Consumer Reference Group

Review of international equity beta and market risk premium issues raised in the ERA 2022 gas rate of return Focussed Consultation Discussion Paper

7 May 2022

CRG Members

John Fallon – Chair
Director, Economic Insights Pty Ltd

Graham Hansen
Senior Policy Officer, Western Australian Council of Social Service

Paul Keay
Consultant, energyXL

Adrienne LaBombard, Manager of Industry Competitiveness at The Chamber of Minerals and Energy of Western Australia

CONTENTS

ACRONYMS

AER	Australian Energy Regulator
AER CRG	Australian Energy Regulator Consumer Reference Group
AGIG	Australian Gas Infrastructure Group
ATCO	ATCO Gas Australia Pty Ltd
CAPM	Capital Asset Pricing Model
CMEWA	Chamber of Minerals and Energy Western Australia
CEG	Competition Economists Group
CRG	Consumer Reference Group
ENA	Energy Networks Australia
ERA	Economic Regulation Authority
GGT	Goldfields Gas Transmission
NGO	National Gas Objective

1 INTRODUCTION

The Economic Regulation Authority (ERA) is currently undertaking a review to help determine the rate of return it will allow for the gas pipelines it regulates in Western Australia for the four-year period starting in January 2023.

As part of the consultation process for the review, the ERA has established a Consumer Reference Group (CRG) to provide direct and ongoing feedback to the ERA on rate of return issues that represents broad consumer perspectives.

The ERA has published a paper setting out the engagement process and also a technical discussion paper on the 2022 gas instrument review. Submissions have been made on the ERA discussion paper including a submission by the CRG. The submissions are available here

The ERA hosted a Focussed Consultation, on 27 April 2022, on two key matters: (1) the scope for expanding the comparator set for estimating the equity beta to include international energy businesses; and (2) how the ERA should best combine inputs when estimating the market risk premium and whether the market risk premium should be fixed for the term of the 2022 gas instrument. The issue of using an arithmetic or geometric mean for the market risk premium was also discussed at the Focussed Consultation.

This paper provides the CRG's views on the matters considered in the ERA's focussed consultation.

The CRG is interested in feedback on its views presented in this paper. You can contact the CRG here

2 INTERNATIONAL COMPARATORS FOR THE EQUITY BETA

2.1 INTRODUCTION

The ERA Focussed Consultation Discussion Paper noted that submissions in response to the ERA December 2021 Discussion paper presented diverging views on whether the energy network sample should be extended to included international energy networks.[1]

The ERA has posed the following questions, on international comparators, for consideration at the Focussed Consultation:

Questions – Equity beta

1. Are the firms selected by the ERA in the discussion paper (reproduced in Appendix 1 of this paper) appropriate? If there are firms which are inappropriate, what characteristics make them inappropriate?

2. Are there any additional jurisdictions that should be considered by the ERA?

3. Should the ERA consider reweighting foreign market indices to be reflective of the Australian Securities Exchange (ASX), or would this create distortions and interpretation issues as the market beta would no longer be one?

4. What adjustments, if any, should be made to estimates of international equity betas?

5. Once the sample has been selected and individual betas have been estimated, how should the ERA best use this information to determine an equity beta point estimate? Should this be done in a mechanical way or should regulatory discretion be used?

The CRG submission to the ERA December 2021 Discussion Paper argued that expanding the comparator sample to include international firms to estimate beta was not appropriate because it would likely introduce bias in arriving at a representative estimate of an appropriate equity beta for the Western Australia regulated gas pipelines and it was unnecessary at this stage given the stability in betas over a long time in the Australian sample.

In the following sub-sections, the CRG provides responses to the questions posed in the ERA's focussed consultation discussion paper in broad terms. We have not provided a response to each specific question as we consider the proposed international sample is not justified.

[1] ERA 2022 and ERA 2021.

2.1 MOTIVATION FOR USING INTERNATIONAL DATA

The ERA’s 2018 gas instrument applied an equity beta of 0.7, which was fixed over the period of the instrument. The equity beta was estimated using similar methods used by the AER but over a much shorter period for the ERA. It is understood that the data covered the most recent five-year period with weekly returns for a sample of four companies: APA Group, DUET Group, Ausnet Services and Spark Infrastructure. The four companies were chosen based on the criteria for a benchmark efficient firm i.e. “a pure-play network service provider operating within Australia without parental ownership, with a similar degree of risk as that which applies to the service provider in respect of the provision of gas network services”.

The ERA’s sample of listed Australian energy networks is reducing, with DUET having already been delisted and Spark Infrastructure and AusNet receiving take-over bids in 2021 and to be delisted in 2022. However, while the current sample may still provide a sufficient number of relevant observations (particularly recognising the stability in the beta estimates for domestic firms including several others that have been delisted) there is a concern that at some stage the sample may have to be expanded to help ensure a reliable statistical estimate for the equity beta.

The ERA has been considering how, and if, the benchmark sample needs to change due to market developments, including expanding the domestic sample to include similar domestic industries to domestic energy networks and international energy networks. The ERA considers that expanding the domestic sample to other non-energy network Australian infrastructure firms is on balance not appropriate given the departure from the pure-play energy network benchmark approach, the wide range of estimates and the continued delisting risk. Hence the focus has shifted to the scope for developing international energy comparators for the equity beta.

For now, the ERA notes that, as the delistings have occurred recently, its working view is that recently delisted firms will still be considered as they are informative of the underlying systematic risk of the benchmark entity. This may not be the case for firms which have been delisted for a substantial amount of time.[2]

The ERA has advised that: to arrive at an estimate of equity beta, it will utilise its discretion and place more weight on the domestic energy sample, informed by the estimates from other countries.[3]

The ERA considers that its current domestic energy sample of four firms provides a range of equity beta estimates from 0.5 to 0.6. When international comparators are examined, for the United States, Canada, United Kingdom, and New Zealand this provides a range of estimates is from 0.6 to 1.1. The average beta estimate across all countries is 0.76.[4]

The ERA’s working view for the 2022 gas instrument is to use an equity beta of 0.7. This number has been selected by the ERA as being below the international estimates to recognise the lower Australian equity beta estimates. The ERA also notes that the equity beta will remain fixed for the life of the gas instrument.[5]

[2] ERA 2022, p. 5.
[3] ERA 2021, p. 84.
[4] ERA 2021, p. 84.
[5] ERA 2021, p.85.

The main reasons for maintaining the status quo option for the domestic benchmark are that the sample includes the closest, comparable pure-play energy networks, the approach is consistent with prior practice, regulatory approach and precedent, beta estimates for regulated network energy businesses in Australia have been quite stable over long periods and the existing sample provides an ample number of observations.

2.2 CRG VIEW

2.2.1 Sample size and bias

Assuming there is sufficient comparability in the comparator firms used to estimate beta, increasing the number of observations by increasing the number of comparators will tend to reduce the standard error of the estimate of beta thereby providing a more precise statistical estimate i.e. a narrower confidence interval for the estimate. However, the potential for a narrower confidence interval is misleading if there is diversity in the beta estimates for individual comparators because the comparators are not sufficiently similar in terms of their economic and risk characteristics. Thus the standard error by itself is not reliable as an indicator of the predictive potential of an estimate. It is no point having a low standard error with a biased estimate.

This is well expressed by Partington and Satchell:[6]

> "The current problem of a small sample size and therefore a potentially high standard error, or sensitivity of the results to a particular observation, is not solved by collecting data from a different population."

The CRG considers that, in forming its international sample, the ERA needs to present evidence demonstrating sufficient comparability of international energy equity betas. Consideration of a range of factors suggests there are likely to be material differences between the domestic comparator sample and the international sample which in turn the CRG considers is likely to introduce a material bias when using the international sample.

The AGIG Focussed Consultation presentation claimed that there is no statistically significant difference between Australian and overseas energy betas based on a Competition Economics Group (CEG) study.[7] This finding was based on the standard 5% level of statistical level of confidence but the CEG statistical findings did, however, support rejection of the null hypothesis for the OLS estimates (but not the LAD estimates) at the 10 per cent level of statistical significance.[8]

However, importantly, a finding of no formal statistical difference does not prove that domestic and foreign betas are the same based on the standard interpretation of hypothesis testing. In other words, even where one cannot confirm statistically that the mean of an international sample is different to the mean of the domestic sample this does not mean that one can accept there is no difference. This follows from formal hypothesis testing where failure to reject the null hypothesis does not allow the interpretation that the null hypothesis can be accepted. The correct interpretation, when the null hypothesis cannot be rejected, is that there is insufficient

[6] Partington and Satchell 2018, p. 24.
[7] AGIG 2022a, slide 3 and CEG 2022.
[8] CEG 2022, Table 5, p. 9.

statistical evidence from the specific test to confirm a statistical difference. And the observed difference in the means could be consistent with prior theoretical evidence and be economically important. This interpretation was also recognised by the CEG who recommended adopting a middle course between assuming no difference in domestic and foreign betas and some difference based on observed differences between the means – more specifically “an estimate for asset beta that was within the 95% confidence interval for the Australian population mean asset beta (based on a sample of 3) and in the lower half of the 95% confidence interval derived from the foreign sample (sample of 24).” [9]

It is also noted that the CEG study used three Australian firms, 20 ‘highly regulated’ US firms, and four ‘highly regulated’ non-US firms – two Canadian utilities plus and one each from the (UK National Grid) and New Zealand (Vector). However, the CRG study did not appear to control for the vertical integration and other non-regulated activities of the foreign sample, except in specifying a ‘highly regulated’ threshold. It would be useful to have more information on the criteria that were used in relation to the ‘highly regulated’ criterion and the nature of non-regulated activities. Also one of the Australian firms, APA, has only a minority of its revenue regulated and its relevance for forming a relevant ‘pure play’ benchmark is questionable (see Table 3 below).

As noted, in a situation where the null hypothesis of no statistical difference cannot be rejected with the formal statistical methodology it is appropriate to consider the economic impact of assuming there is a difference based on observed differences in average estimates and also fundamental *a priori* reasons that are likely to mean there is truly a difference.

The economic importance of adopting different equity betas is shown in terms of the impact on the after tax nominal WACC in Table 1. The after tax nominal WACC is calculated based on the ERA’s working parameters as per its December 2021 Discussion Paper and a forecast inflation rate of 2.4 per cent.[10] For example the difference between adopting an equity beta of 0.4 and 0.9 amounts to an impact on the after tax nominal WACC of 1.3 percentage points.

Table 1: Equity beta and after tax nominal WACC

Equity beta	After tax nominal WACC %
0.3	3.5
0.4	3.8
0.5	4.1
0.7	4.6
0.9	5.1

Note: based on ERA working assumptions as per ERA 2021 with inflation forecast to be 2.4 per cent and market risk premium of 6.0.

[9] CEG 2022, pp. 9-10, 19.
[10] ERA 2021.

As noted above, the ERA considers that its current domestic energy sample of four firms provides a range of equity beta estimates from 0.5 to 0.6. When international comparators are examined, for the United States, Canada, United Kingdom, and New Zealand this provides a range of estimates is from 0.6 to 1.1. The average beta estimate across all countries is 0.76.[11] It is notable that the higher part of the range for the domestic energy sample corresponds to the lower part of the range for the international sample.

The CRG considers there are strong reasons for not using the international sample based on fundamental differences in economic and regulatory circumstances. Furthermore, as noted, there is likely to be a material economic impact from choosing a beta of 0.4 or less rather than 0.7 or 0.9, There are also conceptual reasons that suggest beta estimates based on high frequency (weekly) data should not necessarily be determinative themselves in the selection of an appropriate beta estimate given investors have longer horizons then indicated by high frequency (weekly) data, particularly in the context of the high degree of regulatory protection for returns.

There are also studies indicating monthly data are more reliable than weekly data for forming a reliable estimate of beta. For example, Patterson (1995, p.123) concludes that use of return intervals less than one month to increase the number of observations is likely to induce a size related bias into beta estimates and considers that monthly intervals are a practical compromise and are most commonly used but that one month is likely to be less than the true average holding period so that the possibility of bias still remains.[12] More recently Gilbert et al (2014) show that differences in betas estimated using higher (daily or weekly) and lower (monthly) frequency may reflect differences in the relative “opacity” of information about the prospects of those firms and how their returns will be affected by market movements.[13]

It is also not clear that there is a need to expand the domestic sample as increased observations could be available by using a longer period of estimation than the five years proposed by the ERA. This is particularly the case where it is reasonable to assume that the equity beta for the domestic sample is relatively stable and unlikely to be impacted materially by economy-wide events given the natural monopoly and regulatory arrangements that suggest relatively low and stable systematic risk.

The CRG also notes that there appears to have been no formal criteria set for establishing an acceptable sample size and that other experts have expressed views that a smaller sample size then has currently been used may be sufficient to obtain reliable statistical estimates. For example, consider the following views:

- The AER, in its 2021 Omnibus paper, did not consider that a small set of comparator firms necessarily meant the comparator set should be expanded and noted that Ofgem and Ofwat in the United Kingdom also use a small number of domestic listed entities to estimate beta. The AER’s preliminary view was that there was not sufficient evidence to support the use of international firms in the 2022 instrument review. However, they may be considered for appropriate use in the future.[14]

[11] ERA 2021a, p. 84.
[12] Patterson 1995, p. 123.
[13] Gilbert et al 2014.
[14] AER 2021, p. 110.

- Brailsford et al (1997, p.15) report that it is generally accepted that at least 50 data points are required to obtain reliable OLS estimates and that beta estimates appear to be reasonably stable over a four to five year period. This has led to a common practice of using five years of monthly data. For example, Wright, Mason and Miles (2003) report that the London Business School Risk Management Service uses the most recent 60 months of returns.

A final issue to consider is the impact of firm-specific events and how these might have less effect with a larger sample. In considering this issue it is important to recognise that only firm-specific events that affect systematic risk are relevant when applying the standard CAPM. If the events are not related to developments in the market as a whole they are treated as diversifiable and so are not relevant for pricing in the standard CAPM.

The following sub-sections provide further discussion of: the reasons why international data is not likely to be reliable for helping to determine an appropriate equity beta for the regulated gas pipelines in Western Australia; the impact of regulation: and the AER's current preliminary views. They draw on the material presented in the CRG (2022) submission to the ERA (2021) discussion paper and the Focussed Consultation held on 27 April 2022.

2.2.2 Insufficient comparability of international energy sample

When considering whether to include international firms in a sample for estimating beta there are two comparability issues.

The first issue is that the foreign market portfolio itself will have a different composition to the Australian market portfolio. It is well known that the composition of the ASX includes a much larger representation of mining and banking firms and smaller representation of technology firms than for example the broad market indices in the United Kingdom and the United States. The point is that the equity betas from international comparators do not measure the systematic risk relative to the Australian market. The questions then are what adjustments should or could be made to adjust for the different compositions in the market portfolio and to what extent would the estimates of beta be affected and be valid?

It would be possible for example to construct market indices for the US, UK and Canada that had a broadly similar composition as Australia and then estimate the betas for energy firms listed in those markets against those indices but it is not clear what would be the interpretation of the adjusted market index for investors in those firms in those countries as conceptually the beta for the market is defined as 1 and it is not clear what is the interpretation of the beta when changing the composition of the market index. Furthermore, changing the composition of the market index in this way is not a widely used technique and the reliability of doing so is not known.

The second issue is that, even if one could allow for such compositional effects, there can be a wide range of economic conditions, specific operational and structural characteristics for individual firms, leverage differences and importantly regulatory arrangements that affect systematic risk. Furthermore, apart from adjustments for gearing, there is no well-defined method for adjusting for such risk differences.

In addition, it is reasonable to question the adjustments for leverage as differing leverage across countries may suggest fundamental differences in the nature or businesses and/or the environment they operate in.[15] Furthermore the equity betas have been estimated on the assumption that debt has no market risk (the debt beta is zero) but debt does have some market risk particularly at higher debt ratios and ignoring the market risk for debt will mean the true equity betas are overstated when adjusting for leverage.[16]

In discussing the basis for its working approach to the rate of return instrument for the network energy businesses that it regulates, the AER, in its final overall rate of return omnibus paper of its current review, considers that differences in the regulatory framework, the domestic economy, geography, business cycles, industry structure, and other factors, such as the degree of vertical integration and extent of involvement in different activities that are not regulated, are likely to drive different equity beta estimates. Further, it noted that the submissions it received which supported use of international data did not propose a practical, transparent, and consistent methodology which would enable beta estimates from international firms to be compared with the benchmark Australian network service provider on a 'like-for-like' basis.[17]

The AER also noted that the beta estimates from the longest period available comparator set continue to be relatively stable despite events such as Covid-19 and the recent takeover bids and that the Australian regulated energy businesses have high-level stability in their revenues and cash flows because they have strong natural monopoly characteristics and operate in a stable regulatory framework.[18]

The CRG considers that the inclusion of international network energy companies is not appropriate at all because of material differences in capital markets, economic features of international energy firms including vertical integration of generation and network services and the presence of other non-regulated activities and likely differences in the nature and extent of application of the regulatory arrangements. It is also not necessary at this stage.

The CRG notes that the ERA recognises that most equity betas in other jurisdictions appear to be greater in magnitude than in Australia. And suggests, as previously discussed in the 2018 gas explanatory statement, it seems likely that differences in regulatory, market and operational activities are responsible for some of these differences. However, it also observes that the international estimates are derived from large liquid capital markets.[19]

The CRG considers that the fact that the international beta estimates are derived in large liquid capital markets is not a sufficient reason to justify the use of these estimates for establishing a suitable Australian benchmark. The Australian capital market is also quite substantial and liquid and analysis of fundamental principles suggests the Australian regulatory environment provides strong protection of revenues and profits. The concern about sufficient liquidity would be important if the beta estimates were based on data where there was a concern about thin trading but thin trading problems are most likely to be important with daily data and the CRG understands that concerns about thin trading have not been expressed for the weekly data sets used by the AER and ERA. Furthermore, any residual thin trading concerns could be ameliorated with the use of monthly data for which the CRG considers there are sufficient observations, particularly if 10 years or more of data were used. In this respect Damodaran

[15] Partington and Satchell 2018, p. 24.
[16] Damodaran, p. 27.
[17] AER 2021, p. 109.
[18] AER 2021, p. 106.
[19] ERA 2021, p. 85.

notes that thin trading problems can be reduced with the use of longer return intervals and that monthly returns should provide sufficient observations for firms listed for more than three years.[20]

Importantly in the sample of firms the ERA has used from the US, Canada, the UK and New Zealand it is notable that most of the firms have involvement in electricity generation and other apparently unregulated businesses:21

- US energy utilities are generally vertically integrated businesses that often include construction, energy retailing, electricity generation and/or natural gas wholesaling; and are not just providers of electricity network or gas pipeline access. The upstream and downstream activities that they are engaged in are riskier than is the provision of natural monopoly infrastructure services i.e. the energy transport functions.

- 7 out of the 8 Canadian firms are vertically integrated with an energy generation business operation, 1 of the 2 UK firms also has a generation business, the New Zealand firm Vector is also a wholesaler of gas and provides broadband services.

The CRG also notes that the ERA has made no adjustments to its sample, at this stage, to account for the existence of non-regulated or non-network energy services in its international sample.

The GGT submission to the ERA December 2021 Discussion Paper also expressed concerns about the lack of material demonstrating sufficient comparability of international comparators and South 32 also expressed concerns about comparability of risks for US firms. The other submissions did not express concerns about comparability of the international data.

If the international estimates were to be formally recognised, the CRG considers the ERA would need to establish that the regulatory and economic environments in these other countries provided similar revenue and profit protection as for the Australian economic regulation of network energy businesses and would need to focus on those energy businesses where a substantial majority of the business was regulated and had similar revenue and profit protection as the Australian regulated network energy businesses.

The CRG has a strong preliminary view that it is not appropriate and not necessary at this stage for the ERA to use an international sample in forming a preferred point estimate of the equity beta and is concerned that this would have a material, adverse and unjustified impact on the long term interests of consumers.

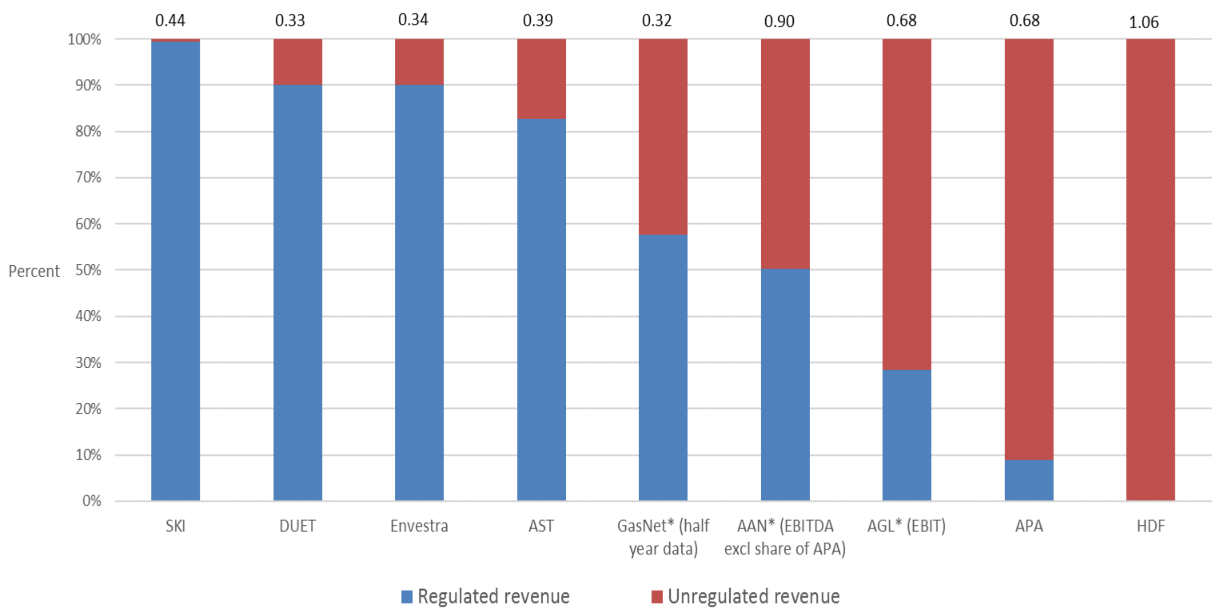
2.2.3 Impact of regulation

The CRG notes that the regulated entities are natural monopolies which in conjunction with the regulatory arrangements is likely to mean they have very strong assurance that they will receive cash flows sufficient to recover all their efficient costs over the regulatory period. This should in turn be reflected in the observed equity beta when measured over a longer period than reflected in weekly or even monthly data. In other words there are fundamental economic

[20] Damodaran, pp. 10-11.
[21] ERA 2021, Appendix 4.

characteristics that suggest that the betas for the regulated gas pipelines should be relatively low. In this respect, there is evidence that the betas for benchmark Australian comparators, as used by the AER, show a general trend of decreasing beta estimates as the proportion of regulated revenue increases, as shown by the AER in its 2018 rate of return explanatory statement as per Figure 14 below.[22]

Figure 14 Regulated revenue percentage and beta estimates



Source: AER, Rate of return instrument. Explanatory statement, December 2018, p. 174

Table 2, which contains the latest AER update for its domestic energy network beta estimates, confirms that the two listed firms (at the time) in the sample with majority regulation of their revenues have much lower equity betas than the average for the whole comparator set of nine (listed and delisted) firms or three still listed firms for most of the estimation periods.

Note also that the estimates indicate considerable stability for the longest period when comparing the 2018 and 2021 estimates and this stability has been confirmed by the AER.

For the most recent 5 years data periods, the increases in the 2018 update and subsequent decreases for the 2021 update for the still listed firms are notable. In its 2018 Explanatory Statement the AER noted that because the comparator firms could be considered bond proxies (where there is likely to be an inverse relation between bond prices and interest rates) they would tend to outperform the market during times of interest rate decreases leading to an increase in short term equity beta estimates.[23] In contrast, for the 2021 update the AER noted that this period included data from the Covid pandemic and that this more recent data has also

[22] AER 2018, p. 174

[23] AER 2018, p.166.

highlighted the stability of the businesses that the AER regulates, in times of material disturbances.[24]

Table 2: AER equity beta estimates for domestic energy network business comparators (OLS estimates for weekly data for various periods from June 2000 to August 2021

Equal and value weighted portfolio estimates	Whole comparator set (9 firms and different combinations)	Still listed firms (APA Group, Spark Infrastructure, AusNet Services)	Still listed majority regulated firms (Spark Infrastructure, AusNet Services,
Longest period			
2018 review	0.42 – 0.67	0.52 – 0.55	0.42 – 0.43
2021 update	0.40 – 0.68	0.51 – 0.55	0.40 – 0.41
Post tech boom and excluding GFC			
2018 review	0.50 – 0.67	0.64 – 0.67	0.52 – 0.53
2021 update	0.47 – 0.69	0.59 – 0.62	0.47 – 0.47
Recent 5 years			
2018 review	0.49 – 0.88	0.81 – 0.88	0.70 – 0.72
2021 update	0.37 – 0.70	0.53 – 0.59	0.37 – 0.38

Source AER 2021 pp. 103-104.

Table 3 contains the latest ERA equity beta estimates for the domestic comparator sample it uses. There is a noticeable difference in the average estimates for the majority regulated assets compared with the estimate for APA which has minority regulated revenue.

Table 3: ERA equity beta estimates for domestic energy network business comparators, weekly data from July 2016 to June 2021

Asset	OLS	LAD	Regulated revenue
APA	0.759	0.896	Minority
AST	0.286	0.532	Majority
DUE	0.466	0.430	Majority
SKI	0.383	0.505	Majority

Source: ERA 2021

[24] AER 2021, p. 107.

2.2.4 AER preliminary view

The AER's preliminary view is that it will retain the 2018 instrument approach placing the most weight on the longest period estimates for its domestic energy network comparator set and not use international energy firms, domestic infrastructure firms or other regulators decisions to inform its estimated range for beta. However, it advised that it would have an open position on its approach to choosing a benchmark sample.[25]

The AER highlighted the importance of promoting stability and predictability in its regulatory approach and the need to ensure there is clear evidence that its current approach is no longer appropriate and that an alternative approach would lead to a better outcome with respecting to the national electricity and gas objectives.

The AER justifies use of the longest period estimates as this can lead to more robust and statistically reliable equity beta estimates. The AER agreed with the proposition that given the natural monopoly characteristics of the Australian regulated energy networks and the stability of and the protection from the Australian regulatory framework, it is likely that their systematic risk is relatively stable over long periods of time. It also noted that this was consistent with the empirical evidence for the comparator set and stability of revenues and share prices for the listed Australian regulated energy businesses.[26]

The AER justifies continuing to use the existing comparator set essentially based on an assessment that other domestic infrastructure firms would face inherently different risks when compared with Australian regulated energy network firms and in the case of international energy firms, differences in regulatory framework, the domestic economy, geography, business cycles and other factors are likely to drive different equity beta estimates.[27]

2.2.5 Conclusion

The CRG supports restricting the sample at this stage to domestic energy networks based on the reasoning set out by the AER.

However, the CRG would like the ERA to give consideration to estimating beta over a longer period as this would likely provide more statistically reliable estimates given the evidence suggesting stability of the beta estimates over longer periods and the advantages that longer term estimates have in reducing the impact of one-off events.

The CRG also considers that the ERA needs to give more recognition of the impact of regulation on beta estimates as there seems to be reasonable evidence the regulatory arrangements in Australia for network energy businesses provide considerable regulatory protection for revenues and profits for those businesses.

[25] AER 2021, p. 102.
[26] AER 2021, pp. 105-6.
[27] AER 2021, p. 109, 112.

3 MARKET RISK PREMIUM – DIVIDEND GROWTH MODEL AND OTHER INPUTS

3.1 INTRODUCTION

The market risk premium issues, for the focussed consultation, relate to stakeholder views on how the ERA should best combine inputs when estimating the market risk premium and whether the market risk premium should be fixed for the term of the 2022 gas instrument.

This entails consideration of how to make use of the historic market risk premium, the dividend growth model and conditioning variables that take account of recent information to establish a point estimate. The conditioning variables are default (corporate bond) spreads over the risk free rate, the five-year interest rate swap spread, dividend yields and the ASX 200 stock market volatility index. When assessing current market conditions, the ERA consider s how the current value of each conditioning variable compares to its historic average.

The ERA notes the recent development of a 'calibrated' dividend growth model that is claimed by Energy Networks Australia to address concerns in relation to previous applications of the dividend growth model but is unsure of its effectiveness or how it could be used.

The ERA has posed the following questions, on the market risk premium. for consideration at the Focussed Consultation:

Questions – Market risk premium

> 6. What are stakeholder views on the calibrated DGM proposed by Energy Networks Australia? Does this amended model provide additional confidence in the DGM and how?
>
> 7. Is it possible to combine inputs in a more formulaic manner when estimating a forward-looking market risk premium?
>
> 8. What weight, if any, should be assigned to the historic market risk premium, DGM and conditioning variables in estimating the market risk premium?
>
> 9. Do you support a fixed or updating market risk premium being used over the four-year term of the gas instrument?
>
> 10. Is it possible to estimate a forward looking market risk premium in a completely mechanical way with no use of regulatory discretion?

In the following sub-sections, the CRG provides responses to the questions posed in the ERA's focussed consultation discussion paper. However, the CRG would like to make it clear that it considers review of the arguments in relation to the use of arithmetic and geometric means is also important with differing views expressed by stakeholders and the choice of method likely to have a material impact on the market risk premium estimate. As the issue of using arithmetic or geometric means was raised at the Focussed Consultation it is discussed in Section 4.

3.2 DIVIDEND GROWTH MODEL

3.2.1 The basic DGM

The most basic dividend growth model (DGM) assumes the current market value of a stock or portfolio can be expressed as a present value of a current dividend assumed to grow at a constant rate with a constant expected return to be realised forever as per equation (1) below.

(1)

$$P = \frac{D\ (1+g)}{r-g}$$

Where

P = current market value
D = current dividend
g = expected dividend growth rate
r = expected return

With information on the current market value, current dividend and an assumption about the expected dividend growth rate equation (1) can be used to solve for the expected return r as per equation (2).
(2)

$$r\ = \frac{D\ (1+g)}{P} + g$$

The basic dividend growth model in (1) has been amended by the ERA to a two stage approach where in the first stage separate forecasts of dividends are used for three years and a perpetuity component is used for the terminal value.[28] The AER uses a similar approach.

The DGM has been the subject of considerable debate in Australian regulatory decisions and the ERA and others have noted various problems with its application.

Key concerns are as follows:

1. The assumptions of a constant dividend growth rate and constant expected return over an extremely long time frame are extreme, with no examples of firms or indexes where this has occurred (Boyle and Murray 2022, p. 55). See also McKenzie and Partington, (2013, p. 6).

2. A constant expected return implies any changes in the market risk premium and risk free rate are perfectly offsetting and this is implausible – giving gives rise to MRP estimates that will be too low when the risk free rate is unusually high and too high when the risk free rate is unusually low. (Lally 2013, p. 3 and 5).

3. The market price at a point in time may not reflect rational pricing of fundamentals at the point in time that the methodology is applied. More specifically D/P can vary a lot and inspection of (2) indicates that r moves more than D/P on a 1-to1 basis. This in turn

[28] ERA 2016, p.

can mean high volatility in r. (Boyle and Murray 2022, pp. 55-56, 60). See also Lally 2013, p.3 and 9-11.

4. Even where the market is highly efficient there is still a need to estimate g and inspection of (2) also indicates that r moves more than g on a 1-to1 basis (Boyle and Murray 2022 pp. 56-57). The estimated cost of equity will still be sensitive to assumptions about the long term growth rate. Furthermore, most firms will not be able to sustain a constant growth rate and it is not clear what the average outcome should be. It is also not clear how rising inflation will be taken account of in the estimation of g.

5. Analysts forecasts for the growth path of dividends tend to be optimistic and slow to react to new information (McKenzie and Partington, 2013, p. 4 and Partington and Satchell 2020, p. 53, 60-62).

6. The method does not recognise the growing importance of non-dividend forms of payment to shareholders (share issues, repurchases and dividend re-investment (McKenzie and Partington, 2013, p. 4, 9-11). It is the net dividend paid to the shareholder that is relevant. The long term growth rate of dividends also depends on new equity capital and this does not seem to be allowed for in applications of the model McKenzie and Partington, 2013, p. 10 and Partington and Satchell 2020, pp. 54-57).

3.2.2 The calibrated DGM

As noted by the ERA (2022) Energy Networks Australia suggests that certain implementation issues with DGMs (choice of long-term growth rates, biased analyst forecasts and sensitivity to assumptions) could be addressed via a model they call the “calibrated DGM” developed by Frontier Economics.

The model solves for a growth rate of dividends over a defined historical and forecast period such that the market risk premium from the dividend growth model equals the historic market risk premium for the historic period.

The model has been applied to the AER’s two stage DGM using, as a starting point, the same assumptions and dividend forecasts adopted by the AER. The steps in the process are as follows:

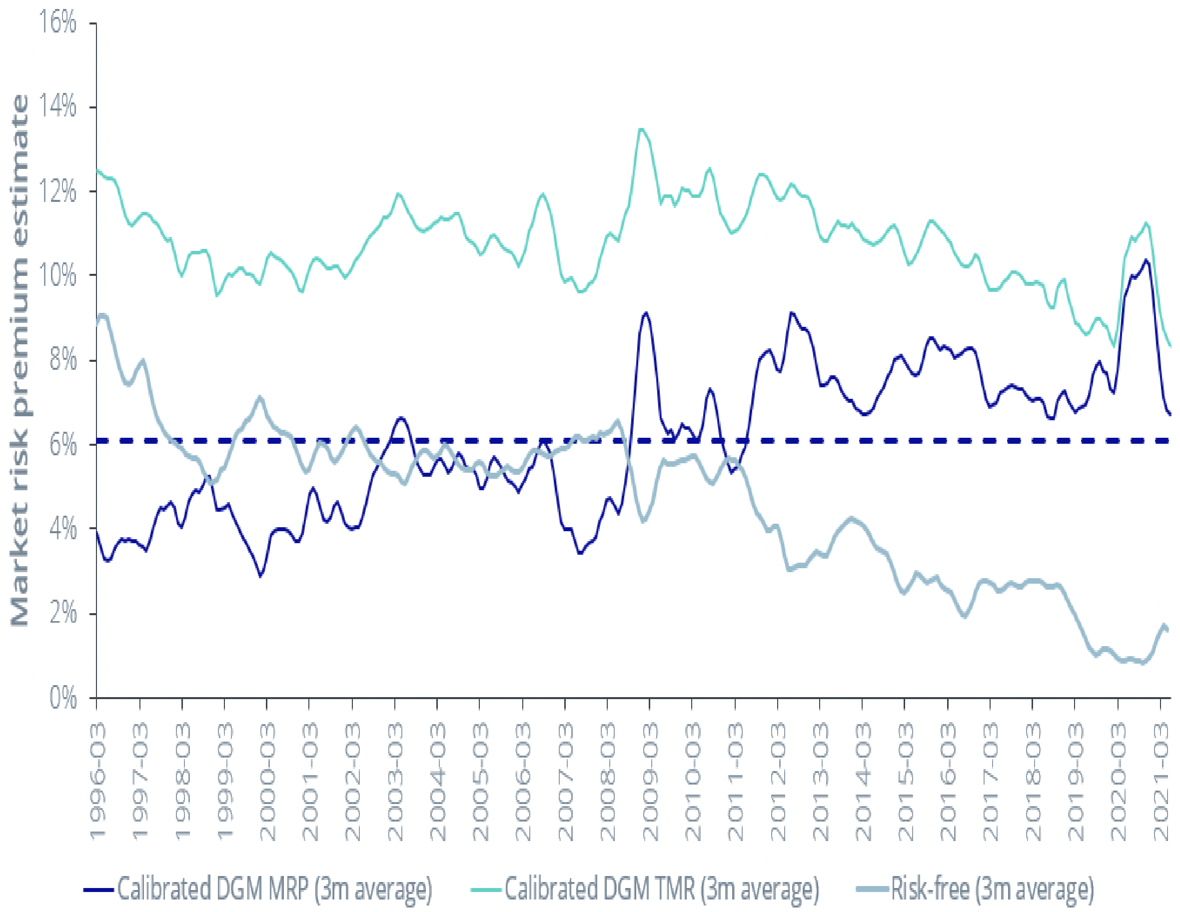
1. Given the price of the market index and the dividend forecasts including an assumption of 4.6% for g (the growth of dividends) solve for the implied return on the market r. The measure of r and the risk free rate can then be used to calculate the market risk premium since r = mrp + risk free rate.

2. Repeat the process in 1 for each month for the defined historical period which will lead to a different estimate of r and the mrp for each month.

3. Calibrate the model by adjusting g such that the average MRP for the DGM equals the historic MRP for a defined period. This will in effect mean adjusting r and the MRP in each period such that the average MRP constraint is achieved.

Note that both the market risk premium and the required return on equity are determined given the risk free rate is also an input. This is consistent with the data presented in Figure 13 of the ENA 2021 submission to the AER (reproduced below) which plots the calibrated DGM MRP, calibrated total market return and risk free rate.[29] The DGM MRPs vary during the estimation period but on average the DGM MRP is equal to the historic MRP. The total market return also varies during the estimation period being the sum of the calibrated MRP and risk free rate.

Figure 13: Calibrated DGM estimates



Source: Frontier Economics calculations in ENA 2021

Note that when reviewing Figure 13 for the period 1996 to 2021 the data for the calibrated MRP shows an above average MRP since about 2008. It would be helpful to compare the calibrated estimates with the actual historic MRP and historic total return for each period. The Frontier Economics Focussed Consultation slides provided an updated chart covering the period 1988-01 to 2022-01.[30] A noticeable feature of the period 1988 to 1990 was a market risk premium of less than 2 per cent when the risk free rate was 12-13 per cent, followed by a trend increase in the market risk premium as the risk free rate declined.

[29] ENA 2021, pp. 55-56.

[30] Frontier Economics 2022, slide 7.

As adjustments appear to be made incrementally to r until the MRP constraint is met, the starting r and incremental adjustments in effect have a strong influence on the results given that the risk free rate is exogenous. The outcome is a noticeable decline in r since about 2008 but rise in the MRP. A question arises is what is the exact nature of the adjustments to r and how are they justified? It is not clear from the documentation.

As the total market return is not fixed then there is not necessarily an inverse relationship between the market risk premium and the risk free rate but the ENA has confirmed there is a negative relationship as a result of the estimation and the relationship is clear from inspection of Figure 13. The ENA notes that this negative relationship is not imposed on the estimation, but is generated by the data as part of the estimation process.[31] This was also confirmed in the Frontier Economics Focussed Consultation presentation.

It is arguable that the calibrated DGM greatly ameliorates some of the problems associated with the use of DGMs in regulatory settings in Australia to date, and in particular problems associated with determining dividend forecasts because of the constraint provided by the historic market risk premium. The calibrated DGM could provide some indication of recent forces impacting on the market risk premium.

If one was to make use of a recent upward trend in the MRP driven apparently by a decline in the risk free rate, in order to estimate a forward looking MRP for the regulatory period it would be important to establish a strong relationship based on other information but there is much disagreement about the nature and stability of such a relationship.

The AER (2021) recently reviewed the evidence for an inverse relationship between the MRP and the risk free rate and made the following points:[32]

- "There is no widely accepted theoretical basis for a negative relationship between the MRP and risk-free rate. (Where applicable, reflective of economic and finance principles and market information).

- It is not fit for purpose because the relationship between the MRP and risk-free rate is likely to be time-varying, may change signs overtime (from positive to negative or negative to positive), and cannot be reliably quantified. (Fit for purpose).

- It is not supported by robust, transparent, and replicable analysis that is derived from available credible datasets. The relationship from empirical studies depends on the sample period, and assumptions used. (Implemented in accordance with good practice).

- The empirical evidence for a negative relationship typically relies on the DGM results. The DGM is not based on quantitative modelling that is sufficiently robust. It is unduly sensitive to errors in inputs estimation, especially the growth rate. Also, it is subjected to arbitrary filtering or adjustment of data, which does not have a sound rationale. (Where models of the return on equity are used)."

[31] ENA 2021, p. 56.
[32] AER 2021, p. 59.

Although the calibrated DGM estimates a growth rate of dividends consistent with the assumed MRP there are still concerns about the application of the model as if it provides exact answers, the assumptions of efficient pricing for the market as a whole and the likelihood that the growth rate of dividends could vary over time.

In summary it is important to recognise that the average DGM MRP is by construction exactly equal to the historic market risk premium but implementation of the DGM appears to reveal a strong negative relationship with the risk free rate. Thus, the model may be helpful in highlighting the relevance of some inverse relationship between the market risk premium and the risk free rate. However, the collective evidence on a negative relationship and its likely stability should be considered when establishing the MRP to apply for the relevant regulatory period. The ERA has the discretion to adjust a market risk premium based on historic information with DGM and conditioning variable inputs as discussed in Sections 3.3 and 3.4 below.

3.3 COMBINING INPUTS IN A MORE FORMULAIC MANNER

It is possible to combine historical and dividend growth estimates of the market risk premium in a mechanical way, for example as per the options in paragraphs 70 of the ERA Discussion Paper, but the CRG considers that it would not be sensible to do so.

The ERA could specify a mechanistic formula to combine inputs but the CRG agrees with the ERA that no formulaic use of conditioning variables would be possible, as there is no mechanical mapping between them and the market risk premium.[33] And these variables together with the DGM are relevant in making a judgement about the extent to which the historic market risk premium should be adjusted to take account of recent conditions.

For the DGM, the CRG considers that there is too great a divergence in views about the DGM estimates and their merit to warrant giving any more weight or recognition or explicit treatment than has been done to date. This is especially so given there is no credible evidence that allowed rates of return have been set too low consistent with providing efficient investment incentives. The uncertainty about the reliability of DGM estimates also supports a position of no explicit determinative weight for them but rather using them, where considered relevant, to help determine the direction for any change in the market risk premium.

For the calibrated DGM, the CRG considers that by specifying the average market risk premium for the DGM is set to a specified historic market risk premium then the model is no longer essentially a forward looking one but rather one that is essentially based on historic data. Furthermore, the CRG considers that the main potential contribution of the model is to highlight the scope for an inverse relationship between the market risk premium and the risk free rate but the weight of evidence suggests a robust relationship cannot be relied on as also recognised by the ERA.[34]

[33] ERA 2022, p. 12.
[34] ERA 2022, p. 12.

3.4 WEIGHTS FOR THE HISTORIC MARKET RISK PREMIUM, DGM AND CONDITIONING VARIABLES

The CRG supports the ERA using the approach described in the ERA December 2021 Discussion paper.[35] With this approach, the ERA places more reliance on the historic market risk premium relative to the dividend growth model and determines a final point estimate by using regulatory judgement including consideration of relevant conditioning variables. On the basis of all available information, together with its regulatory discretion, the ERA 2021 Discussion Paper estimates a market risk premium of 6.0 per cent for the 2022 gas instrument.[36]

The CRG notes the ERA currently uses both the geometric and arithmetic means in forming its preferred historical estimate and supports continued use of the geometric mean noting that there may be merit in giving it more weight than the current averaging process. The issue of using an arithmetic or geometric mean was raised in the Focussed Consultation and Section 4 below provides the CRG's views on this issue.

The CRG also notes that no adjustment has been made for 'survivor' bias which implies a higher observed market risk premium than has actually occurred given removal of failing firms from the market index.

The CRG also considers that the ERA should explain in broad terms how it will use its regulatory discretion to arrive at a point estimate.

3.5. FIXED OR UPDATED MARKET RISK PREMIUM

The CRG considers that it is preferable to estimate the cost of equity (and hence its components) as close as possible to the start of the regulatory period that applies for each regulated entity and the cost of equity capital should be fixed for the length of the regulatory access arrangement period. This reflects a position that the regulated cost of equity capital should be forward looking, taking account of all information including historic and recent information and should apply for the period for which prices or revenues are regulated. However, the rate of return instrument is binding from the date it is specified and not from the date when an access determination applies and this restricts the use of regulatory discretion to the start of the period when the rate of return instrument applies.

The ERA could specify a mechanistic formula to apply at the date an access determination starts but, as noted, the CRG agrees with the ERA that no formulaic use of conditioning variables would be possible, as there is no mechanical mapping between them and the market risk premium. The CRG also considers there is no robust way to mechanically incorporate the DGM into a preferred estimate of the market risk premium.

However, the CRG considers this is not necessarily a problem given the ERA gives most weight to an historic market risk premium which the CRG understands has been stable as a regulatory parameter for some time and that changes in conditioning variables are not likely to justify altering the market risk premium materially over regulatory periods that extend for 5-7 years. And importantly, the CRG is not aware of credible evidence that allowed rates of return have

[35] ERA 2021, para 348, p. 62.
[36] ERA 2021, para 349, p. 62.

been set too low consistent with providing efficient investment incentives including for the period since 2018 when the binding nature of the rate of return instrument has applied.

3.6. MECHANICAL ESTIMATION OR REGULATORY DISCRETION

The CRG considers that it is not sensible to try to estimate a forward looking market risk premium in a completely mechanical way with no use of regulatory discretion. The CRG considers that the objective should be to obtain the best estimate of the market risk premium that is relevant at the start of the regulatory period for the regulatory period and that there are many factors that could affect the market risk premium at a point in time including many unexpected developments. The CRG considers that this in effect creates a necessity for regulatory discretion and based on Australia-wide experience such discretion seems to have been effective in various regulatory settings including for the regulated gas pipelines in Western Australia.

4 MARKET RISK PREMIUM – ARITHMETIC OR GEOMETRIC AVERAGE

The issue of measuring the market risk premium using an arithmetic or geometric average was raised at the focussed consultation and also in the submissions to the ERA's December 2021 discussion paper. This section considers the arguments for both measures.

4.1 CONCEPTUAL MEANING OF ARITHMETIC AND GEOMETRIC AVERAGES

The expected market risk premium in the ERA's regulatory framework is currently measured as an annualised return, although the theory on which the CAPM is based does not define the period except to assume it is a one period model. For example, the period could be a regulatory period of 5 years or it could be a shorter or longer period based on what best represents investors preferred holding period for the investment.

There are two averaging methods which can be used to measure returns — the arithmetic and geometric mean or average. The arithmetic average is just a simple average. The number of periods over which the measurement is to apply is specified and the return for each period is given the same additive weight to form the simple average.

When calculating the arithmetic average return, **the return in each period is in effect assumed to be realised,** so that if the period is a year the return for that year is assumed to be realised by the investor and not compounded over a longer period. To be clear here is no compounding effect when calculating an arithmetic average and the returns for each period are assumed to be fully realised. The same amount is also assumed to be invested in each period.[37]

The geometric average measures a compounded return. It is calculated as the average of a set of products of the terms i.e. it is the nth root product of n numbers and it takes into account the effects of compounding. Thus the geometric average for n periods, r, is = $[(1+r_1)(1+r_2) \ldots (1+r_n)]^{1/n} - 1$. Alternatively, the geometric average is the **annualised return** that can be calculated from the following equation – geometric average r = (future value of investment/ = initial value of investment)$^{1/n} - 1$.

The difference between the two measures can be seen by considering a simple example where there are two periods with a return of +100% in the first period and -50% in the second period. The arithmetic average would be (100-50)/2 = 25%. The geometric average would be $[(1+100/100)x(1-50/100)]^{0.5} - 1 = 0\%$.

In this two period example if the invested capital and returns, including dividends, are retained for the investment (compounded) there is no change in wealth over the two periods. The total return is 0%. If there is re-investment of the capital and returns, the arithmetic average is not relevant for determining what happens to the final value of the investment. For example suppose there is an initial investment of $50. For the arithmetic mean the investment rises to $100 after the first period but $50 is set aside and only $50 is invested in the second period and

[37] Patterson 1995, p.133.

this declines to $25. So the net gain is $25 or $12.50 per year. This is 25% of the constant investment of $50 and equal to the arithmetic mean return of 25%. In contrast the geometric mean assumes $50 is invested in the first year and $100 in the second year and the final value of the investment is $50 for a 0% return over the two periods.[38]

An arithmetic average will tend to overstate returns where compounding is relevant. The upward bias for the arithmetic average arises because of the variability of returns. In contrast the geometric average is considered to entail a downward bias when estimating expected returns. The geometric average may also be biased to the extent continuous compounding does not apply .

Technically the returns for each period are treated equally in an additive fashion for the arithmetic average but when compounding applies for the geometric average all observations are not equal because the compounding in effect gives more weight to larger values. However, increases in the holding period will decrease mean returns asymptotically to the geometric mean.[39] This aspect is discussed further in 4.2.4 below.

The averaging of the two methods is meant to reduce bias. However, the nature of the bias is different for the two approaches so that simple averaging does not necessarily eliminate the biases. Jacquier, Kane and Marcus also examine the upward bias in arithmetic means and downward bias in geometric means and establish for a log normal distribution for returns (which is considered best represents the distribution of returns) that the bias is a function both the imprecision of the estimate and of the horizon for which portfolio performance is forecasted.[40] They argue for the weight on the geometric mean to be equal to the ratio of the investment horizon to the sample estimation period. Note that if a weighting along these lines was adopted it does not address the issue of whether the arithmetic mean should also be adjusted to reflect a lower variance of returns related to the impact of the regulatory arrangements.

4.2 CRG VIEW

The AGIG, ATCO, ENA and GGT submissions to the ERA 2021 discussion paper and Frontier Economics argued that the arithmetic mean must be used because it is the most appropriate estimate of the expected return with references to consultant and academic reports or books.[41]

In contrast South 32 advised that it supports calculating the historic market risk premium as an average of the arithmetic and geometric means.[42]

The CRG views on issues raised about using the arithmetic or geometric mean or a combination are set out below.

4.2.1 Arithmetic mean as a measure of expected return

As noted, several submissions have claimed that the arithmetic mean must be used because it is the most appropriate estimate of the expected return with references to consultant and

[38] Patterson 1995, p.133.
[39] Patterson 1995, p.110.
[40] Jacquier, Kane and Marcus 2003.
[41] See AGIG, 2022, ATCO 2022, ENA 2022a, b, GGT 2022, Frontier Economics 2022.
[42] South 32 2022.

academic reports or books. Several of these references also note that there is an assumption that past returns are independent draws from the same distribution.[43]

However, the CRG understands that returns are often negatively correlated (so that good years are more likely to be followed by poor years and vice versa) and so not independent and in this case the arithmetic mean will overstate the best estimate of the market risk premium.[44] The Frontier Economics presentation at the Focussed Consultation noted that preliminary analysis for APGA indicates there is no evidence of serial correlation, although the CRG is not aware this analysis has been made publicly available.[45]

In addition, the use of the arithmetic mean assumes that the return will be realised in each period that is used to form the average and this does not seem to be a reasonable assumption when annual observations are used to form the average.

4.2.2 Consistency with NPV=0

Three of the submissions refer to the paper by Lally (2012, p. 31) where he explained that if annual returns are independent and drawn from the same distribution then the arithmetic mean will be the best estimate of the cost of capital and will ensure the NPV=0 condition is satisfied but the geometric mean will not.

In response, note that Lally explicitly states the assumption of independent returns is required whereas as noted just above if returns are negatively correlated over time , the arithmetic mean return would not be the best estimate of the expected return of the true annual cost of capital.

The term mathematical proof, when referring to the academic material in support of an arithmetic mean, is misleading because the key point is to choose the best estimate of the cost of capital and that is not necessarily based on an average market risk premium if returns are not independent.

Furthermore, if the most representative time horizon is not annual but longer for example corresponding to the regulatory period or a longer time horizon with compounding (re-investment of returns in the regulated asset) then one would not use an average annual discount rate applied to annual cash flows because the relevant cash flows for investors would relate to a longer period and discounting of the longer period cash flow should be at the most relevant return corresponding to that longer period.

4.2.3 The relevance of compounding

The ATCO submission ENA (2021, p. 47) and Lally (2012, p. 31) have claimed that the regulatory process does not entail compounding and so the geometric mean would therefore not be relevant. However, this point is misplaced because the issue is not whether the

[43] Berk and De Marzo 2020 in ENA 2021, p.45 and Lally 2012, p.32.

[44] For the US see Fama and French 1992 in Damodaran 2021 p.35 who reports that: "The evidence on negative serial correlation in stock returns over time is extensive and can be found in Fama and French (1988). While they find that the one-year correlations are low, the five-year serial correlations are strongly negative for all size classes."

[45] Frontier Economics 2022, slide 3.

regulatory process explicitly entails compounding but rather do investors in the regulated entities in effect experience and expect compound returns by the choice of their investment horizons and practices. Also the regulatory process itself does not preclude compounding of returns by investors.

This perspective is supported by Partington and Satchell in their report to the AER for the allowed rate of return 2018 Guideline Review.[46]

> "The estimation of the market risk premium is for the purpose of determining investors' required rate of return. This return is equal to their expected rate of return if prices are in equilibrium. Investors compound returns and whether or not the AER compounds returns is not relevant to the return that investors require/expect. It is well established that the arithmetic average of annual returns will overestimate expected returns if the holding period is more than one year. The holding period of investors is likely to be more than one year. For example, in the expert evidence session it was suggested that some investors in the regulated businesses had investment horizons of 20 years. Given investor holding periods of more than one year it is appropriate for the AER to have regard to the geometric average for returns. It is also appropriate for the AER to consider return periods of more than one year."

4.2.4 Focus on the expected return over the regulatory period

The objective in setting the parameters for the allowed rate of return for the regulated gas pipelines in Western Australia is to obtain the best estimate of the allowed rate of return for the relevant regulatory period. Historic averages are relevant to the extent they provide relevant information for determining the best estimates of expected future returns for the regulatory period.

The GGT submission claims that:[47]

> "There are studies and academic examples showing there are periods in which the geometric average appears to be the better estimator. But these studies are not concerned with estimation of the MRP from historical excess returns. As Wright, Mason and Miles noted that the geometric mean is the natural metric of returns from the perspective of an investor: an investment with a positive geometric mean return will grow over time. If, as might be the case in portfolio planning, returns are compounded over an extended period then, as Marshall Blume has argued, the geometric mean is the better estimator of the compound growth rate to be applied over the period."

And:[48]

> "This issue of upward bias when estimating expected future portfolio value using the arithmetic mean of period-by-period returns over an extended period is not the same as the issue of estimating the mean of a return distribution using historical time series data. The upward bias imparted to a future portfolio value calculated using an arithmetic mean of period-by-period rates of return is not the issue which arises when using historical excess returns to estimate the MRP. When estimating the MRP, there is no

[46] Partington and Satchell 2018, p. 34.
[47] GGT 2022, p. 30.
[48] GGT 2022, p. 31.

> compounding of returns year-by-year over the period for which historical data are available."

Thus the GGT submission appears to be claiming that the geometric mean is not relevant in estimating the historic market risk premium because of its historic nature and because it considers the estimation cannot entail compounding of returns. However, the GGT submission does indicate the geometric return is preferable if there is compounding over an extended period and there will be upward bias if the arithmetic return is used to estimate a future portfolio value.

However, as suggested above, the historic market risk premium provides relevant information to help formulate the best estimate of future returns so the issue of potential upward bias in the estimated returns is in fact relevant. In addition, it is possible to estimate the geometric return which will entail compounding by simply applying the relevant formula and it is relevant to recognise that compounding is a prominent feature for investors in equity markets.

It is also relevant to make use of some of the material provided by Wright, Mason and Miles and as referred to by the GGT submission. In this respect, assume that the relationship between the arithmetic return and the geometric return is as specified by Wright et al i.e.:

arithmetic return = geometric return plus half the variance of the log normal return.

If this relationship is going to be used to determine the arithmetic return, then one needs the best forward looking estimate of the geometric return and the variance for the log normal return and one needs to consider two things:

1. do the regulatory arrangements provide strong predictability of returns so that the variance of returns as observed based on historic data requires downward adjustment such that the implied arithmetic return is much closer to the geometric return than observed with historic data; and

2. to what extent should there be adjustments to recognise that the most representative relevant time horizon for an investor is either the regulatory period or longer periods that are often advocated by regulated entities.

Wright et al note the following findings that are relevant to the impact on the variance of returns of predictability and a longer investment horizon:[49]

> "One issue that is frequently raised is whether the choice of time period can affect the estimate of *E(Rjt),* since arguably regulation should be framed in terms of fairly long periods. It turns out that the crucial issue is, as in many contexts, whether returns are predictable or not.
>
> However, as Campbell (2001b) and Robertson and Wright (2002) have pointed out, if there is predictability of returns, this can significantly lower long-horizon return variances, compared to the random returns benchmark.

[49] Wright, Mason and Miles 2003, pp . 25-27.

> . . .
>
> However, consistent with much evidence that there is greater predictability of returns at longer horizons, five and ten year return variances are significantly lower than they would be if returns were random.[50]
>
> The implication of these figures is that if they truly capture return predictability, the gap between the arithmetic mean return and the geometric return would fall to only around one percentage point over a five year horizon, and even less over a ten year horizon."

The CRG considers it is reasonable to take account of the extent to which the regulatory arrangements provide much greater predictability for the returns investors can expect for regulated entities as compared to the market as a whole. This effect could be captured in the equity beta rather than the market risk premium but it is not clear this has been done in the past and the CRG considers the perspectives presented here contribute to an understanding that the risk for the regulated entities is very low compared to the broader Australian market. The point is that the expected variance of the total return for the regulated entities should be much lower than for the expected variance of the Australian market as a whole and to the extent this is true it will mean a lower market risk premium for the forthcoming regulatory period.

4.2.5 Conclusion

Many of the key points presented above are summed up well by Damodaran:[51]

> "Many estimation services and academics argue for the arithmetic average as the best estimate of the equity risk premium. In fact, if annual returns are uncorrelated over time, and our objective was to estimate the risk premium for the next year, the arithmetic average is the best and most unbiased estimate of the premium. There are, however, strong arguments that can be made for the use of geometric averages. First, empirical studies seem to indicate that returns on stocks are negatively correlated[52] over time. Consequently, the arithmetic average return is likely to overstate the premium. Second, while asset pricing models may be single period models, the use of these models to get expected returns over long periods (such as five or ten years) suggests that the estimation period may be much longer than a year. In this context, the argument for geometric average premiums becomes stronger. Indro and Lee (1997) compare arithmetic and geometric premiums, find them both wanting, and argue for a weighted average, with the weight on the geometric premium increasing with the time horizon.[53]

[50] Dimson, Marsh and Staunton 2002 have also noted that arithmetic means will be less biased upwards, as the volatility of a series of five-year returns is likely to be typically lower than the volatility of a series of annual returns.

[51] Damodaran 2021, pp. 34-35.

[52] In other words, good years are more likely to be followed by poor years, and vice versa. The evidence on negative serial correlation in stock returns over time is extensive and can be found in Fama and French 1988. While they find that the one-year correlations are low, the five-year serial correlations are strongly negative for all size classes. Fama, E.F. and K.R. French, 1992, The Cross-Section of Expected Returns, Journal of Finance, Vol 47, 427-466.

[53] Indro, D.C. and W. Y. Lee, 1997, Biases in Arithmetic and Geometric Averages as Estimates of Long-run Expected Returns and Risk Premium, Financial Management, v26, 81-90.

> In closing, the averaging approach used clearly matters. Arithmetic averages will be yield higher risk premiums than geometric averages, but using these arithmetic average premiums to obtain discount rates, which are then compounded over time, seems internally inconsistent. In corporate finance and valuation, at least, the argument for using geometric average premiums as estimates is strong."

The CRG considers that. the material presented in this section provides strong support for recognising that geometric averages should be included when forming the best estimate of the market risk premium to apply over the regulatory period. It should be clear that it is not appropriate to rely solely on the arithmetic mean.

Furthermore the Wright et al report referred to by GGT provides support for the proposition that high return predictability would mean giving a much higher weight to the use of the geometric mean because with high return predictability the arithmetic mean would decline towards the geometric mean. The CRG considers this is highly relevant because it is reasonable to conclude that the regulatory arrangements provide very high assurance that the allowed return will in fact be realised over the regulatory period.

5 REFERENCES

AER (2021), Overall rate of return, equity and debt omnibus, Rate of return Final working Paper, December.

AER (2018), Rate of return instrument, Explanatory Statement, December.

AGIG (2022a), ERA approaches to beta, ERA focussed consultation session, power point presentation dated 26 April.

AGIG (2022b), ERA 2022 Rate of Return Instrument Discussion Paper, Submission.

ATCO (2022), Attachment 1: ATCO Submission 2022 Rate of Return Instrument Discussion Paper, Gas Division, 16 February.

Boyle , G., and K. Murray (2022), Estimation of the market risk premium and its relationship to the risk free rate in the context of regulation of electricity and gas energy networks: A report to the Australian Energy Regulator Consumer Reference Group, Sapere Research Group, February 25.

Brailsford, TJ, R. W. Faff, RW, & B. R. Oliver (1997), Research Design Issues in the Estimation of Beta, McGraw Hill.

Campbell, J., (2001b): “Why long horizons? A study of power against persistent alternatives,” Journal of Empirical Finance, 8, 459–491.

Competition Economists Group (2022), Use of foreign asset beta comparators, March.

CRG (2022), Submission on ERA 2022 Gas Rate of Return Instrument Review Discussion Paper of December 2021, 11 February.

Damodaran, A. (2021), Equity Risk Premiums (ERP): Determinants, Estimation, and Implications – The 2021 Edition Updated: March 23, Stern School of Business.

Damodaran, A (undated), *Estimating Risk Parameters*, Stern School of Business.

Dimson, E., P. Marsh and M. Staunton (2002), “Global evidence on the equity risk premium” Journal of Applied Corporate Finance.

ENA (2022a), Rate of Return Instrument Review: Response to AER’s Final Omnibus and Information Papers, 11 March.

ENA (2022b), Letter dated 16 February, Submission on WA Economic Regulation Authority Discussion Paper – 2022 Gas Rate of Return Instrument.

ENA (2021), Estimating the Cost of Equity: Response to AER’s Pathway to 2022 Rate of Return Instrument, Draft Equity Omnibus Working Paper, 3 September.

ERA (2022), Focussed consultation for the 2022 gas rate of return instrument review, Discussion Paper, 4 April.

ERA (2021), 2022 gas rate of return instrument review, Discussion Paper, December.

ERA (2016), Final Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline 2016 – 2020 Submitted by DBNGP (WA) Transmission Pty Limited Appendix 4 Rate of Return.

Fama, E.F. and K.R. French (1992), The Cross-Section of Expected Returns, Journal of Finance, Vol 47, 427-466.

Frontier Economics (2022), Estimating the MRP, ERA focussed consultation session, power point slides, 27 April.

Gilbert, T., C. Hrdlicka J. Kalodimos, and S. Siegel, (2014), 'Daily Data is Bad for Beta: Opacity and Frequency-Dependent Betas', Review of Asset Pricing Studies, vol. 4, no. 1, pp. 78–117.

Goldfields Gas Transmission (2022), Response to ERA Discussion Paper on 2022 Gas Rate of Return Instrument Review, 14 February.

Indro, D.C. and W. Y. Lee (1997), Biases in Arithmetic and Geometric Averages as Estimates of Long- run Expected Returns and Risk Premium, Financial Management, v26, 81-90.

Jacquier E., A. Kane and A.J. Marcus (2003), Geometric or Arithmetic Mean: A Reconsideration, Financial Analysts Journal, 59, pp.46- 53.

Lally, M., (2022), Expert Session 1: Further Notes, 14 February.

Lally, M., (2021), The Appropriate Term for the Allowed Cost of Capital, 9 April.

Lally, M. (2013), Review of the AER's Methodology for the Risk Free Rate and the Market Risk Premium, 4 March 2013, page 40.

Lally, M., (2013), The Dividend Growth Model.

Lally, M., (2012), The Cost of Equity and the Market Risk Premium, 25 July 2012, pp 31-2.

Mckenzie, M., and G. Partington (2013), The Dividend Growth Model, Report to the AER on behalf of the Securities Industry Research Centre of Asia Pacific (SIRCA) Limited, December 14.

Partington, G., and S. Satchell (2020), Report to the AER: Alternative Asset Pricing Models, 30 June.

Partington, G., and S. Satchell (2018), Report to the AER: Allowed Rate of Return 2018 Guideline Review, 25 May.

Patterson, C. (1995), The Cost of Capital: Theory and Estimation, Quorum Books.

Robertson, D., and S. Wright (2002): "The Good News and the Bad News about Long- Run Stock Returns," Mimeo.

South 32 (2022), Letter date 21 February, Submission to the ERA Discussion Paper on the gas rate of return instrument review.

Wright, S., R. Mason and D. Miles (2003), A Study into Certain Aspects of the Cost of Capital for Regulated Utilities in the U.K, on behalf of Smithers & Co Ltd, February 13.