25 September 2018

review of the rate of return guidelines

APA submission responding to AER draft guidelines

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Contents

Attachments

Frontier Economics, *Low-beta bias and the Black CAPM: Report prepared for AGIG and APA Group*, September 2018.

APA's key messages

Credit rating, benchmarking and the rate of return

The credit rating assessment which supports the proposal that the rate of return on debt should be for an issuer rated BBB+ is not as robust as it appears.

The proposed rate of return settings, in particular the benchmark credit rating of BBB+, and the benchmark gearing of 60%, appear to be inconsistent. If a gearing of 60% is assumed, the other rate of return settings lead to funds from operations to debt (FFO/debt) ratios which are more aligned with credit ratings of BBB or below.

If a benchmark credit rating is to be adopted for all regulated service providers, and a benchmark gearing of 60% is to be retained, the benchmark credit rating should be no higher than BBB. The benchmark credit rating should be implemented, as in the past, using the broad BBB yield curve data.

Inconsistent assumptions about credit rating and gearing, together with the lowering of equity returns (through lower estimates of the equity beta and the market risk premium), are leading to cash flows from regulated service provision which do not allow standard credit metrics to be achieved. This may lead to downgrading, to refinancing issues, and to higher financing costs, which must, in the long term, be borne by energy consumers.

Risk free rate of return

Although they are not always the government securities on issue with the longest terms to maturity, there is a well-developed market in nominal CGS with terms to maturity of 10 years. The yields on these securities can provide a reasonable estimate of an Australian risk free rate.

Reasons which have been advanced for estimation of risk free rate from yields on CGS with shorter terms to maturity are ***not*** *consistent with the intended use of the SL CAPM.*

Equity beta

Persistent and robust evidence, now supported by work from Frontier Economics which uses Australian returns expectations data, continue to demonstrate the existence of low beta bias. A pragmatic response, when using the SL CAPM to estimate the equity returns to service providers with measured betas below one, is to choose a beta estimate at the upper end of the statistical range.

If the use of a single beta estimate for electricity network and gas pipeline service providers were to continue to be seen as appropriate then, after having established an empirical range of 0.8, with clustering around 0.6, consideration should be given the *effect of low beta bias. A beta estimate of 0.6 is too low; the estimate of 0.7 which was adopted in 2013 should be retained.*

Econometric analysis, by consultant economists, HoustonKemp provides quantitative evidence for an equity beta estimate for a gas pipeline service provider of at least 0.7. That estimate has been obtained using data for the set of comparators which the AER has used for beta estimation, and using the same estimation methods.

Market risk premium

Estimation of the market risk premium (MRP) should be reconsidered.

Before consideration can be given to the evidence from historical excess returns, an answer must be provided to the question of how that evidence is to be used in estimating the MRP of the SL CAPM. The MRP is not a realised excess return but a forward-looking expectation. The question of how historical excess returns might be used in estimating that forward-looking MRP has not been answered. Indeed, it has not been asked, either in the current guidelines review, in the concurrent expert evidence sessions, or earlier, in 2013.

Even if historical excess returns can be taken to directly estimate the MRP, the evidence does not support the assertion of 6.0%. It supports 6.5%.

Rejection of the use of dividend growth models for MRP estimation, on the grounds that expert advice raises significant concerns about the use of those models, is methodologically unsound when no assessment is made of the alternative (estimation from historical excess returns).

Dividend growth model estimates, the experts at the second concurrent evidence session agreed, must be given material weight. Dividend growth model estimates are the only estimates we have of the forward looking excess return on the market required for application of the SL CAPM.

The AER's dividend growth model estimates point to an MRP estimate of 6.5% as being at the low end of the range of possible values.

In the absence of well-defined relationships between the MRP of the SL CAPM and observed values of certain conditioning variable, such as equity market volatility, and between the MRP and historical debt risk premiums, that volatility and those debt risk premiums neither support an MRP estimate of 6.0%, nor support a change in the estimate from 6.5% to 6.0%.

The evidence adduced by the AER does not support an MRP estimate of 6.0%. The estimate of the MRP which should now be used when applying the SL CAPM is, at minimum, 6.5%, and may be higher if greater weight is given to the results obtained from the AER's own dividend growth models.

Value of imputation credits (gamma)

Little clear evidence supports an increase in gamma from the estimate of 0.4 which the AER has used in its recent regulatory decisions.

Franking credit data from the 20 largest companies does not provide direct evidence for the distribution rate of a benchmark for regulated pipeline service providers. None of the service providers is, in its own right, a very large company with material foreign earnings. Scale of operation, not risk, is likely to be an important factor here, but scale has not been systematically investigated.

ATO concerns about the quality of its franking account balance data do not seem to extend to other taxation statistics. ATO data on franking credits created, and on franking credits redeemed, can be considered as providing a reliable estimate of the utilisation rate. Taxation statistics can provide an estimate of the utilisation rate, and should be used for that purpose.

ABS reservations about the quality of its equity ownership statistics, set out in the explanatory notes accompanying those statistics, draws into question the AER's placing significant reliance on the equity ownership method of estimating the utilisation rate.

1 This submission

APA Group (APA) appreciates the opportunity, now provided by the Australian Energy Regulator (AER), to comment on draft rate of return guidelines (Draft Guidelines) and an associated explanatory statement (Draft Explanatory Statement) issued on 10 July 2018.[1]

The Draft Guidelines, APA understands, are an important step to final guidelines which are to be the basis for the binding rate of return instrument to be used in making energy sector regulatory decisions during the next four years.

APA has participated in the preparation of the submission on the Draft Guidelines made by the Australian Pipeline and Gas Association (APGA). APA's views in this submission are not substantially different from those advanced by the APGA.

APA has little to add to its response to the AER's May 2018 discussion paper on estimating the allowed rate of return on debt. In responding to that discussion paper, we supported continuation of the AER's current approach to the rate of return on debt, thereby allowing service providers and users to gain experience with both the method of estimation and the transition to the trailing average estimate of that rate of return.

We continue to be of the view that the benchmark term for debt should be 10 years. Gas transmission pipelines have long technical lives. Industry practice, long established, is the financing of these long-lived assets with long term debt.

Our submission has three principal sections.

Credit rating, benchmarking and the rate of return (section 2)

We are concerned about the AER's proposals for a BBB+ benchmark credit rating, 60% gearing, and the overall rate of return settings. These are likely to have important and adverse implications for service provider for cash flows.

We discuss the issues in section 2.

Estimating allowed equity returns (section 3)

If implemented, the Draft Guideline will "lock in", during the next four years, a risk premium on equity which is lower than the premium generally allowed to regulated service providers under the AER's current Rate of Return Guideline.

1 Australian Energy Regulator, *Draft Rate of return guidelines*, July 2018. Australian Energy Regulator, *Draft Rate of return Guidelines Explanatory Statement*, July 2018.

The lower equity risk premium is a product of two factors: a lower equity beta, and a lower market risk premium. The lower equity beta is not consistent with the systematic risk of a benchmark efficient transmission pipeline operation. The lower market risk premium is not supported by the AER's evidence from historical excess returns and the interpretation of that evidence.

A beta which cannot lead to estimates of efficient equity returns, and an MRP not supported by evidence and reasoning, are serious defects. A rate of return on equity determined from estimates with these defects cannot contribute to achievement of the national gas objective.

A lower equity risk premium, and lower equity returns, are, APA believes, a threat to future investment in the pipeline sector.

Return on equity estimation is discussed in section 3.

Value of imputation credits (section 4)

In section 4, APA explains why there is insufficient evidence to support an increase in gamma – the value to be attributed to imputation credits – from the AER's current estimate of 0.4.

2 Credit rating, benchmarking and the rate of return

The Draft Explanatory Statement advises that the AER has reviewed the historical credit ratings of service providers and, from the results of that review, is proposing to adopt a benchmark credit rating of BBB+.[2]

This was the benchmark credit rating of the December 2013 Rate of Return Guideline.

The proposed use of a BBB+ benchmark is of concern for APA. As Table 42 of the Draft Explanatory Statement shows, APT Pipelines Ltd, the rated issuer within the APA group of companies, is currently rated BBB, and has been rated BBB since it was first rated in June 2009.

APA might aspire to the BBB+ benchmark but, to achieve the higher rating, it would, among other things, need to lower its gearing. APA cannot aspire to the benchmark BBB+ credit rating, and to the lower cost of debt consistent with that credit rating, without lowering its gearing well below the 60% benchmark of the Draft Guidelines.

The benchmark credit rating and the benchmark gearing appear, to APA, to be inconsistent.

2.1 Elevated credit ratings

The inconsistency between the benchmark credit rating and the benchmark gearing seems to arise, in part, from the elevated credit ratings assigned to a number of the electricity network and gas pipeline service providers listed in Table 42. The credit ratings in Table 42 are elevated by reference to the financial strength and support of parent entities. In consequence, the median credit rating from Table 42 overstates the credit rating of an entity, such as APA, which cannot benefit from the strength and support of a large international parent.

ATCO Gas Australia, for example, is shown in Table 42 as currently being rated BBB+, and as having been rated A- between 2013 and 2016.

ATCO Gas Australia operates a relatively small gas distribution system in the South West of Western Australia. Although it has regulated cash flows, and a stable earnings profile, its market is small in terms of gas volumes delivered, numbers of end users, and revenues from gas transportation service.

In its rating advice for ATCO Gas Australia, Standard & Poor's advise that the current credit rating of BBB+ incorporates a "one notch" uplift reflecting the Australian company's position as a member of the ATCO Group of companies.

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2 Draft Explanatory Statement, page 341.

In 2016, ATCO Gas Australia's parent within the ATCO Group, Canadian Utilities Ltd, was rated A, and ATCO Gas Australia was rated A-. When, in 2017, ratings agencies revised their long term credit ratings for the rated entities within the ATCO Group, and Standard & Poors revised its rating of Canadian Utilities Ltd to A-, ATCO Gas Australia was rated one notch lower at BBB+.[3]

The credit ratings for ATCO Gas Australia shown in Table 42 of the Draft Explanatory Statement are elevated one notch for the financial strength and support of its parent.

ATCO Gas Australia is not the only entity shown in Table 42 which has a credit rating elevated by one notch, or more, for the financial strength and support of a parent. The others are:

- DBNGP Trust (from 2017)
- DBNGP Finance Co P/L (from 2017)
- Energy Partnership Gas P/L (from 2017)
- Powercor Australia LLC (when it was rated)
- SP AusNet Services
- AusNet Service Holdings P/L
- AusNet Transmission Group P/L
- SGSP (Australia) Assets P/L
- The CitiPower Trust (when it was rated)
- Network Finance Company P/L.

When reviewing the credit ratings in Table 42, we have also noted some "double counting". DBNGP Trust, for example, is shown as being rated BBB (earlier BBB-) because its financing business, DBNGP Finance Co., is rated BBB (earlier BBB-). Similarly, ETSA Utilities has been rated A- because its financing business, ETSA Utilities Finance P/L, has been rated A-. SP AusNet, AusNet Services and AusNet Services Transmission Group P/L are, or have been, rated A- because the financing business within the AusNet group, AusNet Service Holdings P/L is, or has been, rated A-.

We have reduced, by one notch, the credit ratings of those entities shown in Table 42 which have elevated ratings reflecting the financial strength and support of a parent, and we have removed from the assessment the entities which are "double counts". The median credit rating for 2013 to 2018 remains BBB+, but the average is revealing.

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3 ATCO Limited 2017 Annual Report, page 83.

Before removal of the parent entity effects, and of the double counting, the average credit rating was BBB for 2013 to 2015, and BBB+ for 2016 to 2018. After their removal, the average credit rating for the period 2013 to 2018 is BBB.

The credit rating assessment which supports the AER's view that the rate of return on debt should be for an issuer rated BBB+ is not as robust as it appears.

2.2 Credit rating, gearing and FFO/debt ratio

The assessment of credit ratings in the Draft Explanatory Statement, and the assessment of gearing (Draft Explanatory Statement, chapter 4), align the benchmark rating of BBB+ with a benchmark gearing of 60%.

APA understands that, when credit rating is assessed, the rating agency pays close attention to the ratio of funds from operations to debt (FFO/debt ratio): a FFO/debt ratio of 8.0% or more is required to achieve a BBB+ rating.

When we look at the AER's November 2017 final decision on proposed revisions to the access arrangement for the Roma to Brisbane Pipeline, we find that the smoothed revenue stream from the Post Tax Revenue Model (PTRM) delivers FFO/debt ratios less than 8.0% in each year of the access arrangement period (2017-18 to 2021-22). In three of the five years of that period, the ratio is above 6.0% (but less than 8.0%); in the remaining two years it is below 6.0%.

If the rate of return settings of the Draft Guidelines are used in place of the settings allowed by the AER in November 2017, the smoothed cash flows from the PTRM continue to deliver a FFO/debt ratio less than 8.0% in each year of the access arrangement period, and the FFO/debt ratio is below 6.0% in all but one year.

The AER's rate of return settings, in particular its assumptions of a benchmark credit rating of BBB+, and a benchmark gearing of 60%, seem, to APA, to be inconsistent. If a gearing of 60% is assumed, the other rate of return settings lead to FFO/debt ratios which are more aligned with a rating of BBB or below.

2.3 Benchmarking and the rate of return

The AER's estimation of the rate of return proceeds from the view that, under the scheme of incentive regulation in the National Gas Law and the National Gas Rules (NGR), the allowed rate of return should be that of an efficient benchmark, and not the rate of return specific to the service provider. Guidance is provided by rule 87 of the NGR, and the Draft Explanatory Statement is clear on what is required:

- in setting the allowed return, the AER provides compensation using a benchmark credit rating for a benchmark efficient entity with a similar degree of risk as that which applies to the service provider in respect of providing regulated services

- the Australian market is the market within which a benchmark efficient entity for each service provider is assumed to operate; this permits a proper comparison of risk: the location of a business determines the conditions under which the business operates including the regulatory regime, tax laws, industry structure and broader economic environment – as most of these conditions will be different from those prevailing for overseas entities, the risk profile of overseas entities is likely to differ from those within Australia, and returns required are also likely to differ.[4]

The AER's proposed benchmark credit rating of BBB+ is not a benchmark for a regulated service provider which operates in the Australian market. It is not a rating consistent with the benchmark having a degree of risk similar to that which applies to a service provider in respect of its providing regulated services.

APA might aspire to the BBB+ benchmark but, to achieve the higher rating, it would, among other things, need to lower its gearing. Table 14 of the Draft Explanatory Statement shows gearing for APA based on market values: the average gearing over the last five years was 48%; for the last 10 years the average was 54%. APA cannot aspire to the benchmark credit rating, and to the lower cost of debt consistent with that credit rating, without lowering its gearing well below the 60% benchmark of the Draft Guidelines.

Rated BBB, APA could work with rates of return on debt which were determined from the yields of corporate issuers with ratings in the broad BBB range, which includes issuers rated BBB-, as well as issuers rated BBB+. APA could also work with allowed equity returns which reflected a gearing of 60%. But APA cannot aspire to a rating of BBB+. The idea of benchmarking is not only the identification of best practice. It is also the replication of that practice by businesses which have not previously achieved the benchmark.[5] A benchmark which cannot be attained and copied is no stimulus to efficiency: it is not a benchmark in any meaningful sense.

In APA's view, if a benchmark credit rating is to be adopted for all regulated service providers, and a benchmark gearing of 60% is to be retained, the benchmark credit rating should be no higher than BBB. The benchmark credit rating should be implemented, as in the past, using the broad BBB yield curve data.

APA is concerned that inconsistent assumptions about credit rating and gearing, together with the lowering of equity returns (through lower estimates of the equity beta and the market risk premium), are leading to cash flows from regulated service provision which do not meet key credit rating and financier cash flow thresholds (FFO/debt). This may lead to the downgrading of some regulated service providers,

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4 Draft Explanatory Statement, page 92.

5 Thijs ten Raa (2009). *The Economics of Benchmarking*. Palgrave Macmillan: page xiv.

to future refinancing issues, and to higher financing costs which must, in the long term, be borne by energy consumers.

3 Estimating allowed equity returns

Clause 4 of the Draft Guidelines requires that the allowed rate of return on equity, k^e, be calculated using the formula

$k^e = k^f + \beta \times MRP$,

where:

- k^f is the risk free rate of return
- β is the equity beta, which is to be set to a value of 0.6
- MRP is the market risk premium, which is to be set to a value of 6.0%.

Clause 4 follows from advice in the Draft Explanatory Statement that the AER will continue to use its foundation model approach, with the Sharpe-Lintner Capital Asset Pricing Model (SL CAPM) as the foundation model.

This section of the submission comprises three subsections.

Risk free rate of return (section 3.1)

Estimation of the risk free rate of return, in the way the AER proposes in the Draft Guidelines, from daily yields on Commonwealth Government Securities (CGS) with terms to maturity of 10 years, provides the estimate required for application of the SL CAPM.

Reasons which have been advanced for estimation of the risk free rate from yields on CGS with shorter terms to maturity are not consistent with the intended use of the foundation model.

We explain why in section 3.1.

Equity beta (section 3.2)

The equity beta proposed in the Draft Guidelines will not lead to estimates of the equity returns of efficiently financed gas pipelines. This seems to APA to be clear from the data which the AER has used for beta estimation. However, we have commissioned econometric analysis from consultant economists, HoustonKemp, to provide a specific pipeline beta estimate. This work, which supports a gas pipeline beta higher than 0.6, is discussed in section 3.2 of the submission.

Market risk premium (section 3.3)

Estimation of the MRP should be reconsidered. Historical excess returns continue to support an estimate of 6.5%, and the estimate would be higher if appropriate weight were to be given to dividend growth model estimates. We discuss the issues in section 3.3.

An MRP estimate which is too low, and an estimate of beta which is below that for an efficiently financed gas pipeline, cannot lead to estimates of efficient equity returns. A rate of return on equity, calculated using the estimates of the MRP and beta proposed in the Draft Guidelines, cannot contribute to achievement of the national gas objective.

3.1 Risk free rate of return

Use of the SL CAPM to estimate risky equity returns requires an estimate of the rate of return on a riskless asset.

The risk free rate of return, the Draft Guidelines advise, is to be estimated from the daily yields on Commonwealth Government Securities (CGS) with terms to maturity of 10 years.[6]

Some have proposed that CGS with shorter terms to maturity, in particular, securities with terms of 5 years, should be used to estimate the risk free rate. They argue that:

- the return on equity is being estimated, and set, for a period of five years – the regulatory period – and the risk free rate should reflect this
- beta and the MRP measure share price volatility over short periods but are estimated by averaging over much longer periods
- investors reassess their portfolios more frequently than at intervals of 10 years.[7]

That the return on equity is being estimated and set for a period of five years (the regulatory period) is not relevant to estimation of the risk free rate. Nor are the views that beta and the MRP measure share price volatility over short periods, but are estimated by averaging over much longer periods. In all likelihood, investors reassess their portfolios as they receive new information about the state of the economy, and more frequently than at intervals of 10 years. But that does not change the nature of the riskless asset, or the way in which the return on that asset might be estimated from the returns on traded assets.

In the next section of this submission, we consider what the use of the SL CAPM implies for risk free rate estimation. In the section which follows, we explain why the estimate of the risk free rate should be made from yields on government securities with long terms to maturity.

6 Draft Guidelines, clauses 5, 6 and 22.

7 Draft Explanatory Statement, page 196.

3.1.1 *What does use of the SL CAPM imply for risk free rate estimation?*

The SL CAPM describes the rate of return on a particular asset, but the model itself is derived from consideration of an equilibrium in the market for all assets. When used as the AER's foundation model, the SL CAPM is used to estimate the rate of return on equity for a regulated electricity network or gas pipeline service provider. The rate of return on equity estimated using the model is for a service provider but, because it is estimated using the SL CAPM, that rate is established by reference to the market for assets as a whole. The riskless asset, and estimation of the risk free rate for application of the SL CAPM, must be seen in this context of the market for all assets. The specific circumstances of the regulated electricity network or gas pipeline service provider for which a rate of return on equity is being estimated, including the regulatory period, have no relevance to the question of what is the riskless asset, or to estimation of the risk free rate of return.

The usual starting point for derivation of the SL CAPM is optimal portfolio theory. The SL CAPM follows from portfolio theory, augmented by assumptions that:

- portfolio theory guides the investment decisions of all investors
- in equilibrium, the market for assets clears; there are sellers and buyers for all of the available assets.

Portfolio theory, and the derivation of the SL CAPM, can be found in any of the standard textbooks on financial economics.[8] They are briefly outlined in the following paragraphs to make clear the focus on all assets, and on all investors. The SL CAPM is not derived from considerations about a particular financial asset (the equity of a regulated service provider). The focus, in model derivation, is the market for all assets, assuming portfolio theory guides the investment decisions of all investors, and assuming market equilibrium. Once the conditions for asset market equilibrium are understood, it is a relatively simple matter of the mechanics of portfolio theory to show that, in equilibrium, there is a linear restriction on portfolio expected returns, including the expected return on a portfolio comprising a single financial asset. This linear restriction is the SL CAPM.

Derivation of the SL CAPM proceeds as follows.

At a point in time (time 0), an investor makes a decision to consume from his or her wealth, and to invest the remainder of that wealth in assets. One period later (at time

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8 See, for example, John Y Campbell (2018), *Financial Decisions and Markets*, Princeton: Princeton University Press; Chi-fu Huang and Robert H Litzenberger (1988), *Foundations for Financial Economics*, New York: Elsevier; and Jonathan E Ingersoll (1987), *Theory of Financial Decision Making*, Savage, Maryland: Rowman and Littlefield.

1), the investor sells those assets to buy goods and services.[9] That is, at time 0, the investor makes a decision to form a portfolio of assets for the purpose of transferring wealth to time 1 to finance future consumption.

A large (but finite) number of risky assets is assumed to be available to the investor at time 0. Each of these assets provides the investor with a payoff, at time 1, from the cash flows generated by the asset. Different circumstances over which the investor has no control (different states), are possible during the period of the investment (between time 0 and time 1), and lead to different possible payoffs on each asset. The payoffs, then, are not known to the investor at time 0. They are stochastic at that time. Provided each asset has a non-zero price at time 0, the rates of return which the investor can earn on the assets are also stochastic.

A key assumption, which we further examine in our discussion of the MRP, is that the investor is able to form a belief about the joint distribution of the rates of return on the risky assets at time 1, including beliefs about the means, variances and covariances of those returns.

A riskless asset is also assumed to be available at time 0. Because that asset is risk free, the payoff which it provides to an investor at time 1 is known with certainty at time 0. This riskless asset has no particular relationship with any of the risky assets, including the equity of any regulated service provider, available to the investor.

The assumption that portfolio theory guides the investment decision of an individual investor implies that the set of portfolios from which the investor will choose is restricted to those portfolios which are linear combinations of the riskless asset, and a portfolio, sometimes called the tangency portfolio, on the frontier of the set of all minimum variance portfolios formed from all of the available risky assets. The frontier of the set of minimum variance portfolios is a hyperbola in the space of standard deviations and expected returns. It has two "branches", an upper branch with higher expected rates of return, and a lower branch with lower expected rates of return. Only the upper branch is relevant: given the same standard deviation of return (risk), an investor can be expected to always choose the portfolio with the highest expected return. The set of portfolios of risky assets from which the investor will choose is restricted to those portfolios which are linear combinations of the riskless asset, and the tangency portfolio on the upper branch of the set of minimum variance portfolios of risky assets. This particular set of linear combinations is often called the efficient frontier.

[9] In a multi-period setting, the investor would also buy financial assets for the next period. The Sharpe-Lintner CAPM is, however, a single period asset pricing model. Most recent asset pricing research uses a multi-period or continuous time setting for the purpose of overcoming the inherent limitations of a single period model.

An investor will choose the linear combination of the riskless asset and the tangency portfolio on the efficient frontier which maximises his or her utility defined over expected return and standard deviation (risk).

Asset market equilibrium requires that the market for assets clears. The market for assets will be in equilibrium if all investors are able to achieve, through the selling and buying of assets at time 0, their preferred portfolios – combinations of the riskless asset and the tangency portfolio – for the transfer of wealth to time 1.

From the "mechanics" of portfolio theory, we know that the expected rate of return on any portfolio p (not necessarily a portfolio on the efficient frontier) is related to expected rate of return on the risk free asset and a portfolio, e, on the efficient frontier via the relationship

$$E(r_p) = r_f + \beta_{pe}[E(r_e) - r_f]$$

where $E(r_e)$ is the expected rate of return on the portfolio on the efficient frontier, and β_{pe} is the ratio of covariance between the rates of return on portfolio p and portfolio e to the variance of the rate of return on portfolio e ($\beta_{pe} = cov(r_p, r_e)/var(r_e)$).[10]

Since each investor chooses a portfolio which is on the efficient frontier, the market portfolio, the portfolio formed by aggregating over all investors, is a linear combination of portfolios on the efficient frontier and must, itself, be on the efficient frontier. If $E(r_M)$ is the expected rate of return on the market portfolio, the relationship described in the preceding paragraph implies:

$$E(r_p) = r_f + \beta_{pM}[E(r_M) - r_f]$$

where $\beta_{pM} = cov(r_p, r_M)/var(r_M)$.

This is the SL CAPM.

Since p is any portfolio, it may be a portfolio comprising just a single financial asset (call that asset i), in which case:

$$E(r_i) = r_f + \beta_{iM}[E(r_M) - r_f]$$

This is the AER's foundation model, to be applied in the particular case of i being the equity of a regulated electricity network or gas pipeline service provider.

In the context of the SL CAPM, r_f is the rate of return on the riskless asset available to all investors. The riskless asset, and its rate of return, are unrelated to the risky assets available to investors. In particular, the riskless asset and its rate of return, are

10 See Chi-fu Huang and Robert H Litzenberger (1988), *Foundations for Financial Economics*, New York: Elsevier, page 80.

unrelated to any individual financial asset for which the rate of return is to be estimated using the SL CAPM.

Asset i may be the equity of a regulated electricity network or gas pipeline service provider, but r_f is unrelated to the regulatory period. It is also unrelated to the way in which β_{iM} and the MRP (= $E(r_M) - r_f$) might, in practice, be estimated for the regulated service provider.

What traded asset might have the characteristics of the riskless asset of the SL CAPM? This question is not easily answered. It is certainly not answered by reference to the circumstances of one particular risky asset (the equity of a regulated service provider which faces a regulatory period of five years). Nor is it answered by reference to the way in which the other parameters of the SL CAPM might be estimated. The issue is not statistical; it is primarily conceptual. It is considered in the next section of this submission.

3.1.2 What traded asset might have the characteristics of the riskless asset?

We noted above, in discussing the derivation of the SL CAPM, that the risk free rate is the rate of return on an asset which delivers the same rate of return in different "states of the world", including states at different times.

But what does this mean?

The identity of the riskless asset is, according to financial economists John Campbell and Luis Viceira, a fundamental issue in finance.[11]

Campbell and Viceira note that government securities with short terms to maturity have been used to estimate the risk free rate.[12] But such securities, they argue, are not riskless; although they have known returns over short periods, their capital values are uncertain over longer periods. Over any extended period, the rolling over of short term securities leads to uncertain – risky – returns because maturing securities must be reinvested at unknown future interest rates.

The riskless asset might be an asset which delivers the same rate of return in different states, including states at different times. However, from the perspective of an investor concerned with maintaining future consumption (in the context of the SL CAPM, concerned with maintaining future living standards by transferring wealth from time 0 to time 1 to finance future consumption), the riskless asset will be an asset which provides investors with returns which can finance a riskless consumption stream over

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11 John Y Campbell and Luis M Viceira (2002), *Strategic Asset Allocation*, Oxford: Clarendon, page 58.

12 Ibid., chapter 3.

the long term. As Campbell and Viceira argue, the ideal riskless asset is an indexed-linked perpetuity – an asset which pays one unit of real consumption forever. Although the price of an indexed-linked perpetuity may vary, its returns finance a riskless consumption stream over the long term.

Campbell and Viceira recognise that indexed-linked perpetuities are not readily found among the assets traded in financial markets. In place of indexed linked-perpetuities, consideration must be given to indexed-linked government securities with long terms to maturity: these have payments fixed in real terms, and are potentially low risk for investors concerned with maintaining future consumption (future living standards).

But indexed-linked government securities with long terms to maturity may not always be extensively traded, and may have liquidity risk. Provided inflation is low, more widely traded nominal government bonds behave much like indexed-linked bonds, and can be reasonable substituted for indexed-linked securities with long terms to maturity.

Although they are not always the government securities on issue with the longest terms to maturity, there is a well-developed market in nominal CGS with terms to maturity of 10 years. For the reasons set out in the preceding paragraphs, the yields on these securities can provide a reasonable estimate of an Australian risk free rate.

This is the proposal of the AER's Draft Guidelines, with which we concur. The reasons which have been advanced for estimation of risk free rate from yields on CGS with shorter terms to maturity are not consistent with the intended use of the SL CAPM.

3.2 Equity beta

Clause 4 of the Draft Guidelines requires that the equity beta of the SL CAPM be set at 0.6.

This point estimate for beta, the Draft Explanatory Statement advises, is towards the middle of the AER's range, and reflects the information currently available.[13] Updated analysis, the Statement explains, supports an empirical range of 0.4 to 0.8, with clustering in the range 0.5 to 0.6: the average of weekly re-levered ordinary least squares (OLS) estimates across all periods is 0.57.[14]

When estimating the equity beta for its 2013 Rate of Return Guideline, the AER drew on the theory of Black's Capital Asset Pricing Model to justify selection of a beta at the upper end of the empirical range. This, the AER now advises, was to account for

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13 Draft Explanatory Statement, page 242.

14 Draft Explanatory Statement, page 243.

potential market imperfections. It was not to address the issue of "low beta bias". No weight was previously given to low beta bias, and the AER's (draft) decision is to continue to give it no weight.[15]

Irrespective of whether or not weight was previously given to the issue, "low beta bias", remains a problem when estimating equity returns using the SL CAPM. We explain why in section 3.2.1 below, and conclude that choosing a beta estimate at the upper end of the statistical range continues to be a pragmatic response to that problem.

Consideration was given, the Draft Explanatory Statement advises, to whether different beta estimates should be used for gas pipeline and electricity network service providers. However, the AER concluded that systematic risks between electricity network and gas pipeline service providers were sufficiently similar to warrant a common equity beta.[16]

The AER's conclusion of similarity was based on a qualitative assessment of what were seen as being the systematic risks to which electricity network and gas pipeline service providers were exposed. Qualitative assessment may assist in broadly concluding that electricity network and gas pipeline service providers have systematic risks less than the systematic risk of the market portfolio, but it lacks the precision required to assess whether there is a difference between the betas for those service providers. Quantitative analysis, which we have commissioned from HoustonKemp, supports a different view: gas pipelines should have a higher beta than electricity networks. We discuss the issue in section 3.2.2.

3.2.1 Low beta bias and the Black CAPM

Since the early 1970s, financial economists have observed that, for financial assets with beta estimates less than (greater than) one, equity returns estimated using the SL CAPM are lower (higher) than the actual returns. This observation is referred to as "low beta bias", although it is not an observation about beta estimates themselves being biased.

In 1972, Fischer Black published an alternative to the SL CAPM – the Black CAPM – as a means of explaining earlier observations of low beta bias.[17] The Black CAPM is, like the SL CAPM, derived from optimal portfolio theory, but without the assumption of a riskless asset, and without the assumption of unrestricted borrowing and lending at the rate of return on the riskless asset. For an asset with a beta less than one, the expected

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15 Draft Explanatory Statement, page 278.

16 Draft Explanatory Statement, page 244.

17 Fischer Black (1972), "Capital Market Equilibrium with Restricted Borrowing", Journal of Business, 45(3): pages 444-455.

return predicted by the Black CAPM will be higher than the expected return predicted by the SL CAPM. For an asset with a beta greater than one, the expected return predicted by the Black CAPM will be higher than the expected return predicted by the SL CAPM.

The Black CAPM, the AER contends, has been advanced, in Australian regulatory debate, to support the upwards adjustment of rates of return estimated using the SL CAPM to recognise the market imperfections reflected in the assumptions about investor borrowing and lending made by Black. In view of the implausibility of these assumptions, the AER concludes that such adjustments are now unwarranted. [18]

The Black CAPM is a proposition about expected rates of return; it is not a proposition about actual rates of return. Setting aside issues of the plausibility of the assumptions made for derivation of the model, and the difficulties associated with estimation of its parameters, there is a question of whether direct comparisons can be made between the expected rates of return predicted by the Black CAPM and actual rates of return.

The SL CAPM is, like the Black CAPM, a proposition about expected rates of return, and the same question about the comparability of rates of return predicted by the model and actual rates of return can be asked.

Low beta bias may be a consequence of the SL CAPM correctly estimating expected returns, but these estimates of expected returns are then being compared against – different – actual returns. If this is the case, then, as the AER concludes, there is no case for adjusting rates of return estimated using the SL CAPM for the implications of the Black CAPM, or for low beta bias.

Nevertheless, there remains a long history of observations that actual returns from low beta assets tend to be higher than the expected returns predicted by the SL CAPM. This was accepted by the AER's panel of experts, although the experts held differing views about its implications.

Most experts agreed that:

- the evidence for low beta bias had been produced by leading finance researchers and is so well-accepted that it appears in all standard finance textbooks

[18] Derivation of the Black CAPM may require a number of implausible assumptions. But derivation of the SL CAPM also requires assumptions (different from those required for the Black CAPM) which are similarly implausible. Perhaps, like beauty, plausibility is in the eye of the beholder.

- the evidence was consistent over decades, and across national markets; the empirical evidence in relation to low-beta stocks had not weakened since the 2013 Rate of Return Guideline
- the evidence likely reflects the actual returns required by investors; it is consistent over time and across markets; and it has been the result of work by leading researchers; it appears in all textbooks: the possibility that low beta bias is due to a previously unknown methodological error, or due to chance, is remote.[19]

3.2.1.1 *Testing asset pricing models may be difficult, but is not a reason for rejecting low beta bias*

The Draft Explanatory Statement advises that the AER makes no adjustment to its equity beta estimate for low beta bias.[20] Reviewed academic papers and consultant reports, the Statement notes, generally refer to empirical tests of asset pricing performance to test for the bias. The AER has consistently noted a range of issues with these tests (the results can depend on test design and may indicate more about shocks to expected returns (volatility)), which cast doubt on this source of material and its suitability for informing the required return on equity.[21]

The testing of asset pricing models is difficult and the subject of ongoing debate, and the observation of low beta bias has been made (and is still made) in academic papers which report model testing. However, low beta bias is not, fundamentally, an issue which arises from the testing of asset pricing models. The persistent observation of low beta bias – that, for financial assets with beta estimates less than (greater than) one, expected rates of return estimated using the SL CAPM are lower (higher) than the actual rates of return – is a matter of simple empirics: comparison of actual returns with the returns predicted by the SL CAPM.

The difficulty of testing asset pricing models was not a valid reason for giving low beta bias no weight in the AER's assessment of equity returns in 2013. It is not now a valid reason for giving low beta bias no weight.

3.2.1.2 *Low beta bias is observed when the SL CAPM predictions are compared with returns expectations*

If low beta bias is unlikely to be explained by previously unknown methodological error, or by chance, then it may be a consequence of the SL CAPM correctly estimating expected returns, which are then being compared against – different – actual returns.

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19 Cambridge Economic Policy Associates, *Expert Joint Report*, 21 April 2018, pages 52-53.

20 Draft Explanatory Statement, page 275.

21 Draft Explanatory Statement, pages 277 and 279.

Financial economists Alon Brav, Reuven Lehavy and Roni Michaely have explicitly recognised this problem, and have sought to test a number of asset pricing models, including the SL CAPM, using returns expectations data rather than using actual returns.[22]

In the case of the SL CAPM, they find that a linear model fitted to expected returns data has a positive and significant intercept: for low beta stocks, observed return expectations are higher than the expected returns predicted by the SL CAPM. Low beta bias does not seem to be a consequence of the SL CAPM correctly estimating expected returns which are then being compared against – different – actual returns.

APA and Australian Gas Infrastructure Group have asked Frontier Economics to replicate the study by Brav, Lehavy and Michaely using Australian data.

As observed return expectations, Frontier Economics has used use forecasts from the I/B/E/S analyst forecast database. These analysts' forecasts are comparable to the First Call data used by Brav Lehavy and Michaely. The Frontier Economics sample covers the period March 2002 through to August 2017. All of the data were collected via Thomson Reuters Datastream.

Frontier Economics has advised that analyst coverage increases significantly over the sample period, with 100 sample firms in March 2002 and 316 firms in August 2017: in total, 1,199 firms over a period of 15 years.

Frontier Economics followed the Brav, Lehavy and Michaely methodology, using the following cross-sectional regression specification, which was applied each month over the sample period:

$$(\hat{r}_e - r_f)_t = a + \delta\widehat{\beta}_t + \epsilon_t$$

where:

- $(\hat{r}_e - r_f)_t$ represents the analysts' expected excess return estimated at time t; and
- $\widehat{\beta}_t$ represents the estimate of the firm's beta at time t.

Under the SL-CAPM, the regression intercept, a, would be zero, and the slope coefficient δ would be equal to the market risk premium.

The Frontier Economics regression results, for both individual firms and for portfolios, are summarised in Table 1 below.

22 Alon Brav, Reuven Lehavy and Roni Michaely (2005), "Using Expectations to Test Asset Pricing Models", Financial Management, Autumn: pages 5 – 37.

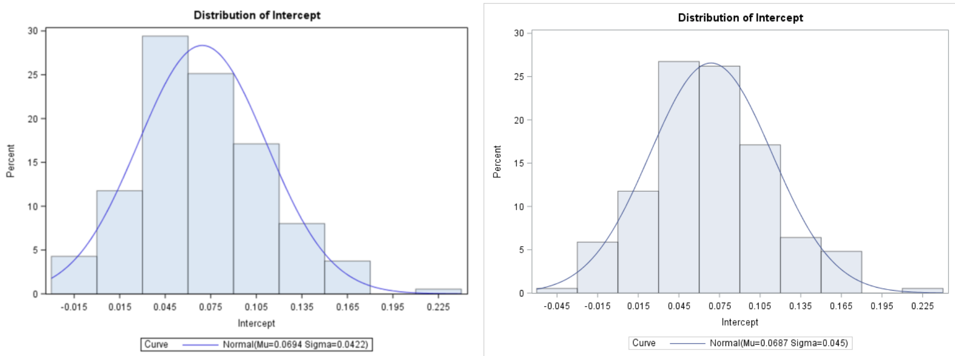
Table 1: Results for Australian sample compared with the results from Brav, Lehavy and Michaely

	US data		Australian data		
	Brav et al Value Line data	**Brav et al First Call data**	**Individual firm**	**Portfolio: Decile**	**Portfolio: Quintile**
Intercept (α)	0.07	0.20	0.07	0.07	0.07
t-statistic	(3.2)	(5.8)	(12.66)	(12.09)	(12.11)
Slope (δ)	0.07	0.07	0.01	0.01	0.01
t-statistic	(5.1)	(4.3)	(2.08)	(1.81)	(2.50)

Table 1 shows that the intercept terms (α) are positive and statistically significant (1% level) in all cases. That is, the relationship between return expectations and beta has a higher intercept than the SL-CAPM indicates: the relationship has a positive α.

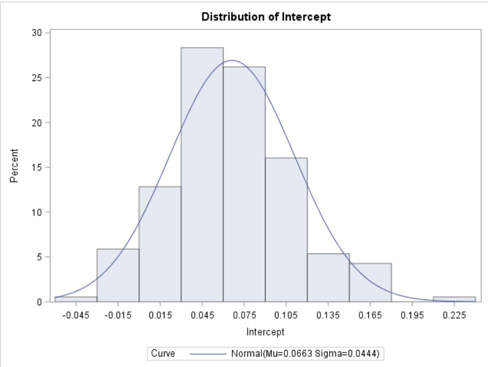
To ensure that the results were not driven by outliers, Frontier Economics examined the distribution of intercepts over time (an intercept was calculated for the cross-sectional regression that was produced each month). The distributions of intercepts for the individual firm and portfolio time series regressions (using the Australian data) are set out in Figure 1. The intercept is consistently positive for almost every firm-year analysis, and the mean intercept (reported above) is highly statistically significant. The distributions in Figure 1 show the intercept (α) for each of the analyses, and Table 1 above shows that the means of these intercepts are highly statistically significant.

Figure 1: Distribution of intercepts for individual firm-level and portfolio time-series regressions for Australian data



Firm-level alphas

Portfolio alphas (deciles)



Portfolio alphas (quintiles)

Frontier Economics concludes:

- using the methodology employed by Brav, Lehavy and Michaely with Australian returns expectations data reveals a consistent and statistically significant intercept (α)
- this is consistent with the empirical evidence from actual returns
- both sets of evidence are inconsistent with the SL-CAPM
- the intercept in the relationship between beta and returns expectations is higher than the SL-CAPM suggests: the returns expectations for on low-beta stocks are higher than the SL-CAPM predicts
- these findings are consistent with the US results for returns expectations reported by Brav, Lehavy and Michaely.

Further details are provided in the report from Frontier Economics which is attached to this submission.

3.2.1.3 *Some expert arguments against low beta bias are arguments against the use of the SL CAPM*

We have previously noted that, in the second of the concurrent expert evidence sessions, Professor Satchell questioned the evidence for low beta bias, arguing that the "bias" was to be expected – the estimates of β and the intercept term (α, which is expected to be zero if the SL CAPM is true) are negatively correlated. More recently, Professors Partington and Satchell have proposed, as a theorem: if high beta assets are over-priced and low beta assets are correctly priced, then the security market line has an intercept in excess of the riskless rate and a slope less than the MRP.

We acknowledge that the estimators for β and α in the standard context of testing the SL CAPM are negatively correlated. We are uncertain about the more recent theorem: no more than a sketch of the proof is offered.

Setting aside proof of the theorem, the point which Professors Partington and Satchell seem to be making is that, in a world in which high-beta assets are over-priced, low-beta assets can appear to be under-priced in cross-sectional tests, even if low-beta assets are correctly priced. But this is irrelevant: time series data can be used to provide evidence of a low-beta bias. Tests for low beta bias can be conducted using time series data for low-beta assets without reference to high-beta assets.

But neither of the reasons advanced by Professors Partington and Satchell for rejecting low beta bias seems to us to be directly relevant to whether the SL CAPM produces (for low beta assets) return estimates which are below actual returns or, indeed, below the returns expectations of market participants.

In the second expert evidence session Professor Satchell also spoke about other factors – principally interest rates – affecting the returns on low beta stocks. He has further explained in recent advice to the AER.[23] A fall in interest rates will lower the stock price if beta is greater than one, and will raise the price if beta is less than one. In the period since 1980, interest rates generally fell, and so low beta assets should have done well relative to high beta assets. This, Professor Satchell advised, is not an anomaly, nor a behavioural quirk that requires compensation, but is the consequence of a sequence of exogenous events which may well reverse in the future.

The recent report from Professors Partington and Satchell also advises that there are other reasons why we should be suspicious of low-beta bias as a basis for increasing the allowed rate of return. In particular, they note the conditional Capital Asset Pricing Model (conditional CAPM), and its implementation by Jagannathan and Wang.

The advice from Professors Partington and Satchell does not point to estimates of beta being biased, or to low beta bias (the observation that, for low beta assets, actual returns, or the return expectations of market participants, are higher than expected returns predicted by the SL CAPM, and for high beta assets, actual returns, or the return expectations of market participants, are lower than the expected returns predicted by the SL CAPM). Their advice seems to be pointing to other models which would not be expected to show the same "bias" if they were to replace the SL CAPM in the comparison of predicted expected returns from the model with actual returns, or with the return expectations of market participants.

If there is evidence of other factors – the long term decline in interest rates since 1980, as Professor Satchell explains – affecting the returns on low beta assets, then that draws into question the validity of using the SL CAPM to estimate equity returns. If the conditional CAPM seems not to show "bias", then perhaps we should be looking more closely at the conditional CAPM for the purpose of estimating equity returns. The

[23] Graham Partington and Stephen Satchell, *Report to the AER: Allowed Rate of Return 2018 Guideline Review*, May 2018, page 29.

conditional CAPM is reported as performing significantly better than the SL CAPM when tested using Australian data.[24]

None of this disposes of the issue of low beta bias: if the SL CAPM is accepted, then expected returns for low beta assets, estimated using the model, will understate both actual returns and the expectations of returns held by market practitioners.

The conclusions which Frontier Economics has reached may not be sufficient to propose specific adjustments to the SL CAPM and, in particular, to propose a specific upward adjustment to the expected rate of return for an asset which has a beta less than one.

Nevertheless, a pragmatic response to low beta bias, when using the SL CAPM to estimate the equity returns to service providers with measured betas below one, is to choose a beta estimate at the upper end of the statistical range.

If the use of a single beta estimate for electricity network and gas pipeline service providers were to continue to be seen as appropriate then, having established an empirical range of 0.8, with clustering around 0.6, the AER should reconsider its decision to reduce the estimate from the value of 0.7 which was adopted in 2013. A beta estimate of 0.6 is too low.

But before taking this course of action, the AER should reconsider its use of a single beta estimate for electricity network and gas pipeline service providers.

3.2.2 *A single benchmark for gas and electricity*

Section 2.4.2 of the Draft Explanatory Statement advises that, if the systematic risk of providing network services is different as between electricity network and gas pipeline service providers, then the AER may need to recognise different benchmarks. The section notes:

- the AER has not started from the position that there should be only one benchmark for both gas and electricity
- submissions have not provided substantially new material or information to that considered in 2013, and in subsequent regulatory decisions (and which supported a single benchmark)
- it is not clear that the experts supported different betas for gas and electricity businesses

[24] Nick Durack, Robert B Durand, and Ross A Maller (2004), "A best choice among asset pricing models? The Conditional Capital Asset Pricing Model in Australia", Accounting and Finance, 44, pages 139-162.

- in 2016, the New Zealand Commerce Commission adopted a gas beta 0.05 higher than the beta for electricity, but the reasons for this do not appear to be relevant to firms regulated by the AER.

Process issues aside, the principal reasons for the AER's adoption of a single benchmark were:

- the similar market-structural circumstances of electricity network and gas pipeline service providers: natural monopoly and limited competition
- similar economic regulation – revenue capping – which mitigates demand risk.

Electricity network and gas pipeline service providers may have natural monopoly characteristics, and may similarly face limited competition.

However, in Australia, competition in the provision of gas pipeline services is not entirely absent. Demand for pipeline service derives from end-user demand for gas, and gas retailers serving end-users in urban and industrial areas, and large (industrial and commercial) end-users in those areas, are able to source gas from different gas fields, with the gas transported from the different fields by different pipelines. There is, in these circumstances, competition among gas supply chains, of which transmission pipelines are an integral part, for gas delivered to end-users.

Furthermore, gas transmission pipelines transport energy, and that energy is often used for electricity generation. Pipeline transported gas may compete in the broader energy market with other fuels for generation, including diesel fuel and liquefied natural gas, both of which are transported by road. Competition is among different energy supply chains, and the pipeline transportation of gas may be a part of those supply chains.

In this environment, pipeline service providers are exposed, through their contracts with users, to volatility in downstream markets – the national electricity market, domestic and international product markets, and commodity markets. Pipeline service providers face the risks associated with volatile electricity prices, or with product and commodity price downturns, which have the effect of reducing requirements for gas. They face the prospect of the closure of downstream operations in adverse market conditions.

These risks are not reduced by regulation which, in the event of prolonged downturn or plant closure, allows pipeline costs to be recovered through higher tariffs for remaining users. Revenue caps, which mitigate demand risk by increasing the tariffs payable by remaining users, simply increase the risk of further closures.

We do not exclude the possibility of competition in the electricity network sector. Competition in that sector is, however, different from competition in the gas pipeline sector: the technologies are different, the alternatives are different, and the costs are different. And we acknowledge the regulation of electricity network and gas pipeline service providers. But gas transmission pipeline service providers are not revenue capped; they are subject to price caps.

We note that the experts have advised that differences between electricity network and gas pipeline service providers are not necessarily translated into rates of return but, rather, into OPEX allowances. This, however, is a statement about unsystematic (or idiosyncratic) risk. It is not a statement about systematic risk, and it tells us nothing about differences between gas and electricity. The experts also advise that there may be upside (and downside) risks. There may be. But, again, on its own this tells us nothing about differences between gas and electricity. And reliably measuring risk differences may be difficult. Yes, we agree; but again this tells us nothing about those differences. The experts, it seems, had nothing to say on whether there are differences in systematic risk, and nothing to say about whether the betas might be different as between electricity network and gas pipeline service providers.

The decision of the New Zealand Commerce Commission to recognise different betas for gas pipeline and electricity network service providers drew, as the AER has noted, on a sample of businesses across three markets outside New Zealand. We have previously expressed our concern with relying on data from markets in different institutional contexts, and with potentially different risk characteristics. The decision by the Commerce Commission indicates a possible difference, but not much more.

There are then, reasons for thinking that the equity betas of electricity network service providers might be different from those of gas pipeline service providers. We doubt, though, that this difference can be discerned by qualitative assessment of vaguely defined systematic risks. Qualitative assessment may assist in broadly concluding that electricity network and gas pipeline service providers have systematic risks less than the systematic risk of the market portfolio, but it lacks the precision required to assess whether there is a difference between the betas for those service providers.

Quantitative analysis is required.

3.2.2.1 *Australian estimates of equity betas for electricity networks and gas pipelines*

APA has, with other members of the APGA, asked HoustonKemp to undertake an econometric analysis, using the data and methods used by the AER for equity beta estimation, to estimate an equity beta specific to gas pipeline service providers.[25]

[25] HoustonKemp, *Australian estimates of the equity beta for a gas business: A Report for the APGA*, September 2018.

HoustonKemp has used data for the nine Australian regulated energy utilities that form the AER's comparator set to:

- estimate the equity beta of an Australian gas pipeline service provider
- test whether that beta is significantly different from the beta estimate of 0.7 in the December 2013 Rate of Return Guideline.

HoustonKemp advise that, of the nine firms in the set of comparators, three have operated in the past solely as gas businesses, one operates and has operated in the past almost exclusively as an electricity business, and five operate or have operated as both electricity and gas businesses (and, in one case, also as a foreign water utility).

Segment information, which listed firms are required to report as notes to their annual financial statements, has been used to gauge the proportions of the value of each firm which can be attributed to gas and electricity operations. With these proportions, and with the ratio of the book value of debt to the market value of equity for each firm, share prices adjusted for capitalisation changes and dividends, and the S&P/ASX All Ordinaries accumulation index, HoustonKemp has been able to estimate equity betas for an Australian gas pipeline service provider, and to test whether these betas are significantly different from 0.7.

These beta estimates have been made for:

- the longest period over which data are available for each firm in the comparator set
- the longest period for which data are available after the "tech boom", and excluding the period of the Global Financial Crisis (GFC)
- the most recent five years (to 17 August 2018).

HoustonKemp has, first, estimated beta for each of the nine firms in the set of comparators.

The results are summarised in Table 2 below.

Table 2 shows an equity beta estimate for gas pipeline service providers of at least 0.675.

Table 2: Individual firm equity beta estimates (60% gearing): 1992-2015

Company	Sector	Gearing	Longest period	After GFC and excluding "tech boom"	Last 5 years
Alinta	Gas	0.364	0.945 (0.231)	1.087 (0.232)	
AGL	Mixed	0.323	0.692 (0.121)	0.678 (0.203)	
APA	Gas	0.524	0.699 (0.064)	0.762 (0.068)	0.952 (0.124)
AusNet	Mixed	0.587	0.396 (0.065)	0.542 (0.061)	0.763 (0.085)
DUET	Mixed	0.702	0.364 (0.062)	0.378 (0.049)	0.331 (0.075)
Envestra	Gas	0.705	0.334 (0.048)	0.349 (0.049)	0.460 (0.182)
GasNet	Gas	0.653	0.339 (0.094)	0.342 (0.094)	
Hastings	Gas	0.451	1.057 (0.227)	0.965 (0.159)	
Spark	Mixed	0.614 0.364	0.432 (0.069)	0.463 (0.064)	0.560 (0.091)
Mean Gas			**0.675** **(0.072)** **[0.364]**	**0.701** **(0.065)** **[0.506]**	**0.827** **(0.101)** **[0.896]**

Heteroscedasticity consistent standard errors are in parentheses below the estimates in Table 2. p-values for tests of the null hypothesis that beta is no less than 0.7 are in brackets.

As HoustonKemp has noted, the results in Table 2 do not provide a clear guide to an equity beta for a gas pipeline service provider. Businesses designated "mixed" in the table are businesses which provide both electricity network and gas pipeline services. To isolate the beta for a pipeline service provider, an estimate must be made from a portfolio designed to be a pure play gas pipeline portfolio.

HoustonKemp has "constructed" such a portfolio, and have used it to estimate the required beta, and to test whether that beta is significantly different from 0.7. The results are summarised in Table 3.

Table 3: Pure play gas pipeline portfolio equity beta estimates

Pure play gas pipeline portfolio	Longest period	After GFC and excluding "tech boom"	Last 5 years
Estimate	0.588	0.640	0.878
Standard error	(0.049)	(0.051)	(0.119)
p-value	[0.012]	[0.122]	[0.933]

Again, the assumed gearing is 60%, and heteroscedasticity autocorrelation consistent standard errors are shown in parentheses below the estimates. p-values for tests of the null hypothesis beta is no less than 0.7 are shown in brackets.

Table 3 shows:

- equity beta estimates for the gas pipeline service providers of at least 0.588
- substantially different beta estimates across the three periods of the analysis.

Since the estimates differ substantially across the three periods, HoustoKemp also test:

- change 1: whether the estimate of the equity beta for the pure play gas pipeline portfolio produced using data for the last five years (23 August 2013 to 17 August 2018) differs significantly from the estimate produced using data for the longest period but excluding the last five years (5 September 1997 to 16 August 2013)
- change 2: whether the estimate of the equity beta of a pure play gas pipeline portfolio produced using data for the last five years differs significantly from the estimate produced using data from after the GFC and excluding the "tech boom" but without the last five years (4 January 2002 to 29 August 2008 and 6 November 2009 to 16 August 2013).

The results are shown in Table 4.

Table 4: pure-play gas pipeline portfolio equity beta change estimates

Pure play gas portfolio	Change 1	Change 2
Estimate	0.344	0.328
Standard error	(0.128)	(0.129)
p-value	[0.007]	[0.011]

The estimates for "change 1" and "change 2" exceed 0.325, and differ significantly from zero at conventional levels. This indicates an equity beta of a pure play gas pipeline portfolio which is higher today than it has been in the past.

Beta is, of course, a relative measure of risk, and this conclusion may reflect, in part, a change in the market portfolio.

Nevertheless, HoustonKemp's results indicate, overall, that there is no evidence from recent data that the equity beta of a pure play gas pipeline portfolio is below 0.7.

HoustonKemp's report, which provides greater detail, is attached to APGA's submission on the Draft Guidelines.

3.2.3 *A beta estimate of 0.6 is too low*

APA concludes:

- if the use of a single beta estimate for electricity network and gas pipeline service providers were to continue to be seen as appropriate then, after having established an empirical range of 0.8, with clustering around 0.6, consideration should be given the effect of low beta bias
- quantitative evidence, obtained using data for the set of comparators which the AER has used for beta estimation, and using the same estimation methods, shows an equity beta for a gas pipeline service provider of at least 0.7
- a beta estimate of 0.6 is too low for gas pipeline service providers; the estimate of 0.7 which was adopted in 2013 should be retained.

3.3 Market risk premium

Clause 4(c) of the Draft Guidelines proposes an estimate of the MRP of 6.0%.

An estimate of 6.5% was adopted for the AER's December 2013 Rate of Return Guideline.

Estimation of the MRP is multifaceted and complex. This section of the submission comprises seven subsections.

Using historical excess returns to estimate the MRP (section 3.3.1)

Estimation of the MRP using historical excess returns is briefly re-examined in section 3.3.1.

We conclude that the estimate which might be obtained from historical excess returns is not below the estimate of 6.5% adopted for the December 2013 Rate of return Guideline.

Should estimation of the MRP rely on historical excess returns? (section 3.3.2)

In section 3.3.2, we find that there has been no consideration of how historical excess returns might provide an estimate of the forward-looking MRP required for application of the SL CAPM.

Rejection of the use of dividend growth models on the grounds that expert advice raises significant concerns about the use of those models is, in these circumstances, of doubtful validity.

Dividend growth model estimates of the MRP (section 3.3.3)

The Draft Explanatory Statement notes that the proposed (lower) estimate of the MRP (6.0%) follows from a decision not to adjust the estimate obtained from historical excess returns using evidence on the premium obtained from dividend growth models. This decision was a consequence of the AER's diminished confidence in the results obtained using dividend growth models. That diminished confidence was informed by expert advice, since 2013, on the deficiencies of those models.[26]

Dividend growth models may have their deficiencies, but the use of historical excess returns to estimate the MRP is also a method which has limitations. These limitations have been, and continue to be, overlooked.

We discuss the issues in section 3.3.3. The AER's dividend growth model estimates of the MRP are noted in the section.

Arithmetic or geometric means? (section 3.3.4)

The decision to adopt a significantly lower MRP estimate – 6.0% – seems to have be influenced by the AER's view that a lower limit on the range of possible values for the MRP is 5.0%. That lower limit was obtained having regard to a set of geometric averages calculated from the available historical excess returns data. This, the Draft Explanatory Statement advises, takes into account the additional information provided by geometric average returns when estimating the MRP.[27]

Section 3.3.4 re-examines the issue of the use of geometric means, and explains why they have no role in MRP estimation. The financial economics literature which appears to provide support for the use of geometric means has, in our view, been misinterpreted.

Conditioning variables and MRP estimation (section 3.3.5)

The adoption of a lower estimate for the MRP also seems to have been influenced by the AER's use of the values of a number of conditioning variables, which appear to indicate that 6.0% is appropriate in current financial market conditions.

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26 Draft Explanatory Statement, page 200.

27 Draft Explanatory Statement, page 212.

In section 3.3.5, we question the use of conditioning variables. They cannot inform an estimate of the MRP made using historical excess returns in the way the AER supposes. Their use in 2013 was conceptually unsound; this remains the case today.

Credit spreads as a directional indicator (section 3.3.6)

In section 3.3.6 we examine the particular case of the use of credit spreads as directional indicators of the MRP.

Where does this leave us on the MRP? (section 3.3.7)

In section 3.3.7, we ask where consideration of the issues raised in earlier sections leaves us on estimation of the MRP for application of the SL CAPM.

We conclude that the estimate which should now be used is, at minimum, 6.5%, and may be higher if greater weight is given to the results obtained from the AER's own dividend growth models.

The evidence and reasoning of the Draft Explanatory Statement does not support an MRP estimate of 6.0%, and that estimate cannot, therefore, lead to an estimate of the return on equity which contributes to achievement of the national gas objective.

3.3.1 Using historical excess returns to estimate the MRP

Historical excess returns have, the Draft Explanatory Statement advises, been the AER's main source of information for estimating the MRP since the December 2013 Rate of Return Guideline. Estimation of the MRP using historical excess returns is easily replicable, and is widely used in regulation and by market practitioners. The AER is of the view that the required risk premium changes relatively slowly through time, and advises that it intends to continue to use historical estimates of realised excess returns on the market as the primary basis for MRP estimation.[28]

We plot historical excess returns data for the period 1883 to 2017 in Figure 2. The data are from the spreadsheet *Historical excess returns and Wright approach data.xlsx*, which is available from the AER's website.

[28] Draft Explanatory Statement, pages 42, 199, 203, 209.

Figure 2: Historical excess returns: 1883-2017

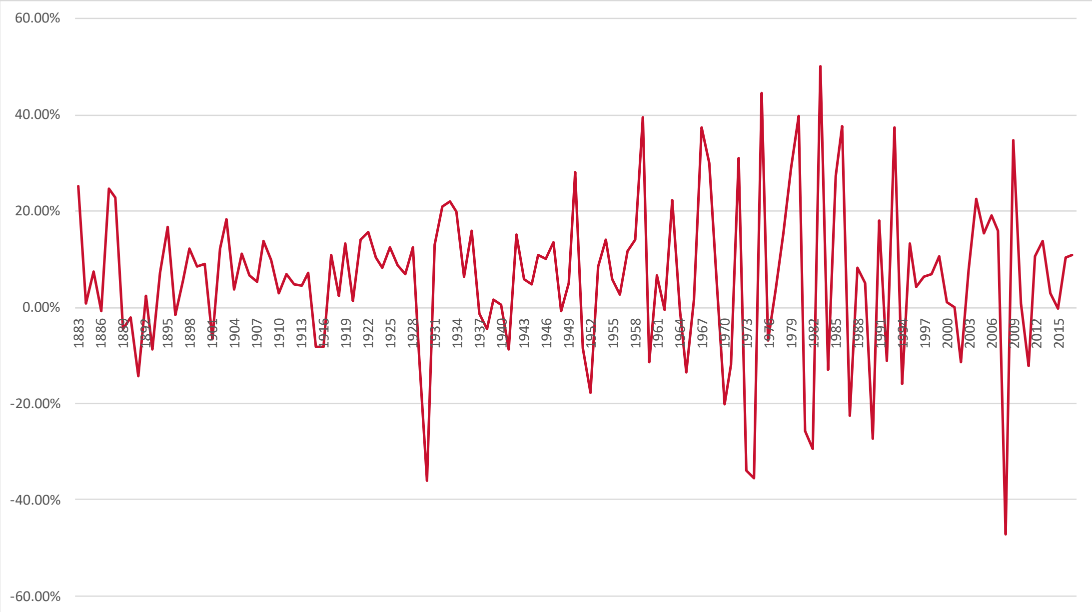

Figure 2 appears to indicate much greater variability in the data after about 1950. This is confirmed by the summary statistics in Table 5.

Table 5: Averages, standard deviations and standard errors of historical returns

Period	Average	Standard deviation	Standard error
1883 – 2017	6.3%	16.3%	1.4%
1883 – 1957	6.1%	10.6%	1.2%
1958 – 2017	6.5%	21.5%	2.8%

The (arithmetic) average of excess returns for the period 1883 to 2017 is 6.3%, with standard deviation 16.3%. For the sub period, 1883 to 1957, the (arithmetic) mean excess return is 6.1%, but the standard deviation is only 10.6%.

The greater variability after about 1950, which is apparent from Figure 2, is clear from Table 5: the standard deviation for the sub period 1958 to 2017, 21.5%, is double the standard deviation for the sub period 1883 to 1957.

If the standard deviation is a measure of the riskiness of returns, and it has doubled, then returns should have increased to provide compensation for the increased risk in the period 1958 to 2017. The historical data seem to indicate some increase: the mean return for the period 1958 to 2017, 6.5%, is higher than the mean return, 6.1%, for the period 1883 to 1957.

We see a number of issues arising from this brief examination of the AER's historical excess returns data:

- data for the period for which reliable data are available (1958 to 2017) indicate an estimate of the expected return on the market of 6.5%
- this estimate of the expected return on the market is not is not very precise: with standard deviation 21.5%, an estimate of the MRP which lies within 2 standard deviations of the mean is within the range 1.0% to 12.1%
- when the less reliable data (for the period 1883 to 1957) are taken into account, the estimate of the expected rate of return on the market is 6.3%, and is still relatively imprecise: an estimate of the MRP which lies within 2 standard deviations of the mean is within the range 3.5% to 9.1%.

If historical excess returns are to be the main source of information for estimating the MRP, the data on those excess returns do not indicate an estimate of the MRP below 6.5%. An estimate of 6.5% is, however, not very precise.

Our examination of the historical excess returns data has used arithmetic means of those data. We consider the question of whether mean returns should be measured using arithmetic or geometric means in section 3.3.4 below.

Before addressing that question, we ask whether estimation of the MRP should rely on historical excess returns alone.

3.3.2 Should estimation of the MRP rely on historical excess returns?

The SL CAPM is not a model of historical, actual, or ex post, asset returns; it is a model of ex ante expected returns.

As we noted earlier, the SL CAPM is derived from consideration of the behaviour of rational investors making decisions to form portfolios from the large (but finite) number of risky assets (and one risk free asset) which are available at time 0, and which can be used to transfer wealth to time 1. The payoffs, and hence the returns, on the risky assets, are, at time 1, uncertain from the perspective of investors making portfolio decisions at time 0.

Using the notation of clause 4 of the Draft Guidelines, k^e is the expected rate of return on a specific asset which provides investors with a payoff, at time 1, that payoff being uncertain at time 0, the time when an investment in the asset is made. k^e is not the historical return on that asset; it is not a realised or ex post return.

Nor is the MRP a historical or ex post return. It is the expected excess return on the market portfolio of risky assets at time 1. At time 0, the return on the market portfolio at time 1 is, like the return on any specific asset at that time, uncertain.

A key assumption made in modelling the portfolio choice of an individual investor is that the investor is able to form beliefs about the joint distribution of the rates of return on the risky assets at time 1, including beliefs about the means, variances and covariances of those returns.

A key assumption which must be made for derivation of the SL CAPM is that all investors form the same beliefs about the joint distribution of the rates of return on the risky assets, including the same beliefs about the means, variances and covariances of those returns.[29]

The SL CAPM is a model of equilibrium expected returns. The expected return on any specific asset is determined by reference to the expected return on the market portfolio:

$k^e = k^f + \beta \times MRP$

But the SL CAPM provides no guidance on how the expected return on the market portfolio is to be determined.

In the 1960's, when the model was first developed, the assumption could be made that returns adjust rapidly and accurately in response to trading so that actual returns and expectations quickly aligned. Averages of historical returns could then provide estimates of the expectations of those returns.

Today, the assumption that returns adjust rapidly and accurately in response to trading, so that actual returns and expectations quickly align, requires careful justification in the particular context in which the assumption is made. The AER and its rate of return experts, Professors Partington and Satchell, recognise that:

. . . expected returns can diverge from realised returns over a persistent period of time, markets can be in disequilibrium and expectations are not always realised even on average.[30]

That being the case, before historical excess returns can be used to estimate the MRP of the SL CAPM, the "model" which links the required expected return with the historical excess returns which are thought to be relevant to estimation of that expectation must be established.

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29 A growing body of research challenges this assumption of homogeneous expectations on the part of investors, but heterogeneous expectations lead to complex market dynamics, instability and chaotic asset price fluctuations. This is not the world of the SL CAPM.

30 Draft Explanatory Statement, page 286.

This is the clear message of the "rational expectations revolution" which had its origins in thinking about the macro-economy in the 1970s: expectations formation must be made explicit in economic modelling and analysis.

We are of the view that this has not been done by the AER when estimating the expected excess return on the market portfolio.

In the absence of an explicit link between the distribution of the expected return on the market and historical excess returns, we do not know whether those historical excess returns provide the estimate required for application of the SL CAPM. This is important. The fact that the SL CAPM is theoretically based is one of the three reasons advanced by the AER for its adoption as the foundation model. If model application is not consistent with the underlying theory of the SL CAPM, then the model being applied to estimate the allowed rate of return on equity will not be the SL CAPM, for which theoretical support is claimed. The estimate will not be the estimate claimed, and there is no reason for expecting that its use will contribute to achievement of the national gas objective.

The AER:

- uses historical excess returns as the primary basis for MRP estimation, but provides little justification for why those historical returns are linked to the expectation which they are intended to measure
- rejects the use of dividend growth models in estimating the MRP because those models are, in a number of ways, deficient.

Dividend growth models may have their deficiencies, as the AER and its experts have explained, but they still provide an approach to estimating, today (at time 0), the expected return on the market portfolio tomorrow (at time 1).

The AER has diminished confidence in the results obtained using dividend growth models, but that diminished confidence must be seen alongside an unjustified confidence in the use of historical excess returns for estimating the MRP. The way in which historical excess returns might be used to estimate the MRP of the SL CAPM continues to be overlooked: it was not considered in 2013, it was not considered by the experts in 2018, and it appears not to have been considered by the AER when arriving at the estimate of the MRP in the Draft Guidelines.

In APA's view, certain deficiencies of dividend growth models have been identified, but the AER has not made a case for rejecting those models in favour of a superior alternative. The AER has proposed to rely on historical excess returns for MRP estimation without providing any explanation for why this is appropriate, and without giving any consideration to the limitations inherent in such an approach.

The AER contends that the use of historical excess returns to estimate the MRP is easily replicable, and is widely used in regulation and by market practitioners. APA agrees, but these are observations about practice. They are not reasons which justify the use of historical excess returns in estimation of the MRP of the SL CAPM.

Reasons for why historical excess returns might be used in estimating the required MRP have not been advanced: they were not considered in 2013, they were not considered by the experts in 2018, and appear not to have been considered when arriving at the estimate of the MRP in the Draft Guidelines.

3.3.3 *Dividend growth model estimates of the MRP*

Dividend growth models may have deficiencies but, in the second concurrent evidence session, most experts agreed that:

- estimates made using dividend growth models can track variation in the short run MRP through time
- dividend growth models are commonly used in practice, including in regulatory settings
- dividend growth model estimates of the MRP should receive material weight: they are the only estimates we have of a forward looking return that is commensurate with prevailing conditions in financial markets.[31]

In their well-known finance textbook, Stanford Professors Jonathan Berk and Peter DeMarzo advise:

Using historical data to estimate the market risk premium suffers from two drawbacks. First, despite using 50 years (or more of data), the standard errors of the estimates are large . . . . Second, because they are backward looking, we cannot be sure that they are representative of current expectations.

As an alternative, we can take a fundamental approach toward estimating the market risk premium. Given an assessment of firms' future cash flows, we can estimate the expected return on the market by solving for the discount rate that is consistent with the current level of the index.[32]

Estimates of the MRP obtained using the AER's two-stage and three-stage dividend growth models are presented in Table 26 of the Draft Explanatory Statement. Those

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31 *Expert Joint Report*, pages 60.

32 Jonathan Berk and Peter DeMarzo (2014), *Corporate Finance*, third ed., Pearson: Boston, page 407.

estimates indicate an MRP in the range 6.08% to 8.56% (the combined-low and combined-high results obtained using the two-stage model).

The MRP estimates from the dividend growth models are not, like the means of historical excess returns, amenable to statistical analysis. But the observation that the range of dividend growth model results (obtained from the AER's combined-low and combined-high results) is much narrower than the range of 2 standard deviations around the mean of historical excess returns is difficult to avoid.

Despite their deficiencies, dividend growth models can be used to make estimates of the return on the market, and of the MRP, which are the forwarding looking estimates required for application of the SL CAPM.

3.3.4 *Arithmetic or geometric means?*

Berk and DeMarzo are clear:

Because we are interested in the expected return, the correct average to use is the arithmetic average.[33]

Suppose an investment has a return of 20% after one year, and has a return of -20% at the end of a second year.[34] The arithmetic mean of the returns is 0% (= (20% + (-20%))/2). The geometric mean is –2.02% (= ((1 + 0.20)(1 – 0.20))^(1/2) – 1). The geometric mean is also the overall rate of return on the investment:

Year	0	1	2
Net cash flow	-1.00	0.00 = 1.00*(1 + 0.20) - 1.20	0.96 = 1.20*(1 - 0.20)
IRR	**-2.02%**		

If returns are compounded, then the geometric mean provides information on the discount rate to be applied over an extended period.

This, and the fact that measurements of return are subject to error ("noisy"), is the subject of the short literature which begins with the paper (to which the AER refers) by Marshall Blume.[35]

33 Berk and DeMarzo, page 406, footnote 5.

34 The example is from Berk and DeMarzo, page 326.

35 Marshall E Blume (1974), "Unbiased Estimators of Long-run Expected Rates of Return", Journal of the American Statistical Association, 69(347), pages 634-638.

The issue is further explained by Jacquier, Kane and Marcus in section 1.1 of their 2005 paper.[36]

Suppose, they argue, the one period return on an investment, R_t, is log-normally distributed so that the log-return $r_t = \ln(1 + R_t)$ is independently and identically distributed normal with mean μ and standard deviation σ. The multi-period log return over an investment horizon of H periods is normal with mean Hμ and variance $H\sigma^2$. In these circumstances, an investment of $1 has future value in H periods:

$$V_H = 1 \times \exp\left(\mu H + \sigma \sum_{i=1}^{H} \varepsilon_{t+i}\right)$$

where the ε_{t+i} are independently and identically normally distributed with mean 0 and standard deviation 1. The expected return over H periods is then:

$$E(V_H) = \exp\left(\mu H + \frac{\sigma^2}{2}\right) = [1 + E(R)]^H$$

This last equation, Jacquier, Kane and Marcus advise, is the basis for the standard practice of forecasting portfolio value by compounding at the expected rate of return. If $\overline{R}$ is a sample arithmetic mean of returns, Jensen's inequality implies:

$$E\left([1 + \overline{R}]^H\right) > [1 + E(\overline{R})]^H = [1 + E(R)]^H = E(V_H)$$

That is, estimation error in $\overline{R}$, the compounded sample arithmetic mean return, imparts an upwards bias to the estimate of expected future portfolio value (as was first discussed by Blume).

This problem of upward bias which the use of a sample arithmetic mean imparts to the estimation of an expected future portfolio value is clearly **not** the problem of estimating the mean of a returns distribution using historical time series data. It is not the problem which arises when using historical excess returns to estimate the MRP. When estimating the MRP, there is no compounding of returns year by year over the period for which historical data are available.[37]

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36 Eric Jacquier, Alex Kane and Alan J Marcus (2005). "Optimal Estimation of the Risk Premium for the Long Run and Asset Allocation: A Case of Compounded Estimation Risk", Journal of Financial Econometrics, 3(1), pages 37-55.

37 There may be compounding of the regulatory rate of return over the regulatory period, as discussed by Lally in a report for the AER but, again, this is not the issue of using a time series of historical excess returns to estimate the MRP. See Martin Lally, *The Cost of Equity and the Market Risk Premium*, 25 July 2012. Lally, we note, concludes that there no compounding over the regulatory period, and the absence of a compounding effect leads to a preference for the arithmetic mean over the geometric mean.

In estimating the MRP the individual observations in a time series of those returns are being used to estimate the mean of the excess returns distribution. Furthermore, if we are using the MRP of the SL CAPM, we are estimating, today, the mean of the excess returns distribution one period ahead.

As we have noted above, the AER uses historical excess returns as the primary basis for MRP estimation, but provides little explanation of the "model" which links those historical excess returns with the mean of the excess returns distribution one period ahead. Without that explanation – without the model – it is difficult to proceed further with the question of whether MRP estimation should use arithmetic or geometric means. Indeed, it is difficult to proceed further with estimation of the MRP.

To progress, and to make clear, we make a series of assumptions to fill the gap in the AER's analysis and reasoning as presented in the Draft Explanatory Statement.

In the 1970s, Ibbotson and Sinquefield proposed a method of MRP measurement, using excess returns, which was subsequently widely used. Robert Merton described that method as "essentially the state-of-the-art".[38] But that was in 1980.

The method of Ibbotson and Sinquefield, assumes:

- the MRP, $E(r_M) - r_f$, is constant
- the expected return on the market, $E(r_M)$, can be estimated as the average of historical excess returns on the market plus the current risk free rate, r_f
- the estimate of the MRP is, then, the average of historical excess returns on the market, plus the current risk free rate, less the current risk free rate, which is simply the average of historical excess returns on the market.[39]

The Draft Explanatory Statement advises that the MRP is not constant, but changes relatively slowly through time.[40] However, this is not explained, there is no description of the pattern of change, and there is no analysis of the implications. Instead, the outcome the AER intends through its MRP estimation using historical excess returns seems to be the outcome of applying the method of Ibbotson and Sinquefield. The assumption being made by the AER, albeit implicitly, is that the MRP is constant.

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38 Robert C Merton (1980), "On Estimating the Expected Return on the Market: An Exploratory Investigation", Journal of Financial Economics, 8: page 327.

39 There is, here, no suggestion of the use of the Wright approach. APA has not, and does not, present the view that asset pricing using what the AER calls the Wright approach is valid. Statements on page 234 of the Draft Explanatory Statement, and in Table 29, to the effect that APA is of the view that the Wright approach is valid, and should be used by the AER, are not correct.

40 Draft Explanatory Statement, page 199.

The assumption that the MRP is constant implies that the mean of the distribution of excess returns one period ahead is the same as the mean of that distribution today.

If the mean of the excess returns distribution is constant, and if the terms of the time series of historical excess returns available for estimating that mean are samples of size one drawn from independent and identical distributions with that constant mean, and with constant variance, then the arithmetic mean of the historical excess returns provides a consistent estimate of the mean of the excess returns distribution. As the number of terms in the historical excess return series becomes large, the arithmetic mean of that series converges in probability to the mean of the excess returns distribution. [41]

The efficient markets hypothesis has sometimes been advanced in support of the independence assumption in the preceding paragraph, but the terms of the series of historical excess returns may not be independent.

Even if the terms of the series of historical excess return are serially correlated, provided the series is covariance stationary with absolutely summable autocovariances, the mean of the distribution of excess returns can be estimated as the arithmetic mean of historical excess returns: as the number of terms in the historical excess return series becomes large, the arithmetic mean of that series converges in mean square to the mean of the excess returns distribution.

Statistical theory points to the arithmetic mean from the series of historical excess returns as being the required estimator of the MRP. The required estimator is not the geometric mean.

We note that convergence of the arithmetic mean to the "population mean", both where the terms of the time series are independent, and where they are serially correlated, is essentially a "large sample" result. Ideally, a long series of historical excess returns should be used to estimate the MRP, and this has been the case: the extended Brailsford, Handley and Maheswaran series, used by the AER, now comprises 136 terms.

With long economic time series, there is, however, a risk that structural change over the long period of the series introduces non-stationarity. This is an issue which should have been discussed. It was not: the Draft Explanatory Statement did not set out a transparent approach to MRP estimation.

The Draft Explanatory Statement advises:

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41 See James D Hamilton (1994), *Time Series Analysis*, Princeton: Princeton University Press, chapter 7, for this result and for the result, noted below, for a series with serially correlated terms.

On balance, we consider there is sufficiently robust evidence to continue to consider geometric averages. For this reason we have maintained our approach of giving most weight to arithmetic averages but using the geometric range to set the lower bound of the overall HER range.[42]

We cannot agree. No evidence has been provided to support the use of geometric means when using historical excess returns to estimate the MRP (and none was provided in December 2013). If the MRP is to be estimated using historical excess returns, then statistical theory requires that the arithmetic mean be used as the estimator. No weight should be given to the geometric mean when making the estimate.

3.3.5 Conditioning variables and MRP estimation

We are concerned about the AER's use of conditioning variables, although our concern is somewhat allayed by the advice of the Draft Explanatory Statement that the AER does not use the values of those variables in making an initial point estimate of the MRP. Rather, conditioning variables are used to inform an initial point estimate derived from historical excess returns.[43]

In our view, there are two issues.

First, conditioning variables may be indicators of an appropriate estimate of the MRP, but only if there are well-defined relationships between the values of those variables and the MRP. In the absence of a clear relationship between the two, the value of a conditioning variable cannot inform an MRP estimate.

This was the essence of the concern raised by Frontier Economics which was noted in the Draft Explanatory Statement.[44] What we refer to as a "well-defined relationship", seems to be what Frontier Economics calls a "formal econometric mapping".

The concern is not addressed by advice that conditioning variables are not given weight as evidence in their own right, and that they do not provide reliable estimates on their own.[45]

If there is no well-defined relationship between a conditioning variable and the estimate of the parameter which is to be informed by that variable, then the conditioning variable cannot inform either the level of the parameter estimate or a change in that level.

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42 Draft Explanatory Statement, page 213.

43 Draft Explanatory Statement, page 227.

44 Draft Explanatory Statement, page 227.

45 Draft Explanatory Statement, page 227.

That the relationship between the conditioning variable and the estimate of the parameter which that variable is to inform should be well-defined is important. This is especially so where the parameter is, like the MRP (an expectation), not directly observable, and is subject to a number of different influences, not all of which may affect the parameter estimate in the same way (some may indicate an increase in the estimate; others may indicate a reduction), and not all of which may act independently of the others.

Second, if as we suppose, the AER is using a long time series to estimate the mean of the excess returns distribution (136 years of annual data), then short series of conditioning variables, even if those variables can be shown to be in some way related to the MRP, are unlikely to point to any change in the estimate of mean excess returns. The mean, in the circumstances of MRP estimation, can only be reliably estimated using a long data series.

3.3.6 *Credit spreads as a directional indicator*

Credit spreads, the Draft Explanatory Statement advises, are a directional indicator which can inform the MRP estimate (and were used for this purpose when developing the AER's December 2013 Rate of Return Guideline).[46] More specifically, the debt risk premium is a valuable relative indicator of the reasonableness of the MRP.[47]

A comparison of the equity risk and debt risk premiums is provided in Figure 15 of the Draft Explanatory Statement. Figure 15 plots the equity risk premium of the (December 2013) Rate of Return Guideline, a constant 4.55% (being the product of the equity beta estimate of the Guideline, 0.7, and its MRP estimate, 6.5%), and the equity premium of the Draft Guidelines, a constant 3.6% (the product of the equity beta estimate of 0.6 and the MRP estimate of 6.0%). Figure 15 also shows the – varying – debt risk premium over the period 2014 to 2018. The Draft Explanatory Statement advises:

- at the end of December 2013, the debt risk premium was about 3.4%; with an equity risk premium of 4.55%, equity investors could expect to receive a premium of 1.1% above returns to providers of debt
- with the current debt risk premium at about 1.9%, and the equity risk premium of the Draft Guideline, equity investors can expect to receive a premium of 1.7% above returns to providers of debt: although the current equity risk premium is lower, equity investors stand to receive a greater margin above the cost of debt.[48]

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46 Draft Explanatory Statement, page 230.

47 Draft Explanatory Statement, page 188.

48 Draft Explanatory Statement, page 189.

Long term averages, embedded in the equity risk premiums, are being compared with current values of the debt risk premium. Long term averages are being compared with "on-the-day" realisations of debt returns. We question the validity of these comparisons, and of any inferences drawn from them.

Whether credit spreads are widening, stabilising or narrowing may indicate that conditions in financial markets have changed, but in the absence of a well-defined relationship between, say, the current spread on BBB-rated corporate debt with a term of 10 years, and the MRP (an expectation about the future level of equity returns), the way in which those spreads might inform the level of the MRP, or a change in that level, is not at all clear. The loosely specified statement that the behaviour of those spreads indicates the way in which financial market conditions have changed does not allow any inference to be made about the level of the MRP, or about a change in that level.

3.3.7 *Where does this leave us on the MRP?*

The Draft Guidelines propose a reduction in the estimate of the MRP, from 6.5% in the December 2013 Rate of Return Guideline, to 6.0%. The Draft Explanatory Statement summarises:

- an estimate of 6.0% is supported by the evidence from historical excess returns
- the AER is not persuaded that this estimate should be changed by reference to the results obtained from dividend growth models; expert advice raises significant concerns about the use of those models
- a reduction in the MRP estimate to 6.0% is consistent with decreased volatility in equity markets since 2013, and with material reductions in debt risk premiums over the last five years.[49]

The evidence of historical excess returns is, of course, important. But before consideration can be given to that evidence, an answer must be provided to the question of how the evidence might be used in estimating the MRP of the SL CAPM. The MRP is not a realised excess return but a forward-looking expectation. The question of how historical excess returns might be used in estimating that forward-looking MRP has been not been answered. Indeed, it has not been asked, either in the current guidelines review, or earlier, in 2013.

Even if historical excess returns can be taken to directly estimate the MRP, the evidence does not support 6.0%. It supports 6.5%.

[49] Draft Explanatory Statement, page 200.

Rejection of the use of dividend growth models for MRP estimation, on the grounds that expert advice raises significant concerns about the use of those models, is methodologically unsound when no assessment is made of the alternative.

Dividend growth model estimates, the experts attending the second concurrent evidence session concluded, should be given material weight. Dividend growth model estimates are the only estimates we have of the forward looking excess return on the market required for application of the SL CAPM.

The AER's dividend growth model estimates point to an MRP estimate of 6.5% as being at the low end of the range of possible values.

In the absence of well-defined relationships between the MRP of the SL CAPM and observed values of certain conditioning variable, such as equity market volatility, and between the MRP and historical debt risk premiums, that volatility and those debt risk premiums neither support an MRP estimate of 6.0%, nor support a change in the estimate from 6.5% to 6.0%.

In APA's view, the evidence adduced by the AER does not support an MRP estimate of 6.0%. The estimate of the MRP which should now be used when applying the SL CAPM is, at minimum, 6.5%, and may be higher if greater weight is given to the results obtained from the AER's own dividend growth models.

4 Value of imputation credits (gamma)

Use of the AER's post-tax approach to regulated revenue determination is to continue, and clause 20 of the Draft Guidelines advises that the value to be attributed to the imputation credits available under Australian taxation law is 0.5.

This was value to be attributed to imputation credits in the AER's December 2013 Rate of Return Guideline. Subsequent regulatory decisions required a value of 0.4.

The value to be attributed to the imputation credits – the parameter *gamma* – has been calculated as the product of two factors:

- the distribution rate, or payout ratio – the proportion of imputation credits generated that is distributed to investors
- the utilisation rate, or theta – the value, per dollar to investors, of imputation credits distributed.

This has been broadly accepted. Issues remain, though, about how each of the factors is to be estimated.

In *Applications by Public Interest Advocacy Centre Ltd and Ausgrid*, the Australian Competition Tribunal found that the AER had not been in error in choosing of one conceptual approach to gamma (the value of imputation credits is the proportion of company tax expected to be returned to investors through the utilisation of those credits) over another (the value of imputation credits is a market-determined value, with theta to be estimated from dividend-drop off studies).[50]

On appeal, the Full Federal Court upheld the AER's view of gamma and, by implication, the regulator's estimate of 0.4. [51]

The Draft Explanatory Statement now proposes:

- an estimate of the distribution rate (payout ratio) of 0.83, based primarily on Dr Martin Lally's estimate from imputation credits data from the annual reports of the 20 largest companies listed on the ASX
- an estimate of the utilisation rate of 0.6.

The product of these estimates, rounded to one decimal place, is the AER's proposed gamma estimate of 0.5.

This section of the submission comprises three subsections.

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50 [2016] ACompT 1.

51 *Australian Energy Regulator v Australian Competition Tribunal* (No. 2) [2017] FCAFC 79.

Distribution rate (payout ratio) (section 4.1)

In section 4.2, we comment briefly on estimation of the distribution rate from the franking account balances which can be found in the financial reports of 20 largest ASX-listed companies.

Utilisation rate (theta) (section 4.2)

The utilisation rate, the Draft Explanatory Statement advises, is to be estimated using equity ownership data published by the Australian Bureau of Statistics (ABS). Limited – no? – reliance is to be placed on estimation from tax statistics.

In section 4.2, we propose that greater weight be given to the use taxation statistics when estimating theta.

Whither gamma? (section 4.3)

Section 4.3 concludes. We see no clear evidence for increasing gamma from the current estimate of 0.4.

4.1 Distribution rate (payout ratio)

An estimate of the distribution rate (payout ratio) can be made, as Dr Lally has proposed, and as explained in the Draft Explanatory Statement, from the franking account balances which can be found in the financial reports of 20 largest listed companies.[52]

However, many of those companies are banks, and most of them have significant foreign earnings.

APA is concerned that reliance on franking credit data from the 20 largest companies does not provide direct evidence for the distribution rate of a benchmark for regulated pipeline service providers. None of the service providers is, in its own right, a very large company with material foreign earnings. Scale of operation, not risk, as the AER suggests in its discussion of the lower distribution rates of BHP and Rio Tinto, is likely to be an important factor here.[53] But scale has not been systematically investigated.

4.2 Utilisation rate (theta)

The Draft Explanatory Statement advises that, in making its proposed estimate of the utilisation rate, the AER has placed significant reliance on equity ownership statistics

52 See Draft Explanatory Statement, pages 426-427.

53 Distribution rates for BHP and Rio Tinto are noted on page 429 of the Draft Explanatory Statement.

available from the ABS, and has placed only limited reliance on tax statistics available from the Australian Taxation Office (ATO).[54]

The most recent equity ownership data from the ABS suggested, to the AER, an "all equity" utilisation rate in the range 0.6 to 0.7. Calculations which had been made for the AER's most recent ElectraNet draft decision suggested ranges of 0.57 to 0.68 for "all equity", and 0.38 to 0.55 for "listed equity".[55]

In 2013, when estimating the utilisation rate for its rate of Return Guideline, the AER gave weight to estimates from tax statistics, which indicated a range of 0.4 to 0.8.[56]

The primary reason for the AER now giving little weight to estimates of the utilisation rate made from tax statistics seems to be advice from the ATO, in a note to the AER dated 19 May 2018. The note advised:

The ATO is of the view that the Taxation Statistics data should not be used for detailed time series analysis of the imputation system.

It would be difficult to use this data to reconstruct franking accounts due to the dynamic nature of the tax system as it impacts on business. Factors such as entries and exits, churn within consolidation groups, and other complexities such the rules relating to life insurance companies would affect any macro analysis.

Consequently, we would not recommend using Taxation Statistics data as the basis of a detailed macro analysis of Australia's imputation system.[57]

On 21 June 2018, the AER and the Electricity Networks Association (ENA) met with the ATO.[58] ATO staff explained that the principal reason for their May advice was concern over the quality of the ATO's franking account balance (FAB) data. The parties at the meeting agreed that the available FAB data should not be used for any purpose.

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54 Draft Explanatory Statement, page 439.

55 Draft Explanatory Statement, page 389.

56 Australian Energy Regulator, *Explanatory Statement Rate of Return Guideline*, December 2013, page 160.

57 The note was available at:

https://www.aer.gov.au/system/files/ATO%20Note%20to%20AER%20regarding%20imputation%20-%209%20May%202018.pdf

58 The AER's minute of this meeting was available at:

https://www.aer.gov.au/system/files/AER%20-%20Minute%20of%2021%20June%202018%20meeting%20with%20ATO%20and%20comments%20on%20ENA%20summary%20-%205%20July%202018.pdf

But FAB data are not required for the estimation of the utilisation rate, and the use of other statistics published by the ATO does not seem to be in question.

Dr Neville Hathaway, who had attended (via teleconference) the meeting with the ATO on 21 June, has now advised the ENA that, in view of the explanations provided by the ATO at that meeting, his earlier work using ATO data on franking credits created, and on franking credits redeemed, should be considered as providing a reliable estimate of the utilisation rate.[59]

There would seem, then, to be no reason for the AER giving little weight to estimation of the utilisation rate using tax statistics.

Moreover, this should be seen in context. The ABS has reservations about the quality of the equity ownership statistics from which the AER proposes to make the estimate of the utilisation rate to which significant weight is now to be given. In an explanation of the equity ownership statistics, the ABS advises:

The estimated market value of equity issued by some sectors is considered to be of poor quality. In particular, estimates of the market value of the amount issued by private corporate trading enterprises are considered poor because they are largely built up from counterpart and other information obtained from ABS Surveys of Foreign Investment and Balance Sheet Information. This sector covers equity issued by both listed and unlisted private corporate trading enterprises, of which there are over half a million.

In terms of the analysis undertaken here, errors in the estimated market value of equity on issue will impact on the accuracy of estimates of the proportion of that equity owned by non-residents.

A further concern relates to valuation. While both financial accounts and international investment statistics (from which the rest of the world data are sourced) are on a market value basis in principle, collection and estimation methods differ between the two sets of statistics. In the financial accounts, estimates of the value of equity issued are derived largely from balance sheet information and therefore are closer to a net worth or net asset value basis. In international investment statistics, shares in listed companies are valued at their traded price. Where recent transactions prices are not available, in the case of shares in unlisted companies for example, a close approximation to market value is sought. The most common proxy used is net asset value and respondents are asked to value assets at market prices. Because of the

[59] ENA letter to the AER, dated 29 June 2018, which was available at: https://www.aer.gov.au/system/files/ENA%20-%20Capital%20Research%20Memorandum%20-%20Cover%20Letter%20-%2029%20June%202018_0.pdf

differences in the methodologies used, it is possible that there could be more variability in the market value estimates of equity held by the rest of the world than in the estimated market value of the equity on issue, thus causing some variation in the foreign ownership series derived from these data.[60]

We are of the view that, when estimating the utilisation rate, the placing of significant reliance on equity ownership statistics, and the placing of only limited reliance on tax statistics, is, at present, unwarranted. On what is known, greater weight should be accorded to estimates made using tax statistics.

4.3 Whither gamma?

APA sees little which provides clear evidence to support an increase in the estimate of gamma from the estimate of 0.4 which the AER has used in its recent regulatory decisions.

[60] The ABS explanation was available at:
http://www.abs.gov.au/AUSSTATS/abs@.nsf/Previousproducts/5306.0Feature%20Article150Jun%201992?opendocument&tabname=Summary&prodno=5306.0&issue=Jun%201992&num=&view