international comparators used, by the AER, as a cross-check?

APA remains of the view advanced in its earlier submissions that, as the effects of climate change are becoming better understood, and as new business opportunities emerge from the public policy response and from associated technological changes, investor perceptions of the risks of investing in the energy sector are changing. Investors are now seeking compensation for their exposures to carbon transition risks. The change in perceptions has become clear since the COP21 Paris Agreement of 2015 and is being attributed, in part, to increased salience of climate risks following that agreement. Equity investors, banks and bond holders have begun to price carbon transition risk into equity and debt for the gas sector.

Asset stranding risk in the context of transition to a low-carbon economy has become an important issue for gas transmission pipelines. The Draft Explanatory Statement

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advises that the AER acknowledges the risk but considers it to be non-systematic.[53] No adjustment of the equity beta for stranding risk is, therefore, required.

If stranding risk is non-systematic, then we agree that no adjustment of beta is required. However, if stranding risk has a systematic dimension, because it is one aspect of a much broader energy transition, then pipeline equity betas will change. The magnitude of such a change is, of course, difficult to assess in advance. It will be revealed in future share price data of appropriate comparators, provided the set of comparators includes companies with pipeline assets. The question of whether a single beta for regulated electricity network and gas pipeline assets is appropriate will then arise.

5.3 An equity beta estimate of 0.6

Key point:

- A beta estimate of at least 0.6 should be retained in the 2022 Rate of Return Instrument

Although APA is of the view that equity beta estimates are rising, at least in part through investor assessment of the risks of transition to a low-carbon economy, insufficient data are available, at this time, to support a value of the equity beta of the CAPM which is above the value in the current (2018) Rate of Return Instrument.

A beta estimate of at least 0.6 should be retained in the 2022 Rate of Return Instrument.

[53] Draft Explanatory Statement, page 185.

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6 Return on debt

The 2022 Draft Instrument proposes continuing the approach to estimation of the rate of return on debt which is in the current (2018) Rate of Return Instrument.

The proposal for rate of return on debt estimation in the 2022 Draft Instrument should, in APA's view, be incorporated in the 2022 Rate of Return Instrument.

In this section of the submission, we comment briefly on the assessment, in the Draft Explanatory Statement, of each of the key elements of rate of return on debt estimation. These key elements are:

- benchmark term of debt;
- use of industry data;
- benchmark credit rating and its implementation;
- simple or weighted trailing average;
- choice of third party provider;
- data provider contingencies; and
- return on debt averaging period.

6.1 Benchmark term of debt

Key point:

- The assumption of a benchmark term of 10 years for service provider debt should be retained in the 2022 Rate of Return Instrument.

The 2022 Draft Instrument proposes retention of the trailing average estimate of the return on debt of the current (2018) Rate of Return Instrument. The trailing average estimate is the cost of debt of a benchmark service provider which maintains a portfolio of debt issued with terms to maturity of 10 years, and which refinances one-tenth of that portfolio each year.

The Draft Explanatory Statement advises that the AER's Weighted Average Term to Maturity Index (WATMI) currently indicates an average term of service provider debt between a lower bound of 8 years and an upper bound between 10 and 11 years.[54]

[54] Draft Explanatory Statement, page 194.

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Moreover, a term of 10 years aligns with the debt financing practices of regulated businesses to issue longer term debt to minimize refinancing risk.[55] APA agrees.

The market evidence, the AER concluded, was not sufficiently strong to justify moving to a different benchmark term: the 2018 benchmark term of 10 years should be retained.[56]

The assumption of a benchmark term of 10 years for service provider debt should, in these circumstances, be retained in the 2022 Rate of Return Instrument.

6.2 Use of industry data

Key points:

- The benchmark rate of return on debt calculated using the method of the 2018 Rate of Return Instrument uses the largest sample available at the time the rate of return on debt is to be estimated; the method of the 2018 Instrument should be adopted in the 2022 Rate of Return Instrument.
- The Energy Industry Credit Spread Index is constructed from a sample of firms which is not sufficiently large to average out inefficiency in debt raising, or to reflect the wide range of contractual responses to risk management found in debt instruments; it should not be used to adjust the benchmark cost of debt.

Debt data are now regularly sourced from service providers and used by the AER in calculating the Energy Industry Credit Spread Index (EICSI).

The AER's (draft) decision, the Draft Explanatory Statement advises, is not to use the EICSI to adjust the rate of return on debt calculated using the method of the 2018 Rate of Return Instrument.[57]

APA concurs with the AER's (draft) decision.

The EICSI is a measure of the spread, over the swap rate, of the cost of debt issued by service providers. Since January 2014 (commencement of the EISCI series), the index has remained below the benchmark rate of return on debt calculated using the

55 Draft Explanatory Statement, page 195.
56 Draft Explanatory Statement, page 199.
57 Draft Explanatory Statement, page 193.

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method of the 2018 Rate of Return Instrument, indicating a possible persistent outperformance of the benchmark by around 18 basis points.[58]

The Draft Explanatory Statement notes an important difference between the data from which the EICSI is calculated and the data, sourced from third-party providers (Bloomberg, the Reserve Bank of Australia and Thompson Reuters) used in benchmark calculation.[59] The EICSI data are primary market data determined by market conditions and service provider characteristics at the time of issue. The data sourced from the third party providers are for a range of businesses extending beyond regulated service providers and are secondary market data. They are for transactions at times different from the dates of primary issue and issuers are not parties to the transactions.

The AER, the Draft Explanatory Statement advises, has undertaken an analysis of the outperformance of the spread implied by the calculated benchmark rate of return on debt and the EISCI by decomposition of the difference into a credit rating effect, a term effect and a residual.[60] That analysis showed:

- no clear relationship between the average of the credit ratings of the service providers represented in the EISCI and outperformance against the benchmark; and[61]
- when the EISCI was compared with the spread calculated using the benchmark method but with matched terms the average outperformance is reduced from 18 basis points to 4 basis points: the difference between terms of the issued debt in the EISCI and the benchmark term appears to be the key driver of the observed outperformance.[62]

The main driver of the observed outperformance of the calculated benchmark rate of return on debt, the AER concludes, is related to the term of debt, with some potential residual outperformance in times of high average risk premiums in the secondary market yield curves.[63]

As we note in section 6.1 above, the AER has decided to maintain the benchmark term of debt at 10 years. In these circumstances, there is little justification for any

58 Draft Explanatory Statement, page 207.
59 Draft Explanatory Statement, page 205.
60 Draft Explanatory Statement, page 207
61 Draft Explanatory Statement, page 209.
62 Draft Explanatory Statement, page 210.
63 Draft Explanatory Statement, page 213.

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use of the EICSI to adjust benchmark rate of return on debt calculated using the method of the 2018 Rate of Return Instrument.

APA agrees with the AER's conclusion that the current data underlying the EICSI are sufficiently robust for use as sense check on benchmark approach.[64] APA doubts that the dataset underlying the EICSI will ever be sufficiently large to appropriately adjust the benchmark cost of debt.

For the reasons set out in its March 2022 submission, APA remains of the view that use of the EISCI must be restricted to the sense checking of an estimate of the rate of return on debt obtained using other means. The number of electricity network and gas pipeline business providing data for index construction is too small to provide a benchmark for return on debt estimation. A large sample of similar issues is required. If the rate of return on debt is estimated from a large sample, any inefficiencies in debt raising will be averaged out as intended, and there will be averaging across the wide range of contractual responses to risk management found in debt instruments. The benchmark rate of return on debt calculated using the method of the 2018 Rate of Return Instrument uses the largest sample available at the time the rate of return on debt is to be estimated.

6.3 Benchmark credit rating and its implementation

Consistent with the available empirical evidence, a benchmark credit rating of BBB+ is to be maintained.[65]

In 2018, APA did not support the use of a benchmark credit rating of BBB+, and remains of the view that the benchmark should be BBB.

If a benchmark credit rating of BBB+ is to be retained, then its implementation as a weighted average of debt costs for A-rated and broad BBB-rated entities, with weightings of one-third and two-thirds, respectively, should be retained.

6.4 Simple or weighted trailing average

Key point:

- The simple trailing average of the current approach to rate of return on debt estimation should be retained in the 2022 Rate of Return Instrument.

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64 Draft Explanatory Statement, page 215.
65 Draft Explanatory Statement, page 216.

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APA supported changing the simple trailing average used in rate of return on debt estimation to a CAPEX-weighted or debt-weighted trailing average on the basis of the change providing a better estimate of the return on debt allowance. Making the change would reduce any mismatch between the return on debt allowance calculated in the PTRM and the efficient debt financing cost implied by a trailing average. If this were the case, APA saw no reason to restrict use of the weighted trailing average to a particular sub-group of service providers; the change should be made for all electricity network and gas pipeline service providers.

APA also recognised that implementation of the change to a weighted trailing average could add considerable complexity to estimation of the rate of return on debt and to determination of the rate of return on debt allowance. APA was of the view that a specific proposal through which the change might be implemented was needed.

Following its receipt of expert advice, and a review of submissions, the AER, the Draft Explanatory Statement advises, concluded:

- whether a benchmark service provider would find that increasing its debt raising significantly beyond 10% in any one year was efficient was not clear; if substantial CAPEX were required, the service provider may issue more equity than was consistent with the benchmark gearing;
- there were practical difficulties with implementing a weighted trailing average, including whether weights based on CAPEX forecasts would require correction after the actual CAPEX was known; correction itself would add further complexity, and may also result in uncertainty because it could be required under a subsequent Rate of Return Instrument;
- simple and weighted trailing averages, examined across a number of scenarios, produced significantly different results only when there were both a very large increase in the RAB and a simultaneous large increase in prevailing interest rates; and
- submissions generally supported retaining the current – simple trailing average – approach.[66]

In these circumstances, the AER has decided that the benefits of a weighted trailing average are not sufficiently clear or necessary to make a change from the current simple trailing average approach.[67]

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66 Draft Explanatory Statement, pages 226-227.
67 Draft Explanatory Statement, page 227.

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APA agrees with the reasons for the AER's decision. The simple trailing average of the current approach to rate of return on debt estimation should be retained in the 2022 Rate of Return Instrument.

6.5 Choice of third-party data provider

Key points:

- The AER should continue to source the data required for rate of return on debt estimation from the Reserve Bank of Australia, the Bloomberg service and the Thompson Reuters service.
- Use of the methods of extrapolation and interpolation which are currently used, and which have been retained in the 2022 Draft Instrument, should continue.
- Rates published by the Reserve Bank, Bloomberg and Thompson Reuters should be converted to effective annual rates where that is required.

Estimation of the rate of return on debt using the approach set out in the 2018 Rate of Return Instrument requires data from multiple external providers of information on debt financing.

Since 2013, those data have been sourced from the Reserve Bank of Australia and the Bloomberg service. In 2018, the Thompson Reuters service was "added to the list" of third-party data providers.

APA agrees with the assessment of the Draft Explanatory Statement that none of the data from the Reserve Bank, Bloomberg or Thompson Reuters is clearly superior to the data from any of the other providers, and that combined use of the data from the three sources will produce the best estimate of the rate of return on debt.[68]

We have not found problems with:

- the method of extrapolation (set out in the current Rate of Return Instrument) to be applied when it is necessary to extrapolate from an observed term to the benchmark term of 10 years; and
- the method of interpolation (also set out in the current Rate of Return Instrument) to be applied where the date of an estimate required for regulatory

[68] Draft Explanatory Statement, page 219-220.

purposes lies between the dates at which relevant observations are available from published sources.

In proceeding to the 2022 Rate of Return Instrument, the AER should, we think:

- continue to source the data required for rate of return on debt estimation from the Reserve Bank of Australia, the Bloomberg service and the Thompson Reuters service;
- continue to use the methods of extrapolation and interpolation which are currently used, and which have been retained in the 2022 Draft Instrument; and
- continue to convert rates published by the Reserve Bank, Bloomberg and Thompson Reuters to effective annual rates where that is required.

6.6 Data provider contingencies

Once promulgated, the Rate of Return Instrument is "locked-in" for a period of four years. The possibility then arises that, during those four years, there may be changes in the debt financing data available from any of the three third-party providers, including certain data ceasing to be available. Some prior planning for these possibilities is desirable, and the 2022 Draft Instrument indicates the AER is proposing to retain the return on debt contingencies in clause 26 of the current (2018) Rate of Return Instrument.

The return on debt contingencies, as set out in the 2022 Draft Instrument should be retained in the 2022 Rate of Return Instrument.

6.7 Return on debt averaging period

Key point:

- Changes to the provisions for debt averaging period proposed in the 2022 Draft Instrument should be incorporated into the 2022 Rate of Return Instrument.

Rate of return on debt estimation uses regularly published market data. To mitigate the effects of day-to-day volatility in the data, regulatory practice has been to average over a short period prior to the beginning of a regulatory period or prior to the beginning of a regulatory year. Subject to certain guidelines set out in the current (2018) Rate of Return Instrument, which also serve to ensure that the instrument can be automatically applied, service providers must nominate the relevant short periods

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for this averaging of market data to be used in rate of return on debt estimation and subsequent annual updating of the rate of return on debt.

The current Rate of Return Instrument requires that a nominated rate of return on debt averaging period starts no earlier than 16 months before the commencement of a regulatory year.

Clause 26 of the 2022 Draft Instrument proposes that this be changed as follows: a nominated rate of return on debt averaging period is to start no earlier than 17 months prior to the commencement of a regulatory year.

This change (together with the further change noted below), the Draft Explanatory Statement advises, should allow service providers to nominate averaging periods of up to 12 months.[69]

The current Rate of Return Instrument requires that a nominated rate of return on debt averaging period finishes no later than 4 months prior to the commencement of a regulatory year.

Clause 26 of the 2022 Draft Instrument proposes that this be changed as follows: a nominated rate of return on debt averaging period is to finish no later than 5 months prior to the commencement of a regulatory year.

This change, the Draft Explanatory Statement advises, should allow service more time for annual tariff variation following an annual update of the rate of return on debt.[70]

These changes to the provisions for debt averaging period proposed in the 2022 Draft Instrument should be incorporated into the 2022 Rate of Return Instrument.

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69 Draft Explanatory Statement, page 223.
70 Draft Explanatory Statement, page 223.

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7 Value of imputation credits

Key point:

- The value to be attributed to imputation credits in the 2022 Rate of Return Instrument should be set at 0.585, as indicated in paragraph 27 of the 2022 Draft Instrument.

APA is of the view (as we have indicated in previous submissions) that there has been no change in the tax law pertaining to dividend imputation, and none is currently expected. Furthermore, there has been no new financial economics on the effects of dividend imputation on equity returns, and no new data have become available. The AER's current method of estimation of the value to be attributed to imputation credits (the value of the parameter gamma), as the product of the imputation credit distribution rate and the credit utilisation rate, remains appropriate.

Estimates of the distribution rate (0.90) and the utilisation rate (0.65) have not changed significantly since 2018, and the AER is proposing an estimate of 0.585 for gamma (as in the current Rate of Return Instrument).

The value to be attributed to imputation credits in the 2022 Rate of Return Instrument should be set at 0.585, as indicated in paragraph 27 of the 2022 Draft Instrument.

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8 Overall rate of return cross-checks

Key points:

- APA broadly agrees with this use of cross-checks in the way the AER proposes
- We would expect the AER to use whatever information is available to sense-check all aspects of its rate of return determination
- Careful specification of the approach to rate of return determination, and careful application of the specified approach, which the AER has sought to achieve, limits the scope for cross-checks.
- RAB multiples are unsuitable for use as cross-checks on the overall rate of return. Scenario testing has some limited value in cross-checking the rate of return. Assessments of financeability can provide a useful indicator of the appropriateness of the overall rate of return.

The Draft Explanatory Statement advises that the AER will use cross-checks as a check on the sensibility of the overall allowed rate of return, and as a means of assisting identification of potential issues.[71] Cross-checks will not be used in a formulaic way to determine the overall rate of return and will not be used to directly determine rate of return parameter estimates.

APA broadly agrees with this use of cross-checks in the way the AER proposes.

Setting the allowed rate of return involves consideration of complex issues and the exercise of judgement. We would expect the AER to use whatever information is available to sense-check all aspects of its rate of return determination. However, careful specification of the approach to rate of return determination, and careful application of the specified approach, which, we think, the AER has sought to achieve, limits the scope for cross-checks.

The only real cross-check, in our view, would be provided by another method, or set of methods, carefully applied, producing another estimate of the allowed rate of return which can be compared with the rate resulting from the approach the AER proposes to adopt for the 2022 Rate of Return Instrument. Constructing such a cross-check is unlikely to be feasible.

[71] Draft Explanatory Statement, page 259.

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The AER has advised (most recently in the Draft Explanatory Statement) that it has found useful as cross-checks for the overall rate of return:

- RAB multiples;
- financeability tests based on the ratio of funds from operations to net debt; and
- sensitivity analyses.[72]

APA continues to be of the views advanced in its earlier submissions:

- RAB multiples are unsuitable for use as cross-checks on the overall rate of return;
- assessments of financeability can provide a useful indicator of the appropriateness of the overall rate of return; and
- scenario testing has some limited value.

[72] Draft Explanatory Statement, page 260.

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Attachment

Professor Stephen Wright

The Appropriate Term for the Risk-Free Rate: A report prepared for APA

The Appropriate Term for the Risk-Free Rate: A report prepared for APA

Stephen Wright
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16 August 2022

1. Introduction

1.1. APA has asked for an expert view on the appropriate term of the risk-free rate, in the context of the Capital Asset Pricing Model (CAPM) being used to estimate the cost of capital for a regulated company such as APA. This note is provided as background for APA'S forthcoming response to the Australian Energy Regulator's Draft Rate of Return Instrument and Draft Explanatory Statement, on 16 June 2022. While APA has commissioned the work, this report is independent and expresses my own views, which may not necessarily reflect the views of APA. Similarly, while the arguments in this report draw from work done for UK regulators, they do not necessarily reflect the views of any UK regulator or party. I also write in a personal capacity; my views are not to be attributed to Birkbeck College.

1.2. I should say at the outset that my experience in working on estimating the cost of capital has been almost exclusively in the UK context. I am very conscious that the Australian system of regulation differs in a number of important ways from the UK. Since I shall not attempt a full comparison between the two approaches, my comments cannot be interpreted as implying that the overall cost of equity assumed by the regulator, the AER, is either too low or too high; I shall focus solely on the issue of the appropriate choice of risk-free rate, and draw any implications on that issue alone.

1.3. I start with the theoretical concept of the risk-free rate in the context of the CAPM; I then proceed to consider how observable measures of the risk-free rate can be related to this context, and at different horizons. I then consider the appropriate horizon, and hence the appropriate term for the risk-free rate from the perspective of different investors, and consider which perspective is most appropriate for a regulated company such as APA with long-lived assets. Finally I provide some background information on the choice of investment horizon (and hence term of the risk-free asset) and choice of risk-free asset that has been assumed in recent UK regulatory discussions.

2. The risk-free rate in the CAPM

2.1. The key relationship in the CAPM is given by the Security Market Line (SML), which is usually written as

$$E\left(R_i\right) = R_F + \beta_i\left(E\left(R_M\right) - R_F\right)$$

where R_i is the return on an individual asset, R_F is the risk-free rate; and the CAPM "beta" $\beta_i = \frac{\text{cov}\left(R_{it}, R_{mt}\right)}{\text{var}\left(R_{mt}\right)}$, captures the sensitivity of asset *i* to the market portfolio, with return R_M.

2.2. While the CAPM is very commonly used in regulation and asset pricing, an immediate problem in any practical implementation of the CAPM is that it is a stylised "two-period model" but does not specify the time period being employed. Conceptually, a more precise specification (which is implicit in the standard textbook version above) would take the form

$$E_t\left(R_{i,t+1}\right) = R_{F,t+1} + \beta_i\left(E_t\left(R_{M,t+1}\right) - R_{F,t+1}\right)$$

where here it is made clear that the expectation terms $E_t\left(R_{i,t+1}\right)$ and $E_t\left(R_{M,t+1}\right)$ are market expectations[1], made in some time period *t*, of the returns on asset *i,* and the market, respectively, in period *t+1*.

2.3. The fact that expectations enter into the equation reflects the key feature that both these returns are unknown at time *t*, and hence must be forecast by market participants. But the more precise specification of the CAPM makes it clear that the return on the risk-free asset will *also* occur in period *t+1*, but does *not* need to be forecast since the nature of the risk-free asset is that its return is known in advance. While this point may seem tautological, it is worth stressing that the CAPM assumes a *complete* lack of uncertainty about the risk-free return in the next period.

2.4. The fact that the CAPM is only a two-period model is not in itself a problem. By assumption, once time moves on to period *t+1* the CAPM will apply again, but with expected returns, formulated at time *t+1*, of returns in period *t+2*. The expected returns on asset *i* in periods *t* and *t+1* will in turn determine the price of asset *i* in both periods, and hence, if new information (e.g., on future profits) changes expected returns, the price will change. The same applies for any two periods into the indefinite future. So conceptually two adjacent periods are enough.

2.5. However, the CAPM does not explicitly specify how *long* each period lasts. In many, if not most contexts, it is assumed that the length of the time period is very short – often as little as a single day, or sometimes even shorter. This is indeed typically the assumption made in estimating the CAPM beta, which is typically estimated on daily, weekly or sometimes monthly data.

2.6. At such short horizons, the theoretical concept of the risk-free rate is reasonably easy to replicate, using overnight, or at most monthly rates, which are indeed set in advance, and which, assuming sufficient collateral, are also risk-free. At a sufficiently short-term horizon, inflation risk is usually also negligible. Proxies such as treasury bill rates are frequently used in empirical analysis.

2.7. In the context of regulation, however, such a short time interval is clearly problematic. The CAPM is required to provide an estimate of the cost of equity, which feeds into the estimate of the weighted average cost of capital (WACC), which is then usually used to set an allowed return

[1] Strictly speaking these are mathematical expectations, hence are the best available forecasts, given all information available to market participants.

on the regulatory asset base (RAB) that is usually fixed[2] for the duration of a price control period, which may be for multiple years (in the case of APA, this period is five years). The standard empirical implementation of the CAPM with a very short assumed time interval simply cannot provide such an estimate, since, as shown below, it only provides it over a single, short period. Clearly therefore it is necessary to move away from this approach, and to assume a longer time period.

2.8. Before considering what is the appropriate choice of period, it is important first to consider how the risk-free rate can be measured over longer horizons.

3. The CAPM risk-free rate at longer horizons

3.1. If we now revisit the explicit two period-model of the CAPM above, but assume a longer horizon, it becomes evident how crucial the assumption is that the future risk-free rate is known with certainty. If we simply attempted to apply the version with a short time period, for example one month, but our horizon is longer than one month, then in order to apply the CAPM today, in period *t*, we would need to know the one-month risk-free rate in one month's time. But since this is only set one month at a time, its value in one month cannot be known – therefore violating the assumption of the CAPM.

3.2. For this reason if we wish to operationalise the CAPM concept of the risk-free rate at a longer horizon, we can only do so by increasing the assumed length of the period to be precisely equal to the chosen horizon. If we do so, then it *is* possible to find at least a reasonable proxy: namely the yield on a default-free zero coupon bond with tenor (remaining maturity) equal to the chosen horizon. By definition, the yield on such a point is simply the compound average return received by an investor in the bond who holds it to maturity given by

$$y_t = \left(\frac{V}{P_t}\right)^{\frac{1}{m}} - 1$$

where *V* is the face value of the bond, which will (assuming no default risk – hence we typically assume a government bond) be repaid with certainty in *m* years' time. Since both *V* and the current price of the bond P_t are known with certainty, then the return if held to maturity (which is the definition of the yield) is also known with certainty even though the return will only actually be realised in *m* years' time. As such, if we set the length of the period in the CAPM to *m,* we do indeed have a viable proxy for the risk-free rate in the CAPM.

3.3. Three caveats are in order at this point.

3.3.1. First, while it is not usually made explicit, the theory underlying the CAPM (the "Consumption CAPM") means that it should apply in real terms, since the market portfolio is assumed to be the wealth of the representative investor, who is ultimately only concerned with the real value of their consumption, and hence with real returns. As a result, the concept of the risk-free rate should in turn be risk-free in real (CPI) terms. In the UK regulatory framework (as discussed further below) this has led to a near-consensus[3] that the

[2] There are some instances of at least partial indexation of the allowed return, in response to movements in the chosen risk-free rate. This approach is applied for example by Ofgem, the electricity and gas regulator in the UK. It appears that at least partial indexation may be under consideration by the AEA.

[3] See below for a brief discussion of this issue.

appropriate measure of the risk-free rate should be the yield on an indexed bond. Australian regulators have not, thus far, chosen to take this approach, which means that any yield chosen must be risk-free only in nominal terms, and is therefore subject to inflation risk.

3.3.2. Second, and a relatively minor point: the argument above strictly speaking *only* applies to a zero-coupon bond. The yield on a coupon bond is complicated by the impact of coupon payments in the intervening periods before the bond matures, and thus cannot be treated as a strictly risk-free return to maturity. Since in practice most bonds are coupon bonds, the notional zero-coupon bond yields at any given maturity usually need to be inferred indirectly from yields on coupon bonds. In the UK context, zero-coupon yields are calculated by the Bank of England. If equivalent zero-coupon yields are not available for Australian bonds, then care needs to be taken in ensuring that yields on coupon bonds are not assumed to be identical to those on zero-coupon bonds.

3.3.3. Third, and crucially, it should be stressed that the clear and necessary link between the horizon (the assumed period in the CAPM) and the maturity of the risk-free bond chosen has the immediate corollary that at any horizon other than *m*, such a bond is *not* risk-free. If, for example the bond is held for some period less than *m*, then the investor will need sell the bond before it matures, and will therefore face price uncertainty. As a result, bonds with long tenor are very far from being risk-free at short horizons, and can indeed be as volatile as equities in the short-term; nor is the yield equal to the expected return over any shorter period, except under very restrictive circumstances. Similarly, if the chosen horizon is *longer* than *m*, an investor would need to buy another bond, with unknown price (a generalisation of the problem outlined above, in applying the standard CAPM with a short assumed time period). Thus it is crucial to align the maturity of the bond yield chosen with the preferred horizon, an issue to which I now turn.

4. What is the appropriate horizon for regulatory purposes?

4.1. The APA has argued, on the basis of analysis by Dr Martin Lally (discussed in greater depth in an appendix) that the appropriate horizon, and hence the term of the risk-free rate, should match the length of the regulatory period, which I take to be five years.

4.2. While the focus of this note is on the risk-free rate, it should I hope be clear from the above analysis that the role of the risk-free rate in the CAPM is in providing a basis for the expected return on equity over the chosen horizon. Thus, although this note will not discuss issues relating to the measurement of the cost of equity, it is necessary to take this context into account. Applying the CAPM in regulation means that the assumed cost of equity that is estimated using the CAPM should be the expected return for a notional investor in equities, with a given beta, over that horizon. We thus need to consider what are the appropriate assumptions to make about this notional investor.

4.3. To examine this issue, I first consider 3 alternative investor perspectives.

Investor perspective 1. Consider first a notional investor whose perspective does in principle match up to the APA's chosen approach. This is a prospective investor in the traded shares of APA (or at least the notional subsidiary of APA which is engaged in regulated activities). In order

to match up to the APA's assumption, this investor must be assumed to liquidate their portfolio (with certainty) in five years' time, but to have no concern about returns in the meantime. If such an investor is assumed to apply the CAPM in pricing assets, then their chosen horizon will be five years, and the risk-free rate should therefore be estimated from default-free bonds with remaining maturity of five years. If the APA also correctly estimates the beta and the market risk premium, then such an investor would be content to invest in the shares of this notional regulated subsidiary.

The problem with the assumptions underlying this notional investor is that, while such an investor may exist, the choice of a five-year period is essentially arbitrary – it was simply chosen to match the regulatory period.

Investor perspective 2. Now consider an alternative perspective, also of an investor in equities considering buying this notional subsidiary, but with a distinctly longer horizon, of perhaps 20 years. We can justify a longer horizon both on grounds of principle and practice. On grounds of principle, because (again reverting to the underlying basis of the CAPM) the underlying investor in equities is engaged in consumption smoothing over their life cycle – and with a working life of around 40 years, the average investment horizon of such an investor is around 20 years. In practice most such long-term investment is not carried out directly by investors, but by financial intermediaries – for example pension funds – but these also will (or should) have the same long-term horizon. For such an investor the appropriate term for the risk-free rate that would provide the basis of their expected return on equity would match this longer horizon.
Since such an investor has, by assumption, an investment horizon that is longer than the duration of the price control period, they would by implication be concerned with the likely path of regulation beyond the current control period.

Note that such an investor *could* in principle liquidate their portfolio after five years. But if their horizon was longer than five years, they would need to reinvest the realised proceeds at that point, and the risk-free rate that would prevail beyond five years is clearly unknown.

A complication for both these investor perspectives is that in both cases we need to assume either that no dividends are received until the investor's horizon, or – more plausibly – that any dividends received are simply reinvested in the portfolio, as is indeed the case for most long-term investors in pension funds or other retail products. If this was not the case, but instead some income was received in the interim, then the effective horizon of the investor would be reduced.

Investor perspective 3. A quite distinct, but closely related perspective, is that of a prospective direct investor in long-lived productive assets of a similar nature to APA's pipelines (I defer for now any discussion of whether such assets are in the regulated or unregulated sector). Any investor who is able to make such investments must also by implication always have the outside option of investing in traded equities. Therefore any direct investment must be expected to yield a return at least as high as the expected return from investing in a diversified portfolio of traded equities, at a matching horizon. Hence such an investor who applied the CAPM would do so in the same way as the second investor, and over similarly long horizons. But there are two complications that make the direct comparison more complicated.

The first complication is that while the second investor would in principle be able to liquidate their portfolio of traded shares at any intervening point, the direct investor in long-lived assets would only be able to do so by selling off the underlying asset, with almost certainly some loss of value due to thin markets. For this reason, to the extent that such an investor valued the option of early liquidation, they would probably require some illiquidity premium.

A second complication is of particular relevance to the issue of choice of horizon. In contrast to the first two cases, which implicitly assume all dividends are reinvested, a direct investment in a long-lived asset with any given asset life will normally yield a flow of income throughout the life of the asset. This will certainly be the case for a regulated asset. As a result there is no clear-cut measure of the horizon of such an investment. An asset with a life of 20 years, for example, but which generates revenues in each year, will have an *average* horizon, in terms of the cashflow that it generates, strictly less than 20 years.

There is a clear, but unfortunately only partial, analogy here with the comparison between a zero coupon bond and a coupon bond. A coupon bond will have an *average* maturity, or "duration" given by the average maturity of all its coupon payments, and its principal, weighted by the market value of each component. Its duration will therefore be strictly less than its maturity. In contrast, a zero coupon bond will have duration precisely equal to maturity.

Unfortunately, while there is a clear parallel with the case of both traded equities and physical assets, it is only a partial one. The duration of a default-free coupon bond can be calculated relatively straightforwardly, since the combined value of the coupons and the principal can be viewed as a portfolio of zero coupon bonds, with progressively increasing maturity. The market value of this notional portfolio can be calculated precisely since all components are known ahead of time, and thus can be valued using risk-free rates at any given maturity. The income generated by both traded shares and longlived productive assets at any given point in time is uncertain, and therefore direct calculations of duration are more complex, and usually involve simplifying assumptions. The key feature does however apply: that the associated duration, or average horizon, will typically be less than, and sometimes significantly less than the life of the asset. As a simple illustrative example, if an asset is expected to generate a constant flow of income for 30 years, and the discount rate applied to its cashflows is positive but relatively close to zero, its duration, or average horizon, will be somewhat less than 15 years. But calculating the duration of risky assets is not straightforward, so, in contrast to the first two cases, even if the expected life of an asset is known, its duration, or average horizon, can only be estimated.

4.4. The conclusion I would draw from these three perspectives is that, for a company investing in long-lived assets, some combination of the second and third is the appropriate benchmark. The precise horizon chosen is not clear-cut – especially in the third case - but the arguments above would suggest it it is likely to be longer than five years.

4.5. A contrasting perspective, is provided by the approach of Dr Martin Lally, as set out originally in Lally (2004)[4] and expanded in Lally (2021). This approach has now been adopted by the AER, as outlined in their *Draft Rate of Return Instrument Explanatory Statement* of June 2022. Since the

[4] Lally, M., 2004, "Regulation and the Choice of the Risk Free Rate", Accounting Research Journal, vol. 17 (1), pp. 18-23.

full discussion of this issue is somewhat technical in nature, I relegate the detail of the discussion to a short technical appendix. Here, I focus on the key elements in the argument.

4.6. Lally (2021) argues that it is not valid to draw the comparison, as I do above, between a regulated company and an unregulated company with a long-lived asset. This argument rests on two key elements specific to a regulated company. First, once a given item of capital has been accepted into the Regulated Asset Base (RAB) its depreciated value at any horizon is known with certainty. Second, within a price control period, the regulator sets expected revenues on the asset, up until the end of the price control period. I do not regard either of these claims as being contentious.

4.7. But Lally then goes on to argue, in the context of a regulatory regime that applied the "NPV=0" criterion, that it is possible to value the RAB only in terms of expected cashflow over the course of the price control period, and the (known) value of the RAB at the end of the price control period, and that, as a result the appropriate horizon is the period to the end of the price control (which he takes to be 5 years). He then argues, further that, while the cashflows generated by the asset imply that the average horizon (or duration) of the asset is less than 5 years, the same applies to a coupon bond with maturity 5 years, and therefore argues that the yield to maturity on such a bond is the appropriate measure of the risk-free rate.

4.8. In the appendix I set out the details of this argument, and examine the assumptions. While Lally's argument does have an internal consistency, the weaknesses in the argument stem from a key assumption implicit in the valuation technique he employs. This has the characteristic of many valuation methods, that its validity relies on a particular investment strategy being viable, namely that it should be possible for a company whose investment is accepted into the RAB at the start of the price control period to entirely liquidate their position at the end of the price control period. The weaknesses that result from this assumption can be summarised as follows:

1. The market for the RAB is likely to be thin. This may imply that the liquidation strategy, if applied, would add an illiquidity premium to the relevant 5 year discount rate.
2. Both Lally and the AER, in their discussion of his arguments, also skate over the issue of both the current value of, and fluctuations in, the RAB multiple. The APA (p24) document the evidence of persistent, but time-varying RAB multiples. If such fluctuations are systematic then the notional liquidation strategy that underlies Lally's approach may well have higher systematic risk than a "buy-and-hold" strategy of retaining the RAB over multiple review periods (since the future value of the multiple as a progressively decreasing impact on the present value calculation, the further it is into the future).
3. Both Lally and the AER ignore both the first two points. But in doing so, Lally's argument for a close analogy between the valuation of the RAB and a 5 year bond also begs the question of why, within his restricted framework, he should simultaneously assume a significant risk premium, since in his analysis the primary element in value must come from the terminal RAB, which he assumes to be known: therefore, following his argument to its logical conclusion, it should be valued using the risk-free rate.
4. To the extent that the future depreciated value of an investment accepted into the RAB is perfectly predictable, this applies at *any* horizon up to the end of the life of the asset. Thus the argument for picking the end of the price control period hinges crucially on the assumption that the price control sets the expected cashflows only until the end of the price

control period. However, implicit in Lally's argument is that the NPV=0 principle is also expected to hold in future price control periods, so, even in Lally's framework, which ignores my first two points above, the argument for picking the five year horizon, while convenient, does not seem to be completely clear-cut.

5. Finally, Lally's assumption that the terminal value of the RAB at the end of the control period is perfectly predictable at the start of the control period appears to be predicated on a single investment at the start of the control period. To the extent that the actual RAB for a regulated company also includes CAPEX over the course of the price control period there may also be random (and possibly systematic) components in, for example, the regulator's propensity to allow CAPEX into the RAB.

4.9. Overall, while there is a certain degree of internal consistency in Lally's approach, it is certainly not watertight; and, to the extent that the weaknesses in the approach as outlined above are taken into account, they all point to the implied investment horizon being longer, and possibly distinctly longer than five years. As a simple counter-example, if the present value calculation were carried out across the entire life of the depreciated asset, with straight line depreciation (as applied by the APA) the average horizon would simply be half the assumed life of the asset.

4.10. I therefore arrive at the pragmatic view that setting the term for the cost of capital by reference to the average horizon of a representative investor – whether a long-term investor in traded equities (the second example above) or a direct investor in a long-lived asset (the third example) is a more robust approach. This implies a distinctly longer horizon than the length of the price control period.

4.11. Nor am I unique in drawing this conclusion. As shown in the next section, this reasoning has underpinned both the advice I and others have given to UK regulators in recent reports and has been followed through in the setting of allowed returns for UK regulated companies.

5. The UK regulatory context

5.1. The question of the appropriate term for the risk-free asset has received relatively less attention in the UK than in Australia. Nevertheless, some advice has been given; and regulatory practice established over an extended period and across a number of different sectors and regulators.

5.2. The most recent cross-regulator guidance for cost of capital matters is summarised in UKRN (2018), a report to UK regulators, of which I was the lead author. That report does consider the term for the risk-free asset (or more generally, as discussed above, the investment horizon when setting cost of capital), although not at great length: section 4.1 of the report. Recommendation 2 contains this advice:

***"Recommendation 2 (Horizon)**: On balance we are in favour of choosing a fairly long horizon, for example, 10 years, in estimating the CAPM-WACC.[5] But we would argue that, more important than the choice of horizon per se is that the components of the CAPM-WACC are estimated using a methodology that is consistent with the chosen horizon."*

[5] The CAPM-WACC is the preferred way that the authors of the report referred to the estimate of the weighted average cost of capital that comes from using the capital asset pricing model (CAPM).

5.3. The general practice by UK regulators has been to follow this advice, and to estimate the risk-free rate based on yields of bonds with long-term tenors. The major recent debate in the UK has been whether the relevant bonds are RPI-index linked gilts (as recommended by the UKRN 2018 report), or e.g., AAA-rated corporate bonds, as used (along with gilts) by the CMA in its final decision for the appeal against Ofwat's 2019 PR19 water decision. (The CAA has also adopted this approach in its final proposal for the cost of capital for Heathrow.) But in the last 8 regulatory decisions, from August 2019 to June 2022, the terms of the assets used to estimate the risk-free rate are as follows:

Table 1: Bond terms used in estimating the risk-free rate in recent UK regulatory decisions

Regulator	Price control	Term
CAA	RP3	10
Ofwat	PR19	15
CMA	RP3	10-20
Ofgem	GD2 & T2	20
CMA	PR19	20
Ofcom	WFTMR	10-15
UR	PR21	10 and 20
CAA	H7	20

Source: various regulatory reports linked from Table 2 of UKRN Cost of Capital—Annual Update Report (2022).

5.4. As Table 1 demonstrates, regulatory practice in the UK has been to use long maturity bonds to estimate the risk-free rate, in line with the recommendations of the UKRN 2018 report, and in line with the arguments presented in this note.

6. Conclusions

6.1. I was asked by APA to provide an expert view on the appropriate term of the risk-free rate, in the context of the Capital Asset Pricing Model (CAPM) being used to estimate the cost of capital for a regulated company such as APA. My key conclusions are:

1) That the choice of term should be set precisely equal to the assumed investment horizon, since the return on even a default-free long-term bond is only risk-free if the bond is held to maturity.
2) That setting the investment horizon, and hence the chosen term, equal to the length of the price control period is a fragile result, and dependent on strong assumptions.
3) That the exact choice of investment horizon is not clear-cut; but that there is a strong case for assuming an investment horizon, and hence the term of the risk-free return, that is distinctly longer than five years.
4) That the above conclusions are consistent with well-established practice by regulators in both the UK and (until recently) in Australia.

Despite the above criticisms, it should be noted that the AER, in adopting Lally's proposed methodology, have applied the change consistently, by recalculating the equity premium, primarily on the basis of realised excess stock returns relative to returns on a five year, rather than ten year

bond, which pushes up the equity premium by around 30 basis points. It was beyond the scope of this report to investigate whether this adjustment is appropriate, but it does imply that there are significant offsetting impacts of the proposed change. The AER are also being consistent with their own firm adherence to the NPV=0 criterion.[6]

[6] Note that this criterion is not so clear-cut in UK regulation; the UK approach is arguably closer to an $NPV \geq 0$ criterion, on the basis of the assumption that there are asymmetric costs of over- vs under-investment. However it appears unlikely that the AER would be responsive to any criticisms on the these grounds.

Appendix: The argument for a term equal to the length of the regulatory period

There has been a long-running argument in Australia (but not in the UK) that the relevant term should be equal to the length of the regulatory period i.e., 5 years. This argument, based on the so-called NPV=0 principle, appears to have originated (or at least, been given some force) by Lally (2004)[7] and is re-stated, with a number of extensions and generalisations in Lally (2021)

The AER's Draft Rate of Return Instrument Explanatory Statement June 2022, pp 103-104 summarises the arguments put forward by Lally with reference to a seemingly straightforward equivalence between expected returns and discount rates.

The basis for this is the standard (and uncontestable) definition of the return, and hence the expected return, on a traded asset

$$E_0\left(R_1\right)=\frac{E_0\left(P_1-P_0+D_1\right)}{P_0}$$

where expectations are formed in period 0 of the return *R* in period 1 (which may not necessarily be a year), *P* is the price of the asset, and *D* is its dividend (for a stock) or more generally any cashflow generated. As a direct consequence this can be rearranged to solve for the current price

$$P_0=\frac{E_0\left(P_1+D_1\right)}{1+E_0\left(R_1\right)}$$

Which is the present value of the cash payoff that can be realised in period 1, namely P_1+D_1. As noted by the APA, the fact that the payoff is simply the sum of the two components is an application of the Law of One Price: selling the asset in the next period at price P_1 would generate cash in just the same way as receiving dividends. Hence the two can be added together to be valued, irrespective of whether the share is actually sold in period 1.

The APA use parallel reasoning for the expected return of a 100% equity financed regulated firm, defining it as

$$E_0\left(R_1\right)=\frac{E_0\left(V_1\right)-V_0+E_0\left(CF_1\right)}{V_0}$$

where V_1 is the market value of regulated assets. A key requirement for this to be a valid application of the concept of the payoff is therefore that the market value is both observable and realizable in cash – i.e., there must be a liquid market in regulated assets.

So a first caveat is that it is unclear how close this is to being the case. If there is a thin market for regulated assets, a strategy of holding the regulated asset for a single period (which may possibly be the duration of the regulatory cycle) and then realizing the investment may require a higher expected return due to an illiquidity premium.

[7] Lally, M., 2004, "Regulation and the Choice of the Risk Free Rate", Accounting Research Journal, vol. 17 (1), pp. 18-23.

A second, and probably more crucial caveat is that *V* is *not* necessarily equal to the book value of the regulatory asset base – whether in principle or in practice. Thus, if expressed in terms of *A*, the RAB,

$$E_0\left(R_1\right)=\frac{E_0\left(M_1A_1\right)-M_0V_0+E_0\left(CF_1\right)}{M_0A_0}$$

so the expected (and actual) return are potentially impacted by movements in the multiple, M . The equivalent market value formula is

$$M_0A_0=\frac{E_0\left(M_1A_1\right)+E_0\left(CF_1\right)}{1+E_0\left(R_1\right)}$$

These expressions provide important insights into Lally's analysis. It corresponds to the formula in the two period version of Lally's (2021) model if, and *only* if, $M_0=1\ \ E_0\left(M_1A_1\right)=A_1$.

Lally simply assumes the first condition to hold because he takes this to be an intrinsic feature of the "NPV=0" approach: i.e., he simply assumes that markets and the regulator agree on present value calculations. The AER's own evidence suggests strongly that this is not necessarily the case.

Strictly speaking, as Lally acknowledges, the second condition does not require the equivalent condition to hold in the second period, it simply requires that it be *expected* to hold.

Lally (2021) then generalizes to a multiperiod framework, in which the price control period is assumed to be 5 years. By making equivalent assumptions he writes (equation (6) on p19)

$$V_0=A_0=\frac{E(C_1)}{1+k}+\frac{E(C_2)}{(1+k)^2}+\cdots+\frac{E(C_5)+A_5}{(1+k)^5}$$

Where, crucially, he makes the substitution $E_0\left(V_5\right)=A_5$, or, equivalently, using my notation, $E_0\left(M_5A_5\right)=A_5$ along with the additional assumption that A_5 , the value of the RAB at the end of the 5 year control period, is known at the *start* of the control period.

On the basis of this combination of assumptions, Lally then draws the analogy between the valuation of the RAB and the valuation of a coupon bond with a five year maturity. He argues that the only conceptual difference between the two is that there may be some expected difference in the cashflow profile during the price control period, but argues, further, that such differences are relatively minor in numerical terms, and that therefore the appropriate benchmark risk-free rate for the expected return is the yield to maturity on a 5 year coupon bond (nb, *not* a zero coupon bond, which, as outlined in the main paper, is the only measure of the risk-free rate that corresponds precisely to the assumptions of the CAPM). He therefore sets *k* equal to this yield to maturity, plus a risk premium which is assumed constant.

Lally argues that, as a direct result, there is a clear distinction between the valuation of the regulated asset base, compared to the valuation of an unregulated company, because there is no equivalent terminal value, therefore unregulated firms need to do present value calculation over an infinite horizon.

It must be acknowledged Lally's assumptions are largely mutually consistent. However, the assumptions underlying Lally's analysis *are* very strong, and are crucially dependent on the assumption that there would in principle be a viable investment strategy of purchasing the RAB at the start of the control period, and liquidating the entire position at the end of the control period. This leads to the significant caveats listed in the main text.

If these limitations in Lally's arguments are taken seriously, would this necessarily lead to the adoption of a longer horizon than 5 years? One fairly clear argument for doing so is that if we consider the alternative "buy-and-hold" strategy of holding the RAB into the indefinite future, then the issue of the RAB multiple ceases to be material, since future market values are simply substituted out into the indefinite future, and thus have no impact on the value of such a strategy – the only thing that matters is the cashflow profile, but in multiple price control periods, not just the current one. As discussed in the main text, if the present value calculation is carried out over the depreciated life of the asset, an obvious alternative horizon would be half the assumed capital life.