2018-22
POWERLINK QUEENSLAND REVENUE PROPOSAL

APPENDIX 9.02

Powerlink Queensland
Rate of Return and Gamma
Independent Expert Advice Summary

Delivering better value

This page is left intentionally blank

Contents

INTRODUCTION **1**

SUMMARY 1
MARKET RISK PREMIUM 1
EQUITY BETA 3
COST OF DEBT 4

GAMMA **6**

VALUE OF IMPUTATION CREDITS 6

List of Tables

TABLE 1 INDEPENDENT EXPERT OPINION – ESTIMATE FOR RATE OF RETURN AND GAMMA 1
TABLE 2: FRONTIER'S RECOMMENDED MRP ESTIMATE 2
TABLE 3: FRONTIER'S RECOMMENDED EQUITY BETA ESTIMATE 3

Introduction

In developing its estimate for the rate of return and gamma, Powerlink sought independent expert opinion from:

- Frontier Economics Pty Ltd (Frontier) in relation to the return on equity and gamma; and
- Queensland Treasury Corporation (QTC) in relation to the return on debt.

An overview of the advice received is provided below with the full reports contained as attachments to this this Appendix.

Summary

Based on independent expert opinion, departures from the Rate of Return (RoR) Guideline are appropriate to arrive at an estimate of the required rate of return and gamma that best meets the requirements of the National Electricity Law (NEL) and the National Electricity Rules (Rules) and supports the National Electricity Objective (NEO). Table 1 sets out an estimate for the rate of return and gamma based on this independent expert opinion and compares this against Powerlink's proposed approach in its Revenue Proposal.

Table 1: Independent expert opinion – estimate for rate of return and gamma

Method	Independent expert opinion	Powerlink's proposed approach
Nominal risk free rate	2.79%	2.79%
Market risk premium	7.9%	6.5%
Equity beta	0.91	0.7
Return on equity	9.9%	7.3%
Return on debt	5.41%	5.20%
Total WACC	7.24%	6.04%
Gamma	0.25	0.4

The following sections provide the basis of the independent expert opinion and parameter estimates.

Market Risk Premium

AER's Approach

In estimating the Market Risk Premium (MRP) the Australian Energy Regulator (AER) estimates the range for the MRP with regard to theoretical and empirical evidence, including historical excess returns, Dividend Growth Model (DGM) estimates, survey evidence and conditioning variables. The AER has indicated that it will also have regard to recent decisions of other Australian regulators.

Having established a range for the MRP, the AER has determined the point estimate by applying regulatory judgement, taking into account estimates from each of these sources of evidence and considering their strengths and limitations.

In its Explanatory Statement to the RoR Guideline,[1] the AER determined that based on the market evidence as at December 2013, its methodology would return a range for the MRP of 5% to 7.5%, from which it selected a point estimate of 6.5%. In Draft Decisions made for NSW and ACT networks in November 2014, examination of the same evidence produced an updated range of 5.1% to 8.6%, with the increase in the upper bound reflecting higher DGM estimates. However, the AER maintained its point estimate at 6.5%. In its most recent Final Decisions made for Energex, Ergon Energy and SA Power Networks in October 2015 the AER's range largely remained unchanged. It applied a point estimate of 6.5%.

Issues

In applying the RoR Guideline the AER has not disclosed the relative weightings that it applies to the various sources of data. Its decision to maintain a point estimate of 6.5% while its upper bound has materially increased, clearly reflects reduced weight being applied to DGM estimates (and comparatively higher weight applied to historical excess returns), with the AER continuing to express concerns regarding the reliability of DGM estimates.

While Powerlink understands the need for the application of regulatory discretion and judgement, this limited transparency makes it difficult for a network service provider and other stakeholders to replicate, and more importantly, predict, the approach taken by the AER. This is also highlighted in the Frontier report "The Required Return on Equity under the AER's Rate of Return Guideline." Powerlink agrees with Frontier that increased transparency through to the weights applied to different pieces of evidence, and the reasons why those weights have been applied (or why they have been varied), would enable it and other stakeholders to better understand the AER's approach and how it might change in different market conditions.

Frontier also considers that the Wright approach, currently used by the AER as a "reasonableness check" on the return on equity estimate, should be used directly in the estimation of the MRP.[2] Frontier considers that both historical excess returns, and the Wright approach, are relevant pieces of evidence that should be used to inform the MRP. It also considers that independent expert valuation reports provide another relevant source of evidence.[3]

Having regard to the RoR Guideline approach and the requirements under the Rules, Frontier has produced what it considers to be the most appropriate estimate of the MRP in prevailing market conditions. Frontier has used the AER's data sources, although including the use of using the Wright approach (appropriately weighted amongst other sources of evidence) to inform the estimate of the MRP rather than as an overall cross check on the return on equity estimate, as well as evidence from independent expert valuation reports. Transparent weights have been applied reflecting the relative strengths and weaknesses of each piece of evidence. The estimates and weights are provided in Table 2.

Table 2: Frontier's Recommended MRP Estimate

Method	Value	Weight
AER estimate from mean historical excess returns	6.5%	20%
AER estimate from historical real returns	8.8%	20%
AER estimate from DGM approach	8.2%	50%
Frontier estimate from independent expert valuation reports	6.9%	10%
Weighted average	7.9%	100%

[1] *Better Regulation, Explanatory Statement Rate of Return Guideline*, AER, pp. 89-97.
[2] The Wright approach is at the opposite end of the theoretical spectrum to examining historical excess returns, which results in a reasonably constant MRP. The Wright approach, which is based on historical real returns, assumes that it is the required return on equity that remains relatively stable, resulting in a MRP that varies with changes in the risk free rate.
[3] Frontier has conservatively applied the data excluding any adjustments or uplift factors applied in those reports in recognition of the historically low risk free rate.

Equity Beta

AER's Approach

The AER's RoR Guideline approach involves estimating the range for equity beta based on empirical analysis of Australian energy utility firms that the AER considers to be comparable to the benchmark efficient entity. In its RoR Guideline, the AER has determined that this approach leads to a range for equity beta from 0.4 to 0.7.

The AER then uses other information sources to inform the selection of a point estimate from within that range. This additional information includes:

- Empirical estimates of overseas energy networks; and
- The theoretical principles underpinning the Black CAPM.

This has resulted in a point estimate of 0.7.

Issues

The AER's approach to establishing its range for beta and selecting the point estimate from within that range has been contentious and is also currently subject to appeal. Some of the key concerns as summarised by Frontier include:

- The AER's exclusive reliance on a small sample of domestic comparators and the reliability of those comparators;
- The AER's interpretation and application of the international evidence; and
- The way in which the AER uses the "theory of the Black CAPM" (which adjusts for low beta bias) to influence its selection of its point estimate from within the range.

Frontier then assesses what it considers to be the most appropriate estimate of beta, having regard to all relevant estimation methods, financial models, market data and other evidence. It has relied on a SL-CAPM beta estimate produced by SFG Consulting, who constructed a sample of relevant domestic and international comparators and arrived at an estimate of 0.82. It has also relied on:

- An adjustment to the SL-CAPM beta estimate using the Black CAPM to correct for low beta bias;
- An estimate based on the Fama-French model, which has shown an "unambiguously better fit" to the data than the SL-CAPM through its recognition of factors, such as the book to market ratio, which have been shown to explain stock returns; and
- An estimate based on the DGM, which does not require any assumptions regarding the factors that drive returns.

Again, Frontier assigns transparent weights to the various pieces of evidence, having regard to their relative strengths and weaknesses. This is shown in Table 3.

Table 3: Frontier's Recommended Equity Beta Estimate

Method	Value	Weight
Unadjusted SL CAPM estimate	0.82	12.5%
Adjustment to correct for low beta bias/Black CAPM estimate	0.91	25.0%
Adjustment to correct for book to market bias/Fama-French estimate	0.92	37.5%
Adjustment to reflect DGM estimate	0.94	25.0%
Weighted average	0.91	100%

Frontier observes that the overall estimate is not sensitive to the weights applied, with an equal weight producing a beta of 0.9.

Cost of Debt

AER's Approach

Another key change made to the Rules in 2012 was the method used to estimate the return on debt. Clause 6A.6.2(j) of the Rules now allows for one of three methods to be used, being:

- The previous "on the day" approach;
- The trailing average approach; or
- Some combination of the two.

The AER has determined that the trailing average approach is its preferred method under the RoR Guideline, based on the following key characteristics:

- The length of the trailing average is 10 years;
- Equal weights to be applied to all the elements of the trailing average; and
- The trailing average to be automatically updated every regulatory year within the regulatory period.

The trailing average approach proposed by the AER differs from its previous approach using the "on the day" methodology. While not required under the Rules, the AER has proposed a transitional arrangement under which:

- In the first year, the return on debt will be based on the prevailing rate (being the same as the "on the day" approach); and
- In each subsequent year, the maturing fixed rate loan (which funds 10% of the benchmark debt balance) is refinanced with a new 10 year fixed rate loan at the prevailing 10 year benchmark debt yield.

As a consequence, the trailing average is gradually phased in over a 10 year period.

To estimate the prevailing return on debt the AER has relied on the observed yields published by an independent third party data service provider. While it has not specified a preferred data source in the RoR Guideline, in its recent decisions published for Energex, Ergon Energy and SA Power Networks in October 2015, Powerlink notes that the AER has used a simple average of estimates sourced from the Reserve Bank of Australia (RBA) and Bloomberg's BVAL data series.

For the purpose of the annual updates to the return on debt that will occur during the regulatory period, Powerlink must nominate its proposed averaging periods for each year. The observation period is to be between 10 consecutive business days up to a maximum of 12 months. These averaging periods must be nominated in either the Framework and Approach or initial Revenue Proposal, for approval by the AER.

Issues

Powerlink procured expert advice from Queensland Treasury Corporation (QTC), who identified two main issues with the AER's proposed approach. These issues are documented in two separate reports that accompany Powerlink's Revenue Proposal.

The first issue is the AER's use of a simple trailing average to determine the allowed return on debt. In the QTC report "Return on Debt Transaction Analysis," QTC submits that a simple trailing average incorrectly compensates annual increases in the PTRM debt balance (i.e. new borrowings) predominantly at the historical cost of debt rather than the prevailing cost of debt. This would seem inconsistent with the allowed rate of return objective as it produces a return on debt that cannot be achieved in the market, which is likely to create investment distortions as persistent differences between the historical average and prevailing cost of debt will naturally occur over time.

It is also internally inconsistent, as the annual refinancing of 10% of the existing PTRM debt balance is compensated at the prevailing cost of debt, while an increase in the PTRM debt balance, which occurs at the same time, is compensated at the historical cost of debt.

QTC considers that the better approach is to use a weighted trailing average with the weights based on annual changes in the AER's approved PTRM debt balances (the 'PTRM weighted' trailing average). QTC shows that the historical annual differences between the simple and PTRM weighted trailing average have been material. Based on PTRM debt balances and actual 10 year BBB+ debt yields back to 2001, the annual difference between the simple and PTRM weighted trailing average would have frequently exceeded 1% of Powerlink's maximum allowed revenue, which the AER has applied as a materiality threshold.

The second issue is the AER's 10 year transition to the trailing average, which as noted above, is not a requirement under the Rules. As QTC highlights in their report "PTRM Weighted Trailing Average Approach," the AER and its consultants agree that the appropriate debt management strategy for the benchmark efficient entity under the "on the day" approach was to overlay an interest rate swap on a portfolio of floating rate loans with annual maturities from 1 to 10 years. As the benchmark efficient entity will enter its next regulatory period with a Debt Risk Premium (DRP) equal to the average DRP over the last 10 years, a DRP transition is not required for the allowed return on debt to match the efficiently incurred cost of debt.

As explained by QTC, the AER initially claimed that its DRP transition was designed to neutralise the significant windfall gains that were alleged to have accrued to service providers due to the spike in the DRP during the global financial crisis (GFC). This claim was largely based on some short term generic estimates produced by Associate Professor Martin Lally.

In response, QTC produced longer term estimates of past mismatches between the trailing average DRP and the "on the day" DRP, which contradicted the AER's claim. As a consequence, the AER changed its position and stated that it will no longer rely on analysis of whether its DRP transition will "erode" or "neutralise" past windfall gains or losses. Despite this lack of analysis, the AER remains satisfied that its DRP transition has been designed to neutralise the one-off impact (*positive or negative*) of the change in the return on debt approach.

QTC has estimated the historical mismatches between the trailing average DRP and the "on the day" DRP for a benchmark efficient entity in Powerlink's circumstances (i.e. the estimates are based on benchmark debt balances and debt yields rather than Powerlink's actual debt balances and cost of debt). QTC's analysis shows that a benchmark efficient entity in Powerlink's circumstances would have suffered a material cumulative windfall *loss* due to past applications of the "on the day" approach since 2001.

Under the AER's DRP transition a benchmark efficient entity in the same circumstances as Powerlink should expect to receive positive mismatches during the 10 year transition period with a present value equal to the cumulative windfall loss. However, as shown in QTC's report, the "on the day" DRP will need to increase to levels experienced during the GFC to achieve this outcome.

The more likely outcome is that a benchmark efficient entity in the same circumstances as Powerlink will experience additional losses during the transition period, which is the opposite of what the AER believes its DRP transition was designed to achieve.

QTC therefore concludes that a 10 year transition for the DRP should not be required. Powerlink notes that the return on debt transition is currently subject to appeal with the Tribunal.

Gamma

Value of Imputation Credits

This section briefly summarises the AER's approach and the issues raised by Powerlink's independent expert, Frontier, related to an estimate for gamma.

AER's Approach

The value of imputation credits (or gamma) is estimated as the product of:

- The dividend payout ratio; and
- A utilisation rate (also referred to as the value of franking credits, or theta).

When it finalised its RoR Guideline in December 2013 the AER arrived at a gamma of 0.5, which reflected a payout ratio of 0.7 and theta of 0.7.

Payout ratios can generally be observed from taxation statistics. The value of theta, on the other hand, is more difficult to determine. Based on the AER's conceptual definition of theta (noting that this has been subject to some modification since the RoR Guideline was finalised), its "value" of imputation credits has been interpreted to mean the utilisation of imputation credits. Effectively, this is simply the proportion of credits that are likely to be redeemed and assumes that those credits are fully valued by the holder at the full face amount.

Given this conceptual definition, the AER has placed most weight on Australian equity ownership statistics and some weight on tax statistics to estimate theta. It has updated these estimates since the RoR Guideline was finalised in 2013 and in its most recent regulatory determinations has applied a gamma of 0.4.

Issues

In establishing an estimate for the value of imputation credits (gamma) Powerlink engaged Frontier to provide independent expert advice on the application of the AER's RoR Guideline which is outlined in their report "The Required Return on Equity under the AER's Rate of Return Guideline."

The first main area of contention is how theta (the value of a distributed imputation credit) should be defined. Frontier summarises the two proposed interpretations, being:

- A value interpretation, reflecting what imputation credits are worth to investors, or the price that investors would be prepared to pay for imputation credits. This interpretation was widely accepted prior to the RoR Guideline review; and
- A redemption (or "utilisation") interpretation, reflecting the proportion of credits that are likely to be redeemed by investors. This is the AER's proposed interpretation under the RoR Guideline.

The rate of return is assessed from the perspective of investors, that is, given the risk profile of the efficient benchmark entity, what return will they require to be prepared to commit capital to that firm, having regard to alternative uses for that capital and prevailing conditions in the market for funds. It is necessary to consider this in terms of the total return required, which includes any value that investors are assumed to derive from imputation credits. It follows that the relevant interpretation is the value that investors place on gamma, or the price they would be willing to pay for imputation credits. As shown by Frontier, if gamma is set to anything other than the value of imputation credits to investors, they will be either under or over compensated by the regulatory framework.

The next issue that then follows is how gamma is estimated, which hinges on this interpretation. The AER has used methods that are consistent with its redemption interpretation, being the equity ownership approach and tax statistics. In its decision in response to the appeal of gamma by Energex, Ergon Energy and (then) ETSA Utilities (the Gamma Case),[4] the Tribunal has previously ruled that at best, redemption rates can only provide an upper bound, not a value, for theta.

[4] Application by Energex Limited (Gamma) (No 5) [2011] ACompT9.

As shown by Frontier, if a value interpretation is (correctly) applied, gamma must be estimated using a market value approach, such as dividend drop off studies. As concluded by Frontier, the best available estimate of gamma continues to be 0.25, which reflects:

- A distribution rate of 0.7; and
- A theta of 0.35, based on the approach applied in the SFG Consulting study commissioned by the Tribunal as part of the Gamma Case, which the Tribunal then endorsed as the 'best estimate' using this approach.[5]

Finally, Frontier has identified issues with the AER's interpretation of the evidence it relies upon in arriving at its preferred value for theta under the equity ownership approach. Frontier concludes that the AER's evidence best supports theta estimates of 0.44 for listed equity and 0.58 for all equity. If combined with the estimate of the redemption rate from tax statistics of 0.43, which the AER has given some weight to, this evidence collectively supports an estimate of theta no greater than 0.5. This in turn would produce a value for gamma of 0.35, applying a distribution rate of 0.7. This means that if the AER's approach is to be relied upon, the resulting estimate should be no higher than 0.35.

[5] Application by Energex Limited (Gamma) (No 5) [2011] ACompT9, paragraph 29.

Regulatory estimation of gamma

REPORT PREPARED FOR POWERLINK

January 2016

Regulatory estimation of gamma

1	**Executive Summary**	**3**
1.1	Context	3
1.2	Summary of conclusions	3
2	**Regulatory estimation of gamma**	**5**
2.1	Estimating gamma	5
2.2	The definition of gamma and its role in the regulatory framework	6
2.3	The best regulatory estimate of gamma	10
3	**The best estimate of gamma under the AER's Guideline approach**	**12**
3.1	Estimating theta	12
3.2	The AER's recent equity ownership estimates	15
4	**Declaration**	**17**
5	**References**	**18**
6	**Appendix: Curriculum Vitae of Professor Stephen Gray**	**19**

Regulatory estimation of gamma

Figures

Figure 1: AER refined and updated domestic share of listed Australian equity 13

Figure 2: AER refined and updated domestic share of listed and unlisted Australian equity 14

1 Executive Summary

1.1 Context

1 Frontier Economics (**Frontier**) has been retained by Powerlink Queensland to provide our views on a range of issues relating to the estimation of the imputation credit (gamma) parameter in the Australian regulatory setting. Specifically, we have been asked to:

a. Explain whether gamma should be interpreted in terms of the value of imputation credits (as in the worth of credits to investors or the price that investors would be prepared to pay for them) or in terms of the proportion of credits that are likely to be redeemed;

b. Explain how gamma should be estimated if the value interpretation is adopted, and to state what we consider to be the best available estimate under that approach; and

c. Explain how gamma should be estimated if the redemption proportion interpretation is adopted, and to state what we consider to be the best available estimate under that approach.

2 This report has been authored by Professor Stephen Gray, Professor of Finance at the UQ Business School, University of Queensland and Director of Frontier Economics, a specialist economics and corporate finance consultancy. I have Honours degrees in Commerce and Law from the University of Queensland and a PhD in Financial Economics from Stanford University. I teach graduate level courses with a focus on cost of capital issues, I have published widely in high-level academic journals, and I have more than 15 years' experience advising regulators, government agencies and regulated businesses on cost of capital issues. A copy of my curriculum vitae is attached as an appendix to this report.

1.2 Summary of conclusions

3 Our main conclusions are as follows:

a. Our view is that gamma should be interpreted in terms of the value (as in worth to investors) of imputation credits. In our view, this approach is consistent with the regulatory framework. If gamma is set to anything other than the value to investors of imputation credits, it is inevitable that investors will be either under-or over-compensated by the regulatory framework;

b. Some empirical methods have been developed to estimate the value of distributed credits, and these methods should be used if

the relevant task is to estimate the value of imputation credits. Our view is that the best available estimate of the value of distributed credits (theta) is 0.35 and that the best available estimate of the distribution rate (F) is 0.7, in which case the estimate of gamma is 0.25. The reasons for these conclusions are set out in detail in SFG (2014)[1] and SFG (2015)[2];

c. If gamma is to be estimated in terms of the proportion of credits that are redeemed, an estimation of the redemption rate will be required. The AER provides three such estimates: a tax statistics estimate and equity ownership estimates for all equity and listed equity only. Our view is that the AER has mischaracterised the equity ownership evidence that is set out in its recent draft decisions. In our view, that evidence best supports theta estimates of 0.44 for listed equity and 0.58 for all equity, as set out above. In its recent draft decisions, the AER appears to apply equal weight to the two equity ownership estimates and to also give some weight to the estimate of the redemption rate from tax statistics, which is 0.43.[3] In our view, this evidence collectively supports an estimate of theta no greater than 0.5. When paired with a distribution rate of 0.7, the resulting estimate of gamma is 0.35. We note that we do not consider this to be an appropriate estimate of gamma because it is not an estimate of the *value* of imputation credits. If, however, gamma is to be interpreted in terms of the redemption proportion, our view is that the estimate should not be higher than 0.35.

---

[1] SFG (2014), *An appropriate regulatory estimate of gamma*, 21 May.

[2] SFG (2015), *Estimating gamma for regulatory purposes*, 6 February.

[3] Jemena Gas Networks Draft Decision, Attachment 4, p. 14.

2 Regulatory estimation of gamma

2.1 Estimating gamma

4 Under Australia's dividend imputation tax system, dividends that are paid out of profits that have been taxed in Australia have imputation credits attached to them. A proportion of those credits will be redeemed against the domestic personal tax obligations of the shareholders who receive them. Credits distributed to non-resident shareholders cannot be redeemed against personal tax obligations and some credits distributed to resident investors are not redeemed due to particular provisions in the tax legislation[4] or due to the recipient not taking the active steps that are required for redemption.

5 Of course, only those credits that are distributed to investors (attached to dividends) can possibly be redeemed and consequently be of value to investors. For this reason, gamma is estimated as the product of two parameters:

$$\gamma = F \times \theta$$

where F represents the distribution rate (the proportion of credits that are distributed to investors) and θ (**theta**) represents the value of a distributed imputation credit.[5] The estimation of gamma as the product of these two components is uncontentious.

6 The key point of contention is whether the second parameter, theta, should be defined as:

a. The value of distributed credits, as in the worth of credits to investors or the price that investors would be prepared to pay for credits; or

b. The proportion of distributed credits that is likely to be redeemed by investors.

7 Some empirical methods have been developed to estimate the value of distributed credits, and these methods would be used if one determined that the relevant task was to estimate the value of imputation credits.

---

[4] For example, the 45-day rule prevents the redemption of credits in relation to shares held for fewer than 45 days around the ex-dividend date.

[5] This standard approach is also adopted in the Guideline. See the AER Rate of Return Guideline, p. 23. The Guideline refers to F as the "payout ratio" and to theta as the "utilisation rate," but the AER's estimate of gamma is obtained by multiplying these two parameters, as set out here. Moreover, in its recent draft decisions the AER refers to F as the distribution rate (throughout Attachment 4) and in places it refers to the second parameter as theta (e.g., Jemena Gas Networks Draft Decision, 3-86, 3-195, 3-199, 3-200, 3-207, 3-209, 3-231-233).

8 Other methods are available to estimate the proportion of distributed credits that might be redeemed, and these methods would be used if one determined that the relevant task was to estimate the redemption proportion.

9 In summary, the first task for any decision-maker is to determine whether theta (and consequently gamma) should be interpreted as the value of imputation credits or as the proportion of credits that might be redeemed. Once the interpretation of theta (and consequently gamma) has been settled, one would then apply the estimation methods that are consistent with that interpretation.

2.2 The definition of gamma and its role in the regulatory framework

10 Many regulated businesses have submitted that the regulatory framework requires gamma to be interpreted as the value (as in "worth to investors") of imputation credits. By contrast, in its Guideline and recent draft decisions the AER has adopted a redemption rate interpretation of gamma. The AER now interprets gamma in terms of the proportion of imputation credits that are likely to be redeemed by investors. Thus, there are two opposing interpretations of gamma:

a. A **value** interpretation, reflecting what imputation credits are worth to investors – the price that investors would be prepared to pay for imputation credits; and

b. A **redemption** (or "utilisation") interpretation, reflecting the proportion of credits that are likely to be redeemed by investors.

11 Prior to the AER's 2013 Rate of Return Guideline, it was uniformly accepted by regulators and all stakeholders that gamma represents the value (as in its usual meaning of "worth") of imputation credits to investors.

12 In its 2013 Guideline, the AER undertook what it described as a "re-evaluation of the conceptual task"[6] in relation to gamma. This has led the AER to now refer to theta as the "utilisation rate"[7] which is defined to be:

> The utilisation rate is the before-personal-tax reduction in company tax per one dollar of imputation credits that the representative investor receives. [8]

13 That is, the AER now defines the utilisation rate (theta) to be the simple proportion of distributed imputation credits that investors are able to redeem. This proportion is known as the "redemption rate" or the "redemption ratio." It is the ratio of redeemed credits to distributed credits – what proportion of the distributed credits is able to be redeemed.

---

[6] AER Rate of Return Guideline, Explanatory Statement, p. 160.

[7] The AER still refers to this parameter as "theta" in some places in its Guideline materials and in its recent draft decisions. Thus, the AER appears to consider these two terms as being interchangeable.

[8] AER Rate of Return Guideline, Explanatory Statement, p. 165.

2.2.1 The rationale for a "value" interpretation

14 The rationale for a "value" interpretation is that the only way to ensure that investors are not under- or over-compensated is for the regulator to make an adjustment in relation to imputation credits that reflects the value (as in "worth") of those credits to investors.

15 Under the building block approach, having settled on its estimate of theta (and consequently gamma), the regulator will then make an adjustment to the allowed return to investors. Suppose, for example, the regulator determines that investors require a total return of $100. Suppose that imputation credits with a face value of $15 are redeemed, but the value to investors from redeeming those credits is $10.[9] In this case, a regulator who is adopting the redemption rate interpretation of theta would reduce the allowed return to investors by $15. Thus, investors would receive an allowed regulatory return of $85 from the firm and imputation credits that were worth $10 to them – a total of $95. This is less than the $100 total return that the regulator has estimated to represent the efficient financing cost – it leaves investors under-compensated relative to the regulator's own calculations.

16 One point that appears to be generally accepted is that the value (as in "worth") to investors of distributed credits is lower than the proportion of them that are redeemed. That is, the value of credits to investors is lower than the redemption rate. For example, the SFG dividend drop-off estimate of the value of credits is 0.35 and the AER's Guideline indicated a range of 0.0 to 0.5 for market value studies, whereas the AER's estimates of the redemption rate are all materially higher.[10] This is also consistent with the Tribunal's statements that redemption rates do not estimate the value of credits, but provide an upper bound.

17 Under the building block approach, the regulator makes an estimate of gamma and then reduces the return that is available to investors from dividends and capital gains from the firm accordingly. Many regulated businesses have submitted that it is clear that the above rationale supports a *value* interpretation. If the *value* of foregone dividends and capital gains is greater than the *value* of received imputation credits, the investors will be left under-compensated, and vice versa.

18 Consistent with this interpretation of gamma, the National Electricity Rules (NER) state that:

> γ is the value of imputation credits,[11]

---

[9] A number of reasons why there may be a difference between the value of distributed credits and the redemption rate are set out in SFG (2014 Gamma). However, the key issue for the point being made here is simply that there *is* a difference – a point that would seem to be uncontentious.

[10] In the Jemena Gas Networks Draft Decision, Attachment 4, Table 4-2, pp. 4-14 to 4-15, the AER reports estimates of the redemption rate within the range of 0.55 to 0.70 based upon listed and unlisted equity, a range of 0.40 to 0.60 based upon listed equity, and a figure of 0.43 based upon statistics reported by the Australian Taxation Office.

[11] NER cls. 6.5.3, 6A.6.4 (current since version 53); NGR r. 87A(1) (current since version 14).

2.2.2 Value and the redemption rate are materially different

19 It is important to understand that the AER's new approach does not suggest that theta still represents the value (as in "worth to investors") of imputation credits and that the redemption rate is simply a relevant method for estimating the value to investors. The Australian Competition Tribunal (**Tribunal**) has already ruled that the redemption rate cannot be used to estimate the value (as in "worth to investors") of imputation credits, but can only be used as an upper bound – such that no reasonable point estimate could exceed this upper bound.[12]

20 Rather, the AER now considers that theta never represented the value (as in "worth to investors") of imputation credits in the first place; that theta should always have been defined as the redemption rate. That is, the AER's new approach represents a "conceptual re-evaluation," not just an expansion of the estimation methods that might be applied to estimate the same concept.

21 In its Rate of Return Guideline, the AER concluded that the value of imputation credits (as in the "worth" of credits in the market):

> …is not consistent with our interpretation of the conceptual framework,[13]

and:

> does not align with the conceptual definition of utilisation rate.[14]

22 That is, the AER has concluded that the market value of imputation credits is an entirely different concept to its redemption rate interpretation of theta. We agree that these two concepts are entirely different and we note that SFG (2014 Gamma) provides a number of reasons why one would expect there to be a difference between the proportion of credits that are redeemed by investors and the value of those credits to investors.[15]

2.2.3 Alignment of estimation approaches

23 Because the value and redemption rate interpretations of theta are very different things, one needs to determine which concept should be adopted and then select estimation methods that estimate the right thing.

24 For example, in its Guideline the AER concluded that:

> There are a number of conceptual reasons why the market value of imputation credits does not align with the relevant utilisation rate.[16]

---

[12] Application by Energex Limited (No 2) [2010] ACompT 7 (13 October 2010), Paragraph 91.

[13] AER Rate of Return Guideline, Explanatory Statement, p. 159.

[14] AER Rate of Return Guideline, Explanatory Statement, p. 168.

[15] SFG (2014), *An appropriate regulatory estimate of gamma*, 21 May, pp. 13-15.

[16] AER Rate of Return Guideline, Explanatory Statement, p. 176.

25 I agree that empirical methods that seek to estimate the value of distributed credits cannot be used to estimate the redemption rate. Of course, the reverse is also true – methods that estimate the redemption rate do not provide an estimate of the value (as in "worth") of distributed credits.

26 In its recent draft decisions, the AER continues to adopt the same interpretation of theta that it adopted in the Guideline:

> This is the interpretation of the value of imputation credits we adopted in the Guideline and continue to adopt in this decision.[17]

Thus there are two different conceptual interpretations of theta:

a. The value (as in "worth" to investors) of distributed credits; or

b. The proportion of distributed credits that is likely to be redeemed by investors.

27 These two conceptual interpretations are inconsistent with each other and each would be estimated by different methods.

28 Having determined which of the conceptual definitions of theta is to be adopted, the corresponding estimation techniques must then be employed:

a. If theta is to be interpreted as the value of distributed credits, then it must be estimated using empirical techniques that are designed to estimate the value of distributed credits; and

b. If theta is to be interpreted as the proportion of credits that are redeemed, then it must be estimated using empirical techniques that are designed to estimate the proportion of credits that are redeemed.

29 The AER proposes two techniques for estimating the proportion of credits that are redeemed:

a. The equity ownership approach – an estimate of the proportion of Australian shares that are owned by resident investors; and

b. ATO tax statistics – an estimate of the ratio of redeemed credits to distributed credits.

30 Neither of these approaches provides an estimate of the value (as in worth to investors) of imputation credits. The value of distributed credits can be estimated using a market value approach such as:

a. Dividend drop-off analysis, which estimates the market value of dividends and imputation credits as the difference between (a) the market value of a share including the dividend and credit, and (b) the market value of a share excluding the dividend and credit; and

b. Simultaneous pricing analysis, which estimates the market value of dividends and imputation credits as the difference between (a)

---

[17] Jemena Gas Networks Draft Decision, Attachment 4, p. 35.

the market value of a share, which entitles the owner to receive the dividend and credit, and (b) the market value of a futures contract, which does not entitle the owner to receive the dividend and credit.

31 If theta is to be defined as the value (as in worth to investors) of imputation credits, the redemption rate estimates cannot be used to estimate theta. They can, at best, be used to provide an upper bound for theta. The AER and Tribunal have both previously accepted this point:

> The AER accepted that utilisation rates derived from tax statistics provide an upper bound on possible values of theta. Setting aside the manner in which the AER derived a value from the tax statistics study, it correctly considered that information from a tax statistics study was relevant. However, its relevance could only be related to the fact that it was an upper bound. No estimate that exceeded a genuine upper bound could be correct. Thus the appropriate way to use the tax statistics figure was as a check.[18]

32 By contrast, if theta is to be redefined as the redemption rate, then studies that estimate the redemption rate would (tautologically) provide an appropriate estimate of theta.

2.3 The best regulatory estimate of gamma

33 Our view is that gamma should be interpreted in terms of the value (as in worth to investors) of imputation credits. In our view, this approach is consistent with the regulatory framework. As set out above, if gamma is set to anything other than the value to investors of imputation credits, it is inevitable that investors will be either under-or over-compensated by the regulatory framework.

34 As set out above, some empirical methods have been developed to estimate the value of distributed credits, and these methods should be used if the relevant task is to estimate the value of imputation credits.

35 Our view is that the best available estimate of the value of distributed credits (theta) is 0.35 and that the best available estimate of the distribution rate (F) is 0.7, in which case the estimate of gamma is 0.25. The reasons for these conclusions are set out in detail in SFG (2014)[19] and SFG (2015).[20]

36 We note that the AER has reached a different conclusion in its Rate of Return Guideline and its recent draft and final decisions. The AER now interprets theta as the proportion of credits that are likely to be redeemed, rather than as the value (worth or price) of those credits to investors. Accordingly, the AER has employed an estimation method that seeks to estimate the redemption rate rather

---

[18] Application by Energex Limited (No 2) [2010] ACompT 7 (13 October 2010), Paragraph 91.

[19] SFG (2014), *An appropriate regulatory estimate of gamma*, 21 May.

[20] SFG (2015), *Estimating gamma for regulatory purposes*, 6 February.

than the value of the credits. This leads the AER to conclude, in its recent draft decisions, that theta should be set to 0.6 – that 60% of distributed credits are likely to be redeemed. However, our view is that the data on which the AER relies does not support a theta estimate of 0.6. We address this issue in detail in the subsequent section of this report.

3 The best estimate of gamma under the AER's Guideline approach

3.1 Estimating theta

37 As set out above, in its Rate of Return Guideline and its recent draft decisions, the AER defines theta in terms of the proportion of credits that are likely to be redeemed by investors.

38 When estimating the proportion of distributed credits that might be redeemed by investors, the AER relies primarily on its "equity ownership approach." Under this approach, the AER estimates the proportion of Australian equity that is owned by domestic investors and then assumes that those domestic investors will redeem 100% of all imputation tax credits that are distributed to them.

39 In its recent draft decisions, the AER acknowledges the problems with the equity ownership estimates set out in its Guideline and indicates that it has now "examined more closely the relevant data"[21] which has "allowed us to update and refine our estimates."[22] This process has led the AER to depart from its own Guideline estimate.[23]

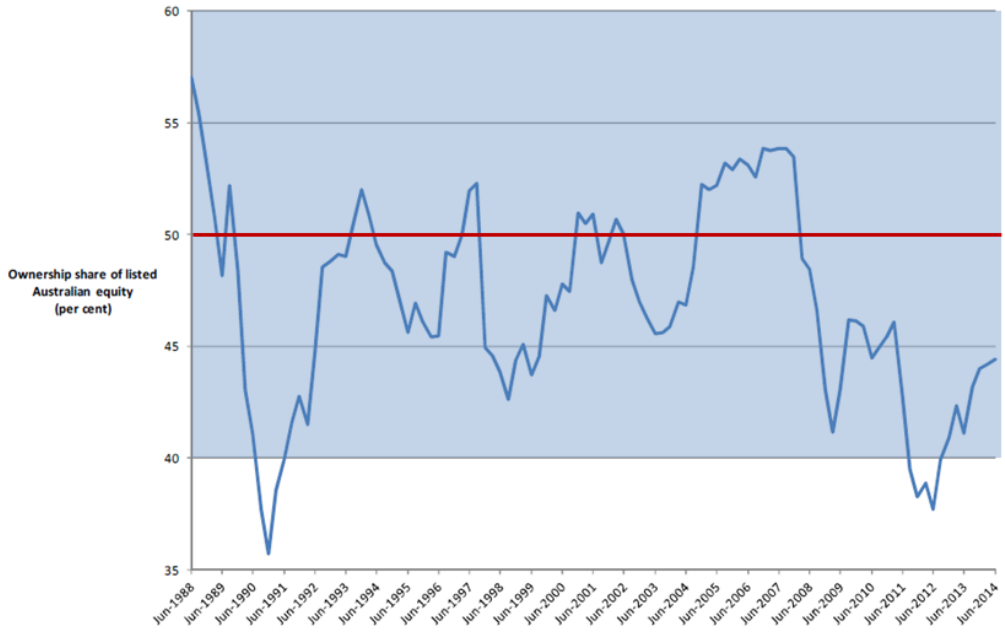
40 Specifically, in its recent draft decisions the AER sets out its updated and refined estimates of domestic equity ownership for listed equity and for all equity. In relation to listed equity, the AER provides the updated and refined data that is summarised in Figure 1 below.

[21] Jemena Draft Decision, Attachment 4, pp. 54.

[22] Jemena Draft Decision, Attachment 4, pp. 54.

[23] Jemena Draft Decision, Attachment 4, pp. 57.

Figure 1: AER refined and updated domestic share of listed Australian equity



Source: Jemena Gas Networks Draft Decision, Attachment 4, p. 56.
The shaded area is the AER's proposed range. The red line represents the mid-point of the AER's proposed range.

41 The AER interprets this evidence as supporting an estimate in the range of 0.4 to 0.6. In our view, there are two problems with this conclusion:

a. To the extent that domestic equity ownership is relevant, what is required is an estimate that is commensurate with the prevailing conditions in the market – as is the case for all parameters relating to the return on equity.[24] The regulatory process reduces the return that would otherwise flow to shareholders over the forthcoming regulatory period by the assumed value of imputation credits over the forthcoming regulatory period. It is not clear why estimates of what the domestic equity ownership proportion was in the 1980s are relevant to the current determination for the forthcoming regulatory period. This data represents an estimate of the domestic equity ownership proportion at each point in time. I see no reason why estimates that are more than 25 years out of date would receive the same weight as current estimates. In this regard, I note that the most recent estimate is 44% and that it has been more than six years since the estimate was materially above 44%; and

b. Even if the entire history of the domestic equity ownership proportion is considered to be equally relevant, the proposed

[24] See, for example, NER 6.5.2(g).

range of 0.4 to 0.6 is not a reasonable characterisation of that data:

i. None of the estimates are above 0.6, but several are below 0.4;

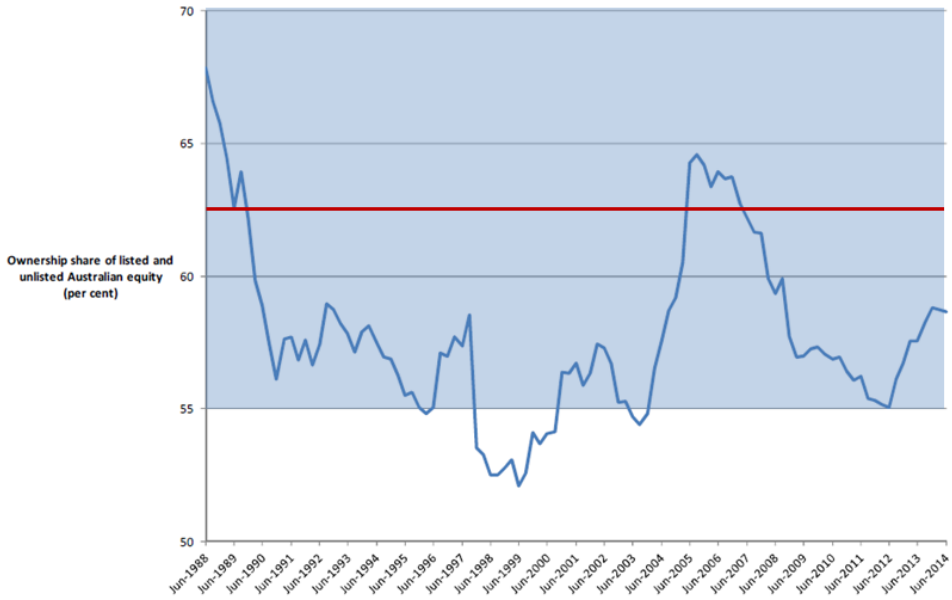
ii. It is only the first estimate in the series that is above 0.55 (the top quarter of the range), whereas a large proportion of the estimates are below 0.45 (the bottom quarter of the range); and

iii. The vast majority of the estimates are below the 0.5 mid-point of the proposed range.

42 For the reasons set out above, it is our view that the most recent estimate of 0.44 is a more reasonable characterisation of the evidence that is set out in Figure 1 above.

43 The same issues apply to the AER's updated and refined estimates of the domestic equity ownership proportion for listed and unlisted Australian equity, set out in Figure 2 below.

Figure 2: AER refined and updated domestic share of listed and unlisted Australian equity



Source: Jemena Gas Networks Draft Decision, Attachment 4, p. 56.
The shaded area is the AER's proposed range. The red line represents the mid-point of the AER's proposed range.

44 The AER interprets these estimates as supporting a range of 0.55 to 0.7. The current estimate is 0.58, marginally above the lower bound of the proposed range.

45 Even if the entire history of estimates are considered to be equally relevant, the proposed range of 0.55 to 0.7 is not a reasonable characterisation of that data:

a. None of the estimates are above 0.7, but several are below 0.55;

b. It is only the first two estimates in the series that are above 0.65 (the top third of the proposed range), whereas the vast majority of the estimates are below 0.6 (the bottom third of the range); and

c. The vast majority of the estimates are below the 0.625 mid-point of the proposed range.

46 For the reasons set out above, it is our view that the most recent estimate of 0.58 is a more reasonable characterisation of the evidence that is set out in Figure 2 above.

47 In summary, the Rate of Return Guideline sets out the AER's views about how theta should be defined, interpreted and estimated. In its recent draft decisions, the AER confirms its view that theta should be defined and interpreted as the proportion of distributed imputation tax credits that are likely to be redeemed. The AER also confirms that the equity ownership approach is its favoured method for estimating theta. However, our view is that the AER has mischaracterised the equity ownership evidence that is set out in its recent draft decisions. In our view, that evidence best supports theta estimates of 0.44 for listed equity and 0.58 for all equity, as set out above.

48 In its recent draft decisions, the AER appears to apply equal weight to the two equity ownership estimates and to also give some weight to the estimate of the redemption rate from tax statistics, which is 0.43.[25] In our view, this evidence collectively supports an estimate of theta no greater than 0.5. When paired with a distribution rate of 0.7, the resulting estimate of gamma is 0.35.

49 We note that we do not consider this to be an appropriate estimate of gamma because it is not an estimate of the value of imputation credits. If, however, gamma is to be interpreted in terms of the redemption proportion, our view is that the estimate should not be higher than 0.35.

3.2 The AER's recent equity ownership estimates

50 In its Guideline and draft decisions the AER estimated the redemption rate by assuming that credits distributed to government entities would not be redeemed – the same as credits distributed to foreign investors. However, in its recent final decisions, the AER makes an adjustment to its equity ownership estimates by assuming that credits distributed to government entities were never distributed at all.[26] The AER justifies this by redefining the redemption rate *from* the proportion of distributed credits that are likely to be redeemed *to* the proportion of credits that are likely to be redeemed among those that are not distributed to government entities.

---

25 Jemena Gas Networks Draft Decision, Attachment 4, p. 14.

26 TransGrid Final Decision, Attachment 4, p. 72.

51 The AER states that it has adopted this approach:

> …because the value of imputation credits forms part of our determination of the rate of return required by private investors in the benchmark efficient entity.[27]

52 This suggests that the redemption rate is being estimated for the benchmark efficient entity, whereas elsewhere in its final decisions the AER (correctly) states that the redemption rate should be estimated as a market-wide parameter.[28]

53 If the redemption rate is to be estimated as a market-wide parameter, then all of the credits in the market should be considered – not some subset of credits that the AER asserts would be relevant to the benchmark firm. Alternatively, if the redemption rate is to be estimated as a firm-specific parameter, the starting point would be to examine the actual shareholder bases of the comparator firms that the AER uses to estimate other WACC parameters. The current approach of the AER is not consistent with either a market-wide or a firm-specific approach.

54 Our view is that, to the extent that the distribution rate is relevant, it should be estimated on a market-wide basis. Consequently, we consider the market-wide estimates that were set out in the AER's November 2014 draft decisions (set out above), rather than the adjusted estimates set out in its recent final decisions.

---

27 TransGrid Final Decision, Attachment 4, p. 72.

28 TransGrid Final Decision, Attachment 4, p. 21.

4 Declaration

55 I confirm that I have made all the inquiries that I believe are desirable and appropriate and no matters of significance that I regard as relevant have, to my knowledge, been withheld from the Court.

Professor Stephen Gray

5 References

Australian Energy Regulator, 2015, *Final decision for TransGrid Transmission 2015-16 to 2018-18, Attachment 3 – Rate of return,* April.

Australian Energy Regulator, 2014, *Draft decision, Jemena Gas Networks (NSW) Ltd Access Arrangement 2015–20,* November.

Australian Energy Regulator, 2013, *Rate of return guideline,* December.

Australian Energy Regulator, 2013, *Rate of return guideline – Explanatory Statement,* December.

6 Appendix: Curriculum Vitae of Professor Stephen Gray

Stephen F. Gray

Professor of Finance
University of Queensland
Business School
Brisbane 4072
AUSTRALIA
Office: +61-7-3346 8032
Email: s.gray@business.uq.edu.au

Director
Frontier Economics
Email: Stephen.Gray@frontier-economics.com.au

Academic Qualifications

1995 Ph.D. (Finance), Graduate School of Business, Stanford University.
Dissertation Title: Essays in Empirical Finance
Committee Chairman: Ken Singleton
1989 LL.B. (Hons), Bachelor of Laws with Honours, University of Queensland.
1986 B.Com. (Hons), Bachelor of Commerce with Honours, University of Queensland.

Employment History

2000-Present Professor of Finance, UQ Business School, University of Queensland.
1997-2000 Associate Professor of Finance, Department of Commerce, University of Queensland and Research Associate Professor of Finance, Fuqua School of Business, Duke University.
1994-1997 Assistant Professor of Finance, Fuqua School of Business, Duke University.
1990-1993 Research Assistant, Graduate School of Business, Stanford University.
1988-1990 Assistant Professor of Finance, Department of Commerce, University of Queensland.
1987 Specialist Tutor in Finance, Queensland University of Technology.
1986 Teaching Assistant in Finance, Department of Commerce, University of Queensland.

Academic Awards

2014 E Yetton Prize for best paper in the Australian Journal of Management, Brailsford, T., S. Gray and S. Treepongkaruna, (2013), "Explaining the bid-ask spread in the foreign exchange market: A test of alternate models."
2006 Outstanding Professor Award, Global Executive MBA, Fuqua School of Business, Duke University.
2002 Journal of Financial Economics, All-Star Paper Award, for Modeling the Conditional Distribution of Interest Rates as a Regime-Switching Process, JFE, 1996, 42, 27-62.
2002 Australian University Teaching Award – Business (a national award for all university instructors in all disciplines).
2000 University of Queensland Award for Excellence in Teaching (a University-wide award).
1999 Outstanding Professor Award, Global Executive MBA, Fuqua School of Business, Duke University.
1999 KPMG Teaching Prize, Department of Commerce, University of Queensland.
1998 Faculty Teaching Prize (Business, Economics, and Law), University of Queensland.
1991 Jaedicke Fellow in Finance, Doctoral Program, Graduate School of Business, Stanford University.
1989 Touche Ross Teaching Prize, Department of Commerce, University of Queensland.
1986 University Medal in Commerce, University of Queensland.

Large Grants (over $100, 000)

- Institute of Teaching and Learning Innovation Grant 2016-17, Technology-enhanced Learning Grant ($200,000), with K. Benson, B. Oliver and J. Birt.

- Australian Research Council Linkage Grant, 2008—2010, Managing Asymmetry Risk ($320,000), with T. Brailsford, J.Alcock, and Tactical Global Management.
- Intelligent Grid Cluster, Distributed Energy – CSIRO Energy Transformed Flagship Collaboration Cluster Grant, 2008-2010 ($552,000)
- Australian Research Council Research Infrastructure Block Grant, 2007—2008, Australian Financial Information Database ($279,754).
- Australian Research Council Discovery Grant, 2006—2008, Capital Management in a Stochastic Earnings Environment ($270,000).
- Australian Research Council Discovery Grant, 2005—2007, Australian Cost of Equity.
- Australian Research Council Discovery Grant, 2002—2004, Quantification Issues in Corporate Valuation, the Cost of Capital, and Optimal Capital Structure.
- Australian Research Council Strategic Partnership Grant, 1997—2000, Electricity Contracts and Securities in a Deregulated Market: Valuation and Risk Management for Market Participants.

Current Research Interests

Benchmark returns and the cost of capital. Corporate Finance. Capital structure. Real and strategic options and corporate valuation. Financial and credit risk management. Empirical finance and asset pricing.

Publications

Faff, R., S. Gray, and H. Norton, (2015), "Yes, one-day international cricket 'in-play' strategies can be profitable!" *Journal of Banking and Finance*, forthcoming.

Gray, S. and J. Nowland, (2015), "The Diversity of Expertise on Corporate Boards in Australia," *Accounting and Finance*, forthcoming.

Darat, A., S. Gray, J. C. Park and S. Wu, (2014), "Corporate governance and bankruptcy risk" *Journal of Accounting, Auditing and Finance*, forthcoming.

Gray, S., I. Harymawan and J. Nowland, (2014), "Political and government connections on corporate boards in Australia: Good for business?" *Australian Journal of Management*, forthcoming.

Brailsford, T., S. Gray and S. Treepongkaruna, (2014), "Explaining the bid-ask spread in the foreign exchange market: A test of alternate models," *Australian Journal of Management*, 39, 4, 573-591.

Faff, R., S. Gray and M. Poulsen, (2014), "Financial inflexibility and the value premium," *International Review of Finance*, 13, 3, 327-344.

Fitzgerald, T., S. Gray, J. Hall and R. Jeyaraj, (2013), "Unconstrained estimates of the equity risk premium" *Review of Accounting Studies*, 18, 560-639.

Gray, S. and J. Nowland, (2013), "Is prior director experience valuable?" *Accounting and Finance*, 53, 643-666.

Chen, E. T., S. Gray and J. Nowland, (2012), "Family representatives in family firms" *Corporate Governance: An International Review*, 21(3), 242-263.

Treepongkaruna, S., R. Brooks and S. Gray, (2012), "Do Trading Hours Affect Volatility Links in the Foreign Exchange Market?" *Australian Journal of Management*, 37, 7-27.

Chen, E. T., S. Gray and J. Nowland, (2012), "Multiple founders and firm value" *Pacific Basin Finance Journal*, 20, 3, 398-415.

Chan, K-F., R. Brooks, S. Treepongkaruna and S. Gray, (2011), "Asset market linkages: Evidence from financial, commodity and real estate assets," *Journal of Banking and Finance*, 35, 6, 1415-1426.

Parmenter, B, A. Breckenridge, and S. Gray, (2010), 'Economic Analysis of the Government's Recent Mining Tax Proposals', *Economic Papers*: *A Journal of Economics and Policy*, 29(3), September, 279-91.

Gray, S., C. Gaunt and Y. Wu, (2010), "A comparison of alternative bankruptcy prediction models," *Journal of Contemporary Accounting and Economics*, 6, 1, 34-45.

Feuerherdt, C., S. Gray and J. Hall, (2010), "The Value of Imputation Tax Credits on Australian Hybrid Securities," *International Review of Finance*, 10, 3, 365-401.

Gray, S., J. Hall, D. Klease and A. McCrystal, (2009), "Bias, stability and predictive ability in the measurement of systematic risk," *Accounting Research Journal*, 22, 3, 220-236.

Treepongkaruna, S. and S. Gray, (2009), "Information volatility links in the foreign exchange market," *Accounting and Finance*, 49, 2, 385-405.

Costello, D., S. Gray, and A. McCrystal, (2008), "The diversification benefits of Australian equities," *JASSA*, 2008, 4, 31-35.

Gray, S. and J. Hall, (2008), "The Relationship Between Franking Credits and the Market Risk Premium: A Reply," *Accounting and Finance*, 48, 1, 133-142.

Gray, S., A. Mirkovic and V. Ragunathan, (2006), "The Determinants of Credit Ratings: Australian Evidence," *Australian Journal of Management*, 31(2), 333-354.

Choy, E., S. Gray and V. Ragunathan, (2006), "The Effect of Credit Rating Changes on Australian Stock Returns," *Accounting and Finance*, 46(5), 755-769.

Gray, S. and J. Hall, (2006), "The Relationship Between Franking Credits and the Market Risk Premium," *Accounting and Finance*, 46(3), 405-428.

Gray, S. and S. Treepongkaruna, (2006), "Are there non-linearities in short-term interest rates?" *Accounting and Finance*, 46(1), 149-167.

Gray, P., S. Gray and T. Roche, (2005), "A Note on the Efficiency in Football Betting Markets: The Economic Significance of Trading Strategies," *Accounting and Finance*, 45(2) 269-281.

Duffie, D., S. Gray and P. Hoang, (2004), "Volatility in Energy Prices. In V. Kaminski," (Ed.), *Managing Energy Price Risk: The New Challenges and Solutions* (3rd ed.). London: Risk Books.

Cannavan, D., F. Finn and S. Gray, (2004), "The Value of Dividend Imputation Tax Credits in Australia," *Journal of Financial Economics*, 73, 167-197.

Gray, S. and S. Treepongkaruna, (2003), "Valuing Interest Rate Derivatives Using a Monte-Carlo Approach," *Accounting and Finance*, 43(2), 231-259.

Gray, S., T. Smith and R. Whaley, (2003), "Stock Splits: Implications for Investor Trading Costs," *Journal of Empirical Finance*, 10, 271-303.

Gray, S. and S. Treepongkaruna, (2003), "On the Robustness of Short-term Interest Rate Models," *Accounting and Finance*, 43(1), 87-121.

Gray, S. and S. Treepongkaruna, (2002), "How to Value Interest Rate Derivatives in a No-Arbitrage Setting," *Accounting Research Journal* (15), 1.

Gray, P. and S. Gray, (2001), "A Framework for Valuing Derivative Securities," *Financial Markets Institutions & Instruments*, 10(5), 253-276.

Gray, P. and S. Gray, (2001), "Option Pricing: A Synthesis of Alternate Approaches," *Accounting Research Journal*, 14(1), 75-83.

Dahlquist, M. and S. Gray, (2000), "Regime-Switching and Interest Rates in the European Monetary System," *Journal of International Economics*, 50(2), 399-419.

Bollen, N., S. Gray and R. Whaley, (2000), "Regime-Switching in Foreign Exchange Rates: Evidence from Currency Options," *Journal of Econometrics*, 94, 239-276.

Duffie, D., S. Gray and P. Hoang, (1999), "Volatility in Energy Prices. In R. Jameson," (Ed.), *Managing Energy Price Risk* (2nd ed.). London: Risk Publications.

Gray, S. and R. Whaley, (1999), "Reset Put Options: Valuation, Risk Characteristics, and an Example," *Australian Journal of Management*, 24(1), 1-21.

Bekaert, G. and S. Gray, (1998), "Target Zones and Exchange Rates: An Empirical Investigation," *Journal of International Economics*, 45(1), 1-35.

Gray, S. and R. Whaley, (1997), "Valuing S&P 500 Bear Market Warrants with a Periodic Reset," *Journal of Derivatives*, 5(1), 99-106.

Gray, S. and P. Gray, (1997), "Testing Market Efficiency: Evidence from the NFL Sports Betting Market," *The Journal of Finance*, 52(4), 1725-1737.

Gray, S. (1996), "Modeling the Conditional Distribution of Interest Rates as a Regime- Switching Process," *Journal of Financial Economics*, 42, 27-62.

Gray, S. (1996), "Regime-Switching in Australian Interest Rates," *Accounting and Finance*, 36(1), 65-88.

Brailsford, T., S. Easton, P.Gray and S. Gray, (1995), "The Efficiency of Australian Football Betting Markets," *Australian Journal of Management*, 20(2), 167-196.

Duffie, D. and S. Gray, (1995), "Volatility in Energy Prices," In R. Jameson (Ed.), *Managing Energy Price Risk*, London: Risk Publications.

Gray, S. and A. Lynch, (1990), "An Alternative Explanation of the January Anomaly," *Accounting Research Journal*, 3(1), 19-27.

Gray, S. (1989), "Put Call Parity: An Extension of Boundary Conditions," *Australian Journal of Management*, 14(2), 151-170.

Gray, S. (1988), "The Straddle and the Efficiency of the Australian Exchange Traded Options Market," *Accounting Research Journal*, 1(2), 15-27.

Teaching

Fuqua School of Business, Duke University, Student Evaluations (0-7 scale):

- Financial Management (MBA Core): Average 6.5 over 7 years.
- Advanced Derivatives: Average 6.6 over 4 years.
- Empirical Issues in Asset Pricing: Ph.D. Class

1999, 2006 Outstanding Professor Award, Global Executive MBA, Fuqua School of Business, Duke University.

UQ Business School, University of Queensland, Student Evaluations (0-7 scale):

- Finance (MBA Core): Average 6.6 over 10 years.
- Corporate Finance Honours: Average 6.9 over 10 years.

2002 Australian University Teaching Award – Business (a national award for all university instructors in all disciplines).
2000 University of Queensland Award for Excellence in Teaching.
1999 Department of Commerce KPMG Teaching Prize, University of Queensland.
1998 Faculty Teaching Prize, Faculty of Business Economics and Law, University of Queensland.
1998 Commendation for Excellence in Teaching, University-wide Teaching Awards, University of Queensland.
1989 Touche Ross Teaching Prize, Department of Commerce, University of Queensland.

Board Positions

2012 - Present: Director, Children's Hospital Foundation, Queensland.
2002 - Present: Director, Financial Management Association of Australia Ltd.
2003 - 2012: Director, Moreton Bay Boys College Ltd. (Chairman from 2007).
2002 - 2007: External Risk Advisor to Board of Enertrade (Queensland Power Trading Corporation Ltd.)

Consulting

SFG Consulting: 1997-2014.
Frontier Economics: 2014-Present.

Twenty years' experience in consulting to companies, government-owned corporations, government and regulatory agencies. Examples include:

- *Regulatory cost of capital*: Preparation of submissions in regulatory determinations. Clients include all Australian energy transmission and distribution businesses, FOXTEL, Telstra, BBI, ACCC, IPART, ERA.

- *Corporate cost of capital reviews*: Review of cost of capital estimates for project evaluation and impairment testing purposes. Clients include QANTAS, Stanwell Corporation, Ecowise.

- *Executive stock option valuation*: Clients include Collins Foods Group, Ground Probe, Crater Gold Mining, Beach Petroleum.

- *New Project Evaluation*: Assisting companies and GOCs to evaluate proposed new projects. Particular focus is on quantifying risk and uncertainty and presenting possible outcomes in a probabilistic framework. Clients include Queensland Treasury Corporation, Queensland Accommodation Group, Stanwell, EnerTrade.

- *Financial modelling and forecasting*: Clients include ATO (forecasting delinquent payments), ASX (forecasting trading volumes), Compass Resources (integrated mine valuation model).

Retained as a valuation expert in many litigation cases; produced many expert witness reports; appeared in Court for cross examination many times including:

- *Macquarie Generation*: Witness for AGL in competition case.
- *Telstra v. ACCC*: Witness for Telstra in rate of return regulation case.
- *C7 Case*: Witness for PBL, Newscorp, Telstra re valuation of Seven's failed cable TV network.
- *Alcan v. NT Commissioner of Revenue*: Witness for Alcan re valuation of combined bauxite mine and alumina refinery for stamp duty purposes.

FRONTIER ECONOMICS | MELBOURNE | SYDNEY
Frontier Economics Pty Ltd 395 Collins Street Melbourne Victoria 3000
Tel: +61 (0)3 9620 4488 Fax: +61 (0)3 9620 4499 www.frontier-economics.com
ACN: 087 553 124 ABN: 13 087 553 124

The required return on equity under the AER's Rate of Return Guideline

REPORT PREPARED FOR POWERLINK

January 2016

The required return on equity under the AER's Rate of Return Guideline

Executive Summary iii

1.1 Context iii

1.2 Summary of conclusions iii

2 The regulatory framework 9

2.1 The AEMC's rule changes 9

2.2 The AER's Rate of Return Guideline 12

2.3 The AER's foundation model approach 16

2.4 The focus of this report 19

3 The required return on equity 20

3.1 The risk-free rate 20

3.2 Equity beta 20

3.3 Market risk premium 45

4 Consideration of the AER's cross checks 57

4.1 Overview 57

4.2 Consideration of MRP estimates derived using historical real returns 57

4.3 Consideration of independent expert estimates of the return on equity 58

4.4 Consideration of broker reports 60

4.5 Conclusions in relation to cross checks 61

5 Inflation forecasts 63

6 Declaration 66

7 References 67

8 Appendix: Curriculum Vitae of Professor Stephen Gray 69

Final

The required return on equity under the AER's Rate of Return Guideline

Figures

Figure 1: Government bond yields and the AER's allowed return on equity 18

Figure 2. Summary of AER international beta estimates 27

Figure 3. The relationship between excess returns and beta 33

Figure 4. Sharpe-Lintner CAPM vs. empirical relationship. 34

Figure 5. Derivation of adjusted equity beta. 35

Figure 6: Lewellen, Nagel and Shanken (2010) analysis of Sharpe-Lintner CAPM 37

Figure 7: Lewellen, Nagel and Shanken (2010) analysis of Fama-French three factor model 38

Figure 8. SL-CAPM and Fama-French explanatory power 39

Figure 9: Range of AER DGM estimates of the required return on the market 49

Figure 10: AER estimates of MRP from historical excess returns and the DGM 52

Figure 11: AER comparison of independent expert estimates of the return on equity 59

Tables

Table 1. PwC (2014) beta estimates for the Utilities sector in New Zealand 31

Table 2: Equity beta estimates for use in SL-CAPM 45

Table 3: AER DGM estimates of the required return on the market 48

Table 4: Market risk premium estimates 56

Table 5: AER's inflation forecasts in recent NSW draft decisions 64

Table 6: AER's inflation forecasts in recent Ergon Energy final decision 64

Table 7: Forecast inflation for the period 2015-16 to 2024-25 using the AER's preferred approach 65

Executive Summary

1.1 Context

1 Frontier Economics (**Frontier**) has been retained by Powerlink Queensland to provide our views on a range of issues relating to the computation of the allowed return on equity in the Australian regulatory setting. Specifically, we have been asked to:

a. Apply the "foundation model" approach for estimating the required return on equity that is set out in the Australian Energy Regulator's (**AER's**) Rate of Return Guideline (**Guideline**) to updated data that have become available;

b. Summarise the main submissions from stakeholders in relation to the estimation of foundation model parameters; and

c. Apply the AER's approach to estimating expected inflation on a rolling basis from the 2015-16 financial year.

2 This report has been authored by Professor Stephen Gray, Professor of Finance at the UQ Business School, University of Queensland and Director of Frontier Economics, a specialist economics and corporate finance consultancy. I have Honours degrees in Commerce and Law from the University of Queensland and a PhD in Financial Economics from Stanford University. I teach graduate level courses with a focus on cost of capital issues, I have published widely in high-level academic journals, and I have more than 15 years' experience advising regulators, government agencies and regulated businesses on cost of capital issues. A copy of my curriculum vitae is attached as an appendix to this report.

1.2 Summary of conclusions

3 The context of this report is that:

a. The AER has, in its Rate of Return Guideline and subsequent regulatory decisions, adopted the Sharpe-Lintner Capital Asset Pricing Model (**SL-CAPM**) as its foundation model for the purpose of estimating the required return on equity for the benchmark efficient entity; and

b. The revised National Electricity Rules (**NER**) require the AER, when estimating the required return on equity, to have regard to

relevant estimation methods, financial models, market data and other evidence.[1]

4 In this report we consider how a regulator would best have regard to the relevant estimation methods, financial models, market data and other evidence – conditional on using an approach where only one financial model is estimated (i.e., a "foundation model" approach) and where the SL-CAPM is used as that foundation model. That is, our task in this report is to consider how the SL-CAPM parameters would best be estimated so that the resulting estimate of the required return on equity properly reflects all of the relevant estimation methods, financial models, market data and other evidence.

5 For the risk-free rate:

a. The AER's Guideline approach for estimating the risk-free rate is to use the yield on 10-year Commonwealth Government Securities (CGS) averaged over a 20-day rate-setting period; and

b. That approach is uncontroversial and produces an estimate of 2.72% when applied to the 20-day period ending on 15 September 2015. This estimate will eventually have to be updated to the averaging period adopted at the beginning of the relevant regulatory period;

6 In regard to the equity beta:

a. The AER's Guideline approach is to fix a primary range based on regression estimates for a small sample of domestic comparators and to then use other relevant evidence to select a point estimate from within the primary range;

b. In our view, there is no reason to believe that the application of the AER's approach to the latest available data would produce an estimate different from its Guideline estimate of 0.7. This is because:

i. In several recent decisions, the AER has adopted a "primary" range for beta of 0.4 to 0.7, based on its own interpretation of the evidence. It is not a statistical range or confidence interval and it is inconsistent with the recommendation of its own consultant. Thus, it seems highly unlikely that the AER would now adopt any range other than 0.4 to 0.7; and

ii. Under the AER's approach, the primary range is apparently immutable and any other relevant evidence can

[1] NER 6.5.2(e)(1); ^A.6.2(e)(1)

only inform the selection of a point estimate from within that range. There is already a wealth of evidence to support an estimate above 0.7. Consequently, it is unlikely that the AER's approach would result in an estimate other than 0.7.

c. Many stakeholders have submitted that the AER's approach:

   i. Applies unreasonably disproportionate weight to the very small sample of domestic comparators;

   ii. Assigns a range of 0.4 to 0.7 to the domestic evidence without any proper basis;

   iii. Misconstrues the international evidence; and

   iv. Misconstrues its conceptual analysis.

   Addressing any of these issues would result in an equity beta estimate above the AER's current allowance of 0.7.

d. In our view, the AER's approach of setting an initial immutable range on the basis of a subset of the relevant evidence effectively neuters the effect of the other relevant evidence. In Section 3.2 of this report, we explain why we consider that a proper consideration of all of the relevant evidence supports a foundation model equity beta estimate of 0.91.

7 In regard to the market risk premium (MRP):

a. The AER's Guideline approach involves estimating ranges from the historical excess returns and Dividend Growth Model (**DGM**) approaches, merging those two ranges into a single combined range, and then using judgement to select an estimate from within the combined range;

b. The AER's November 2014 draft decisions and recent final decisions indicate that the AER implements its approach to estimating the MRP by first setting a primary range. This primary range is formed by taking the long-run average of excess returns over different historical periods. Other relevant evidence is then relegated to informing the selection of a point estimate from within that primary range;

c. In its Guideline, the AER adopted a point estimate of 6.5% at the top of its primary range, because the DGM evidence at the time suggested an estimate of at least 6.5%;

d. The AER's own DGM evidence now supports MRP estimates that are materially above 6.5%;

e. Given that the AER's approach effectively caps the MRP estimate at 6.5% (the upper bound of its primary range), that approach would currently produce an estimate of 6.5% because the other relevant evidence supports a higher estimate;

f. Our view is that the AER approach (as set out above) does not produce the best possible estimate of the MRP. The approach of capping the MRP to the top of the range derived using historical excess returns has no logic to it because:

   i. The historical excess returns approach provides an estimate of the MRP over *average* market conditions.[2] Thus, the range that is generated from this approach encompasses the statistical uncertainty about the MRP for long-run average market conditions. There is no basis at all for constraining an estimate of the MRP for the *prevailing* market conditions on the basis of statistical uncertainty about the estimate of the MRP for long-run *average* market conditions.[3] The NER provide that, when estimating the return on equity, the AER must have regard to "the prevailing conditions in the market for equity funds";[4] and

   ii. Such an approach would be inconsistent with the AER's own DGM evidence, which suggests that the MRP in the prevailing market conditions has increased materially since the publication of its Guideline;

g. Rather, our view is that the DGM evidence should not be constrained by a cap of 6.5% that is based on the long-run mean of historical excess returns. That approach has produced a MRP estimate of 6.5% even as the AER's own DGM evidence suggests that the contemporaneous MRP is further and further above 6.5%.

h. In our view, the AER's approach of setting an initial immutable cap of 6.5% on the basis of a subset of the relevant evidence effectively neuters the effect of the other relevant evidence. In

---

2 That is, the average conditions over the particular historical period that was used.

3 That is, the arithmetic mean estimates that the AER considers are estimates of the average risk premium over the relevant sampling periods. Those estimates range from 5.9% to 6.5%. This does *not* imply that the MRP could be as low as 5.9% in some market conditions or as high as 6.5% in other market conditions. What it *does* imply is that a point estimate for the MRP in *average* market conditions should come from the range of 5.9% to 6.5%.

4 National Electricity Rules Version 73, clause 6A.6.2(g).

Section 3.3 of this report, we explain why we consider that a proper consideration of all of the relevant evidence supports a foundation model MRP of 7.9%.

2 The regulatory framework

2.1 The AEMC's rule changes

8 Throughout 2011 and 2012, the Australian Energy Markets Commission (**AEMC**) considered a number of Rule change proposals submitted by the AER and a group of major energy users. SFG (now part of Frontier) assisted the AEMC as principal adviser on rate of return issues throughout this process.

9 In its determination in November 2012, the AEMC made a number of fundamental changes to the National Electricity Rules (NER) insofar as the allowed return on equity is concerned. The key changes that the AEMC made were:

a. To introduce an "overall rate of return objective" to ensure that the focus is on the reasonableness of the allowed rate of return – eliminating the silo approach that focused separately on each individual parameter; and

b. Requiring the AER to have regard to all relevant approaches and evidence – seeking to eliminate the focus on a single model (the Sharpe-Lintner CAPM) that could be used without having regard to a weight of evidence suggesting that the way the regulator implemented that model produced an estimate of the required return on equity that was implausible in the circumstances.

10 In particular, the new rules require that the allowed rate of return must achieve the **allowed rate of return objective**:

> [t]he rate of return for a Transmission Network Service Provider is to be commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk as that which applies to the Transmission Network Service Provider in respect of the provision of prescribed transmission services.[5]

11 In determining the allowed rate of return, regard must be had to:

> 1. relevant estimation methods, financial models, market data and other evidence;
>
> 2. the desirability of using an approach that leads to the consistent application of any estimates of financial parameters that are relevant to the estimates of, and that are common to, the return on equity and the return on debt; and
>
> 3. any interrelationships between estimates of financial parameters that are relevant to the estimates of the return on equity and the return on debt.[6]

---

[5] For example, see NER 6A.6.2(c).

[6] For example, see NER 6A.6.2(e).

12 When determining the allowed return on equity, regard must also be had to:

> the prevailing conditions in the market for equity funds.[7]

13 In addition, the required return on equity must:

> be estimated such that it contributes to the achievement of the allowed rate of return objective.[8]

14 In its Final Determination, the AEMC was very clear about its intention that the AER should not use a narrow formulaic approach, but should have regard to all relevant evidence while keeping a focus on the reasonableness of the allowed return on equity. For example, the AEMC noted that:

> The Commission also expressed concern that the provisions create the potential for the regulator and/or appeal body to interpret that the best way to estimate the allowed rate of return is by using a relatively formulaic approach. This may result in it not considering the relevance of a broad range of evidence, and may lead to an undue focus on individual parameter values rather than the overall rate of return estimate.[9]

15 The AEMC also noted that the rule changes were designed to:

> encourage the regulator to focus on whether its overall estimate of the rate of return is appropriate.[10]

16 The AEMC was also very clear about the need to ensure that the allowed return on equity has regard to the prevailing conditions in the market for equity funds. The AEMC stated that:

> If the allowed rate of return is not determined with regard to the prevailing market conditions, it will either be above or below the return that is required by capital market investors at the time of the determination. The Commission was of the view that neither of these outcomes is efficient nor in the long term interest of energy consumers.[11]

and:

> The second principal requirement is that the return on equity must take into account the prevailing conditions in the market for equity funds. It reflects the importance of estimating a return on equity that is sufficient to allow efficient investment in, and efficient use of, the relevant services. However, this requirement does not mean that the regulator is restricted from considering historical data in generating its estimate of the required return on equity. Rather, it ensures that current market conditions are fully reflected in such

7 For example, see NER 6A.6.2(g).

8 NER 6A.6.2(f).

9 AEMC Rule Change Final Determination, p. 40.

10 AEMC Rule Change Final Determination, p. 41.

11 AEMC Rule Change Final Determination, p. 44.

> estimates to ensure that allowed rates are sufficient for efficient investment and use.[12]

17 The AEMC also noted that for a framework to produce an allowed return on equity that has proper regard to the prevailing conditions in the market for equity funds, it must be flexible enough to respond to changes in financial market conditions. One of the AEMC's primary concerns was that the mechanistic CAPM approach was "overly rigid" such that the AER's implementation of the CAPM produced unreasonable results in an environment where financial market conditions can change significantly. The AEMC stated that:

> The global financial crisis and its continuing impact through the European sovereign debt crisis have highlighted the inherent dangers in an overly rigid approach to estimating a rate of return in unstable market conditions.[13]

and that its rule change would:

> enable the regulator to better respond to changing financial market conditions.[14]

18 The AEMC explicitly linked the consideration of a range of models to the production of the best possible estimate of the efficient financing costs as required by the National Electricity Objective (**NEO**) and the Revenue and Pricing Principles (**RPP**):

> Achieving the NEO, the NGO, and the RPP requires the best possible estimate of the benchmark efficient financing costs. The Commission stated that this can only be achieved when the estimation process is of the highest possible quality. The draft rule determination stated that this meant that a range of estimation methods, financial models, market data and other evidence must be considered.[15]

19 That is, the AEMC's clear view is that the NGO and RPP require the AER to produce the best possible estimate of the required return on equity, which in turn requires the consideration of a range of financial models.[16]

20 In its Final Determination, the AEMC sought to address concerns that, despite its best efforts in making material changes to the Rules, the regulator would seek to continue to estimate the required return on equity via a mechanistic implementation of the SL-CAPM. The AEMC sought to assuage these concerns, but indicated that it would not set out a list of what other information and models the regulator should consider, due to the risk that any such list itself would be applied in a mechanistic fashion:

---

12 AEMC Rule Change Final Determination, p. 69.

13 AEMC Rule Change Final Determination, p. 40.

14 AEMC Rule Change Final Determination, p. 23.

15 AEMC Rule Change Final Determination, p. 43.

16 The required return on equity is a key component of the efficient financing costs.

> A major concern expressed in numerous submissions is that under the proposed changes the regulator would still be able to, in effect, make exclusive use of the CAPM when estimating a rate of return on equity. The Commission understands this concern is potentially of considerable importance given its intention is to ensure that the regulator takes relevant estimation methods, models, market data and other evidence into account when estimating the required rate of return on equity. As discussed above, the Commission takes the view that the balance between flexibility and prescription has been adequately achieved in the final rules. It would be counterproductive to attempt to prescribe a list of models and evidence, which would almost certainly be non-exhaustive and could lead to rigid adherence to them in a mechanistic fashion.[17]

21 Rather:

> To determine the rate of return, the regulator is also required to have regard [to] relevant estimation methods, financial models, market data and other evidence. The intention of this clause of the final rule is that the regulator must consider a range of sources of evidence and analysis to estimate the rate of return. In addition, the regulator must make a judgement in the context of the overall objective as to the best method(s) and information sources to use, including what weight to give to the different methods and information in making the estimate. In doing so, the regulator should also have regard to taking an internally consistent approach and, to the greatest extent possible, use consistent estimates of values that are common across the process, as well as properly respecting any inter-relationships between values used.[18]

and:

> Implicit in this requirement to consider a range of methods, models and information is that checks of reasonableness will be undertaken.[19]

22 The AEMC also noted the need to:

> safeguard the framework against the problems of an overly-rigid prescriptive approach that cannot accommodate changes in market conditions. Instead, sufficient flexibility would be preserved by having the allowed rate of return always reflecting the current benchmark efficient financing costs.[20]

2.2 The AER's Rate of Return Guideline

2.2.1 Guideline to be published

23 Under the revised NER, the AER is required to publish a Rate of Return Guideline every three years. The purpose of this Guideline is to indicate what

17 AEMC Rule Change Final Determination, p. 57.

18 AEMC Rule Change Final Determination, pp. 67-68.

19 AEMC Rule Change Final Determination, p. 69.

20 AEMC Rule Change Final Determination, p. 46.

approach the AER will adopt when setting the allowed return on equity in its determinations over the subsequent three years. The Guideline is non-binding in that service providers' proposals and the AER's determinations can depart from the Guideline, but they must explain the reasons for any such departure. The AER published its first Guideline in December 2013.

2.2.2 The AER's approach under the previous Rules

24 Under the previous NER, the AER's approach was to estimate the required return on equity using the SL-CAPM only. This involved estimating three parameters and inserting those estimates into the SL-CAPM formula – the result being used as the allowed return on equity:

$$r_e = r_f + \beta \times MRP\,.$$

25 Thus, estimates are required for the three parameters: the risk-free rate, equity beta, and the MRP.

26 Under the previous NER the AER has traditionally adopted stable estimates of beta and the MRP. For example, it adopted a beta estimate of 0.8 for every one of its determinations after its 2009 WACC Review and its MRP estimates have only ever been 6.0% or 6.5%. Thus, the AER's approach has produced allowed returns on equity that effectively vary in line with movements in government bond yields, which drive estimates of the risk-free rate.

27 This approach created a form of lottery for regulated businesses. Those businesses that were fortunate enough to have prices reset when government bond yields were high were allowed a high return on equity for the entire regulatory period, and other businesses received low returns for their five-year regulatory periods because government bond yields happened to be low at the time their resets were settled. The impact of this approach becomes more extreme during periods of volatility, whereby government bond yields move to extreme levels in one direction or the other.

28 In our view, investors' required return on equity does not vary one-for-one with changes in the government bond yield. We do not suggest that required returns are constant, but our view is that actual required returns are more stable than the "lucky dip" estimates would suggest.

2.2.3 The AER's "foundation model" approach

29 In its Guideline, the AER adopted what it called a "foundation model" approach for determining the allowed return on equity, selecting the SL-CAPM as the single foundation model. Under this approach, the AER inserts estimates of the three SL-CAPM parameters into the pricing formula and the output is then adopted as the allowed return on equity.

30 The AER has stated that, under the new Rules, it will have regard to a broader range of evidence to inform its estimates of beta, and the MRP. Specifically, the AER has indicated that:

a. When estimating beta it will have primary regard to empirical estimates for domestic comparators and secondary regard to international evidence (including empirical estimates for international comparators) and to the "theory of the Black CAPM;"

b. When estimating the MRP, the AER will continue to have primary regard to estimates based on the mean of historical excess returns, but will have more regard to estimates from its dividend growth model (**DGM**); and

c. It will have regard to a number of "cross-checks" to test the reasonableness of its overall allowed return on equity. These cross checks include:

   i. Estimates published in independent expert valuation reports;

   ii. Estimates published by equity research analysts (so called "broker estimates"); and

   iii. Estimates based on historical real returns – a method for estimating the MRP that the AER referred to as "the Wright approach".

2.2.4 Problems with the foundation model concept

31 The AER describes the SL-CAPM as its *foundation* model, but it is in fact the *only* model that it uses to estimate the required return on equity. No other model for the required return on equity is estimated – the allowed return on equity is computed by inserting point estimates for the risk-free rate, equity beta and the MRP into the SL-CAPM formula. The resulting point estimate of the required return on equity is then adopted as the allowed return on equity.

32 The Guideline materials set out the AER's reasons for adopting its foundation model approach.[21] These reasons include the simplicity and predictability of the approach and the opportunity to apply regulatory judgment.[22] However, our view is that the only valid reason for adopting the foundation model approach would be if that approach provides the best estimate of the required return on equity for the benchmark efficient firm in the prevailing conditions in the market

21 AER Rate of Return Guideline, Explanatory Statement, p. 55.

22 AER Rate of Return Guideline, Explanatory Statement, p. 55.

for equity funds. Equivalently, the only reason for disregarding altogether the estimates from other relevant financial models is if those estimates contribute no useful information on the true returns required by equity investors. However, there is no reference to the quality of estimates from different models in any of the AER's reasons. Our view is in alignment with the view of the AEMC that:

> Achieving the NEO, the NGO, and the RPP requires the best possible estimate of the benchmark efficient financing costs. The Commission stated that this can only be achieved when the estimation process is of the highest possible quality. The draft rule determination stated that this meant that a range of estimation methods, financial models, market data and other evidence must be considered.[23]

33 Having determined that it will adopt a single "foundation" model, the AER then goes about selecting that single model. This involves a comparison of each alternative model against the default SL-CAPM according to a set of criteria that the AER has developed. In our view this is the wrong approach. Rather than comparing individual models against the SL-CAPM across its own criteria, the AER should be considering how the estimates from the various relevant models can be used to produce the best possible estimate of the required return on equity for the benchmark efficient entity.

34 The AER states that it has had appropriate regard to other relevant financial models, but it never even proceeds to estimating any parameter for any other model. Rather, the AER "has regard to" the other relevant financial models by either (a) referring to them when applying its judgment to the selection of point estimates to be inserted into the SL-CAPM formula, or (b) considering them and then assigning them zero weight.

35 The obvious problem with this approach is that it is impossible to know whether any adjustment that the AER might make to its SL-CAPM parameter estimates, to account for evidence from other financial models, is appropriate. If the other financial models are never estimated, there is no way of knowing whether or not any particular SL-CAPM adjustment is adequate.

2.2.5 The prospect of change under the new NER

36 In its Guideline materials, the AER raised the possibility that its approach under the new Rules might lead to more stable estimates of the allowed return on equity. In this section, we review the AER's statements about the benefits of a more stable allowed return on equity and the process by which that might be achieved under its foundation model approach.

37 In its Guideline materials, the AER summarised the potential benefits of more stability in allowed returns:

---

23 AEMC Final Determination, p. 43.

> In our consultation paper, we stated that a relatively stable regulatory return on equity would have two effects:
>
> - It would smooth prices faced by consumers.
> - It would provide greater certainty to investors about the outcome of the regulatory process.[24]

38 The AER also noted that:

> Submissions in response to our draft guideline were also broadly supportive of stability.[25]

39 The AER went on to explain the process by which its allowed return on equity might become more stable under the new NER:

> …the DGM and the Wright approach (for implementing the Sharpe–Lintner CAPM) will result in estimates of the return on equity that may be relatively stable over time. The informative use of these implementations of the Sharpe–Lintner CAPM, in addition to the DGM and other information, is expected to lead to more stable estimates of the return on equity than under our previous approach. The extent of this stability will depend on:
>
> - the extent to which movements in the estimates of the risk free rate and market risk premium in the foundation model offset each other
> - the informative value provided by the DGM and Wright approach (and other information that provides relatively stable estimates of the return on equity).[26]

2.3 The AER's foundation model approach

2.3.1 The implementation of the AER's foundation model approach under the new NER

40 Under the revised NER, the AER determines the allowed return on equity by inserting estimates of the same three parameters into the same SL-CAPM formula as it used under the previous NER. The AER does not estimate any parameters for any other financial models.

41 In relation to the risk-free rate parameter, the AER used the contemporaneous yield on 10-year government bonds under the previous NER, and it adopts the same approach under the new NER.

42 In relation to the equity beta parameter, under the previous NER the AER primarily considered regression estimates from a set of domestic comparators and concluded that the evidence supported a range of 0.4 to 0.7. Under the new

---

24 AER Rate of Return Guideline, Explanatory Statement, pp. 65-66.

25 AER Rate of Return Guideline, Explanatory Statement, pp. 65-66.

26 AER Rate of Return Guideline, Explanatory Statement, p. 66.

NER, the AER primarily considers regression estimates from the same set of comparators (even though some of them no longer exist) and concludes that the evidence supports a range of 0.4 to 0.7. Under the previous NER, the AER adopted a point estimate of 0.8 after weighing up issues such as the reliability of its empirical evidence and the prior regulatory estimates of 0.9 to 1.0. Under the new NER, the AER adopts an estimate of 0.7 on the basis that there is an additional five years of data since its 2009 WACC Review, which justifies additional weight being applied to its empirical estimates.[27]

43 In relation to the MRP parameter, under the previous NER the AER relied primarily on historical excess returns and used DGMs as a cross check. This led the AER to adopt a 6.5% MRP in its 2009 WACC Review. The AER now places "most reliance" on historical excess returns and "second most reliance" on DGMs:

> The most notable change to our approach is that we now place more reliance on DGMs than using them as a cross check.[28]

This has led the AER to also adopt a MRP estimate of 6.5% under the new NER.

2.3.2 The effect of the AER's approach under the new Rules

44 Under the revised NER, the AER has adopted the practice of setting the allowed return on equity to be equal to the contemporaneous 10-year government bond yield plus a fixed premium of 4.55%.[29] Thus, as government bond yields rise and fall, the allowed return on equity rises and falls in one-for-one alignment. Since government bond yields have generally fallen since the AER's 2009 WACC Review, the AER's allowed return on equity has fallen commensurately, as illustrated in Figure 1 below.

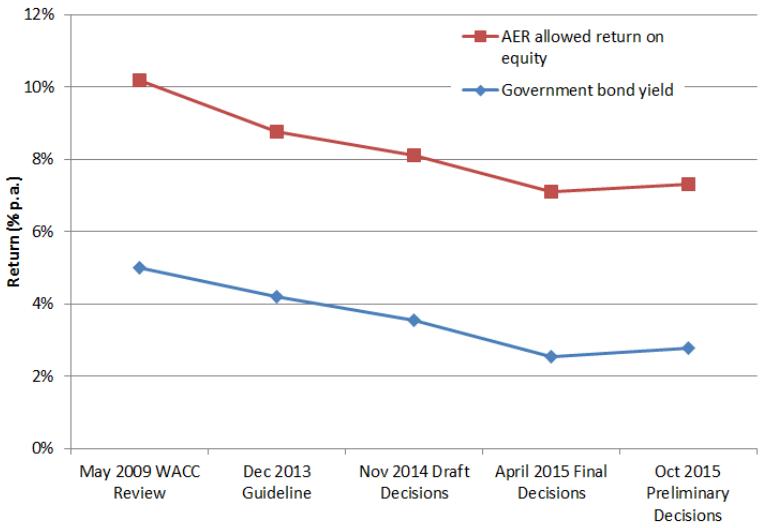
---

27 AER Rate of Return Guideline, Equity Beta Issues Paper, p. 8.

28 AER Rate of Return Guideline, Explanatory Statement, p. 110.

29 Equity risk premium = Equity beta × market risk premium = 0.7 × 6.5% = 4.55%.

Figure 1: Government bond yields and the AER's allowed return on equity



Source: AER decisions.

45 In its October 2015 Preliminary Decision for JEN, the AER's allowed return on equity was 7.3%. Relative to this benchmark, the AER's allowed return on equity was:

a. 40% higher at the time of its 2009 WACC Review;

b. 20% higher at the time of its Guideline; and

c. 11% higher at the time of its November 2014 draft decisions (for NSW and ACT network service providers).

46 Moreover, under the AER's approach, the allowed return on equity for the five-year regulatory period would have been:

a. 7.6% for a firm regulated in December 2014;

b. 6.9% for a firm regulated in April 2015; and

c. 7.5% for a firm regulated in May 2015.

47 In summary, the prospect of some measure of stability in the allowed return on equity has not materialised. Rather, the allowed return on equity is still determined by adding a fixed premium (4.55%) to the government bond yield.

48 The reason that the prospect of some stability was not delivered is that the means of delivering that stability (the DGM and Wright approaches for estimating the MRP) have had no perceptible effect on the AER's decision-making process:

a. The AER's own DGM estimates indicate that the MRP has increased materially since its 2013 Guideline – which would offset much of the effect of falling government bond yields and produce some stability in the allowed return on equity. However,

the AER discounts that evidence, concluding that it will have much less regard to its own DGM evidence when government bond yields are very low or very high.[30] That is, in just the scenarios where the DGM evidence could have a stabilising effect on the allowed return on equity, the AER will have less regard to it.

b. Despite its comments about the beneficial stabilising effect of its use of historical real returns to estimate the MRP in the Guideline (i.e., the Wright approach), in practice the AER has had no real regard to that approach.[31]

2.4 The focus of this report

49 The SL-CAPM is only one of a number of financial models that can be used to estimate the required return on equity for the benchmark efficient firm. In its Guideline, the AER concluded that three other financial models are also relevant: the Black CAPM, the Fama-French model and the DGM. Many stakeholders have submitted that all of the relevant models should be estimated and that the regulator should have some regard to those estimates. However, under the AER's foundation model approach no model other than the SL-CAPM is estimated. The other relevant models are used, at most, only to inform the estimation of the parameters of the SL-CAPM.

50 The appropriate use of these other relevant models remains a point of contention between the AER and many stakeholders. In reports commissioned by a number of network service providers, we have submitted that the AER cannot possibly have proper regard to a relevant financial model if it does not even estimate it. In that context, we have previously proposed what has become known as a "multi-model approach," whereby each relevant model is estimated and the resulting estimates of the required return on equity are distilled into a single allowed return on equity by taking a weighted-average, where the weights reflect the relative strengths and weaknesses of each model.

51 While it remains our preferred approach, in this report we do not consider the multi-model approach. Rather, we have been asked to consider how all of the relevant evidence can be best accommodated within the AER's foundation model approach. This involves making the best possible use of all of the relevant evidence when estimating the parameters to be inserted into the SL-CAPM.

---

30 JEN Preliminary Decision, Attachment 3, Appendix B, Section B.5.1.

31 We address this point in more detail below.

3 The required return on equity

3.1 The risk-free rate

52 The AER's Guideline approach for estimating the risk-free rate is to use the yield on 10-year Commonwealth Government Securities (CGS) averaged over a 20-day rate-setting period. Since there is unlikely to be a series of CGS with exactly 10 years to maturity, the AER's approach is to interpolate using the yields from two CGS bonds – one with slightly more, and one with slightly less than 10 years to maturity. All yields are converted from semi-annual compounding to annual compounding using the standard conversion formula.

53 This approach is largely uncontroversial and is accepted by the majority of stakeholders. Some user groups have submitted that a shorter term should be used, but that argument was considered at length in the AER's 2009 and 2013 WACC reviews and was rejected on both occasions.

54 We have applied the AER's approach to CGS yields obtained from the Reserve Bank of Australia over the 20-day period ending on 15 September 2015. The estimate of the risk-free rate for this period is 2.72%.

3.2 Equity beta

3.2.1 The AER's Guideline approach

55 In its Guideline, the AER proposes to implement its foundation model approach by dividing the relevant evidence into two groups. The AER considers evidence from domestic comparators to represent its "primary" evidence, and all other evidence to be secondary. The domestic comparators are used to estimate a primary range, and then all other relevant evidence is used to inform the selection of a point estimate from within that range.

56 In its Guideline, the AER concludes that the domestic comparators support a range of 0.4 to 0.7. From within this range, the AER selected a point estimate of 0.7 after considering other relevant evidence including "the theoretical underpinnings of the Black CAPM"[32] and international evidence.

57 That approach, and the 0.7 point estimate, has been endorsed in the AER's recent decisions where the AER has proceeded through the following steps:[33]

---

32 TransGrid Final Decision, Attachment 3, p. 3-37.

33 TransGrid Final Decision, Attachment 3, Appendix D. The same approach has since been adopted in the final decisions for the Queensland and SA distribution businesses.

a. **Conceptual analysis.** The AER conducted a conceptual analysis and concluded that the equity beta of the efficient benchmark firm is likely to be less than 1.0.

b. **Range.** The AER decided that beta would be estimated from within a range of 0.4 to 0.7. This range was formed with reference to empirical beta estimates for nine Australian-listed stocks, compiled by Henry (2014). The AER stated that if it were to arrive at a point estimate for beta on the basis of empirical estimates from Australian-listed stocks, the point estimate would be 0.5.[34] The basis for this conclusion was that, across a number of beta estimates made for different firms and portfolios over different time periods, the AER's view was that the beta estimates appear to be concentrated near 0.5.

c. **Black CAPM.** The AER decided not to make a separate estimate of the cost of equity from the Black CAPM. The rationale for this decision was that the Black CAPM requires an estimate of the zero-beta premium, and the AER concluded that this parameter cannot be estimated with any degree of confidence. However, the AER considered that the theory underlying the Black CAPM has some merit. In theory, the cost of equity for stocks with low beta estimates will lie above the return expected under the Sharpe-Lintner CAPM. So the AER used this theory as support for a beta estimate towards the upper end of the AER's initial range.

d. **International listed firms.** The AER decided not to make a separate estimate of beta from analysis of firms listed in markets other than Australia. The AER refers to beta estimates from several reports, considers that the beta estimates implied by these reports range from 0.3 to 1.0,[35] and that in general the empirical beta estimates from international listed firms support a beta estimate towards the upper end of the AER's initial range.

e. **Predictability.** The AER considered that certainty and predictability was important for stakeholders in setting the estimated rate of return, and noted that a beta estimate at the top of the AER's initial range was a modest step down from its prior estimate of 0.8.[36]

---

34 TransGrid Final Decision, p. 3-216.

35 ENERGEX Final Decision, Attachment 3, p. 3-479.

36 The AER also noted that its beta estimated provided a balance between the views expressed by consumers and the views expressed by service providers. Consumers advocated for a lower regulated rate of return and businesses advocated for a higher regulated rate of return. It is unclear whether balancing these two views is used as a separate criterion for estimating the regulated rate of return, or whether the AER is merely emphasising that it has had regard to submissions received from all stakeholders. For the purpose of this report we do not consider this a relevant issue.

58 In summary, the AER adopted an equity beta estimate of 0.7 in its Guideline and it has confirmed that estimate in all of its subsequent draft and final decisions.

59 Importantly, the AER concluded that:

> …there is no compelling evidence that the return on equity estimate from the SLCAPM will be downward biased given our selection of input parameters.[37]

60 The key words in this passage are "given our selection of input parameters." As set out above, the AER concluded that the domestic data supports a beta point estimate of 0.5. Recognising that:

a. the "theory of the Black CAPM" indicates that the SL-CAPM produces estimates of the required return on equity that are systematically downwardly biased for low-beta firms; and

b. the international evidence supports a beta estimate above 0.5,

the AER made an upward adjustment to its equity beta point estimate – from 0.5 to 0.7.

61 The AER then concluded that, after making that adjustment, its foundation model produced an unbiased estimate of the required return on equity.

3.2.2 Points of contention

62 Many regulated network businesses have submitted that the AER's estimate of 0.7 is unreasonable and does not represent the best estimate that is available from the relevant evidence. The main points of contention are the following:

a. **No Basis for categorisation of evidence.** Stakeholders have submitted that there is no basis for the AER to use one subset of the relevant evidence to form an immutable range that bounds the point estimate even if all of the other evidence suggests an estimate outside of the "primary range."

b. **No basis for setting the primary range to 0.4 to 0.7**. The AER's own consultant advised the AER that the appropriate range is 0.3 to 0.8. The AER does not state what its range represents or how it was selected. It is not a confidence interval, it is not a range that bounds all of the relevant estimates and it is inconsistent with the advice of its own consultant.

c. **No basis for exclusive reliance on domestic comparators**. Stakeholders have also submitted that even if it were appropriate to select a subset of the evidence to create an immutable primary range, the evidence from domestic comparators should not be

37 TransGrid Final Decision, p. 3-61; ENERGEX Final Decision, p. 3-63.

used for that purpose. Specifically, there are currently only four domestic comparators, which is such a small sample that no reliable estimates could be derived from such a sample, and so no material weight should be applied to it. Moreover, the AER's beta estimates for domestic comparators vary materially across time periods and estimation methods. For example:[38]

i. The estimates are imprecise with wide standard errors;[39]

ii. The estimates span a wide range[40] with the vast majority of estimates for comparable firms falling outside the AER's proposed range of 0.4 to 0.7;

iii. Many of the estimates vary materially across different estimation methods;

iv. Many of the estimates vary materially across different sampling frequencies;

v. Many of the estimates vary materially across time;

vi. Over the same period where the estimates for some comparators increase by 20%, others decrease by 20%. This indicates that either (a) the true systematic risk of the two firms moved materially in the opposite direction, in which case it is impossible that those two firms are both comparable, or (b) beta *estimates* are statistically unreliable; and

vii. Many of the estimates vary materially depending on the day of the week used to measure returns.

d. **Mischaracterisation of the international evidence**. The AER concludes that the international evidence supports a range of 0.3 to either 1.0 or 1.3.[41] However, all of the estimates that are lower than 0.7 are badly mischaracterised. For example, the AER concludes that one UK study supports a beta estimate of 0.45. However, that study uses data for only three comparators over only one year. That study was submitted to a UK regulator that assigned it negligible weight relative to other evidence and adopted a final beta of 0.95. The AER also mistakenly makes an

38 The following points were made in SFG (May 2014 Beta) and SFG (February 2015 Beta).

39 Estimation errors can be reduced by expanding the sample of comparators used

40 From less than 0.2 to more than 1.0.

41 TransGrid Final Decision, p. 3-123; ENERGEX Final Decision, p. 3-127.

apples-with-oranges comparison of re-levered equity beta estimates with raw equity beta estimates.

e. **Failure to have proper regard to the Black CAPM**. In its Guideline, the AER recognises that the empirical evidence establishes that the SL-CAPM systematically under-estimates the expected return for low-beta stocks (i.e., stocks with a beta less than 1.0). Thus, for any beta within its range of 0.4 to 0.7, the SL-CAPM is likely to produce an under-estimate. This issue can be addressed by estimating the Black-CAPM, which is a version of the CAPM that has been modified to provide estimates that are more consistent with the observed data. Rather than estimate the Black CAPM and have regard to the resulting estimate, the AER's foundation model approach requires that the Black CAPM can only be used to inform the estimation of parameters for the SL-CAPM. Consequently, this requires a convoluted exercise whereby one considers what beta estimate, when inserted into the SL-CAPM, would produce an estimate of the return on equity that is consistent with the Black CAPM. When that exercise is performed using parameters that the AER defines as "plausible," the result is a beta estimate strictly greater than 0.7. That is, the Black CAPM evidence suggests that a beta strictly greater than 0.7 must be inserted into the SL-CAPM in order to produce estimates that are consistent with the empirical data. However, the AER has no regard to any estimates of the Black CAPM, even those that it defines to be plausible. Rather, the AER proposes to address this issue by "having regard to the theoretical underpinnings of the Black CAPM." Stakeholders have submitted that the only way to have proper regard to the Black CAPM is to estimate it; that the AER's vague assertions about theoretical underpinnings are insufficient.

f. **Failure to have proper regard to other relevant models.** Under the AER's foundation model approach, the only way that other relevant financial models can have an impact on the allowed return on equity is by influencing the beta estimate in the SL-CAPM. The AER recognises that the Fama-French model and the DGMs are both relevant financial models for the purpose of estimating the required return on equity for the benchmark efficient firm, but it gives them no weight at all when determining the allowed return on equity.[42] Stakeholders have argued that the

42 The AER has regard to DGM evidence when estimating the market risk premium, but this involves the application of the DGM to the broad market. The DGM can also be applied to provide a direct

AER has erred in assigning zero weight to these relevant models. For example, the empirical evidence establishes that the Fama-French model materially out-performs the SL-CAPM in fitting the observed data, and the DGM approach is used extensively in regulation cases in other jurisdictions.

g. **Mischaracterisation of the conceptual analysis**. There is broad agreement that equity beta is determined by (a) the business risk of the firms operations, and (b) the amount of leverage (debt financing) employed by the firm. There is also broad agreement that, for the benchmark efficient entity, the business risk is lower than average and the leverage is higher than average. The AER concludes that the former dominates the latter, in which case the equity beta would be lower than average. However, there is no basis for this conclusion. The AER is misled by confusing (a) the components of business risk that have a financial flavour with (b) leverage. However the two are materially different concepts. Indeed, the authors of the report on which the AER relies have advised the AER that it is impossible to determine *ex ante* which of the two components of equity beta dominates – that it is an empirical question.

63 In summary, there are many points of contention in relation to the AER's beta estimate of 0.7. All of the issues set out above suggest an estimate above 0.7.

3.2.3 A current estimate for use in the foundation model approach

64 In our view, the best possible estimate of the equity beta for use in the SL-CAPM foundation model is one that has regard to all of the relevant evidence, including the international evidence and the evidence from other financial models.

International evidence

65 In our view, the best assessment of the international evidence is set out in the reports of CEG (2013)[43] and SFG (2013)[44]. These reports were commissioned by the Energy Networks Association as part of the AER's 2013 Guideline process. CEG identified a set of 56 international comparator firms that each has more than 50% of its assets invested in regulated energy distribution. SFG then estimated the equity betas for each of these 56 firms.

---

estimate of the required return on equity for the benchmark efficient firm, but the AER gives zero weight to that evidence.

43 CEG, 2013, Information on equity beta from US companies, June.

44 SFG Consulting, 2013, Regression-based estimates of risk parameters for the benchmark firm, June.

66 SFG estimated equity betas for each of the nine domestic comparators used by the AER and for the 56 international comparators identified by CEG. SFG estimated the mean beta for each sample as well as a portfolio estimate for each sample. SFG then explained how it distilled this evidence into a single beta estimate:

> The next question is to consider how much weight should be placed on the evidence from Australian-listed firms and the U.S.-listed firms. In reaching a conclusion we considered the issues of comparability and reliability. Ideally we would have a large number of Australian-listed firms to analyse. But the reality is that this sample is so small that to consider it in isolation leads to estimates that are highly unreliable, as demonstrated in our companion report.[29] It should also be noted that the set of comparable firms from the United States was carefully scrutinised by CEG (2013) with respect to the proportion of assets under regulation, their industry classification and their prior use in comparable firm analysis for regulatory decision-making.
>
> So in reaching our final parameter estimates we allowed for each observation of an Australian-listed firm to count for twice as much weight as a U.S.-listed firm. This means that the weight placed on the evidence from the Australian-listed firms is 24% [that is, 9 × 2 ÷ (9 × 2 + 56) = 0.24] and the weight placed on the estimates from the U.S.-listed firms is 76%. Placing twice as much weight on an Australian observation compared to a U.S. observation implies…[f]or the CAPM, a beta estimate of 0.82. [45]

67 In our view, this is the best available estimate of the SL-CAPM equity beta (i.e., an equity beta that does not reflect any evidence from any other financial model or any evidence about the systematic biases of the SL-CAPM). This, we adopt an estimate of 0.82 for the SL-CAPM equity beta for the remainder of this report.

68 As set out below, we conclude that a reasonable consideration of the other international evidence that has been submitted also corroborates an estimate materially above 0.7.

International evidence considered in the Guideline

69 The Guideline indicates that the AER considers that empirical estimates of beta for overseas energy networks are relevant evidence,[46] but that this evidence can only be used to select a point estimate from within the primary range of 0.4 to 0.7 based on the (now) four domestic comparators.

70 The AER's Guideline considered a number of pieces of evidence in relation to international comparators, set out in Appendix C to the Explanatory Statement.[47] We summarise that evidence in Figure 2 below.[48]

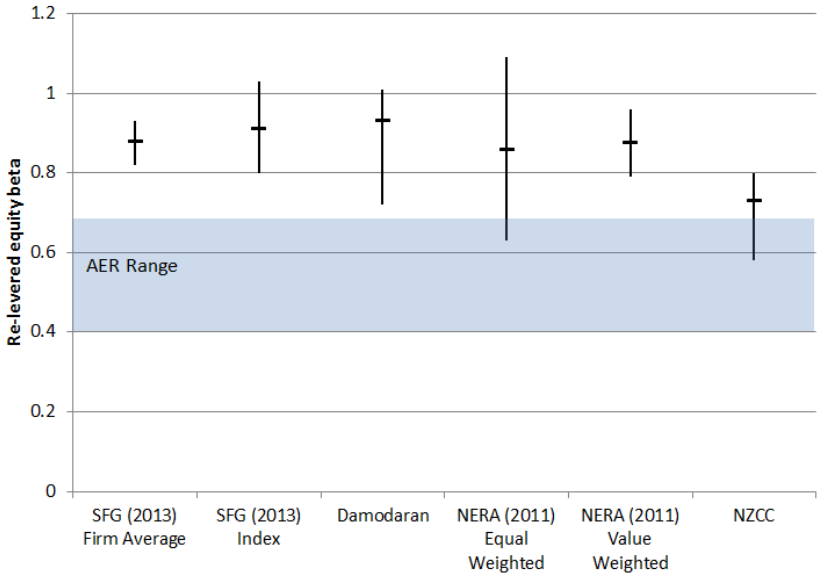
---

45 SFG (2013), p. 16.

46 AER Rate of Return Guideline, p. 15.

47 Specifically, at pp. 66–67.

Figure 2. Summary of AER international beta estimates



Source: AER Appendix C, pp. 66–67.
Notes: The AER only reports the point estimates from SFG (2013), so ranges have been obtained directly from the SFG (2013) report. The figure shows the range and mean of the four point estimates from Damodaran that are set out in the AER's appendix. The AER sets out only the ranges from NERA (2013); the figure shows the mid-point in each case. The AER sets out four estimates from the New Zealand Commerce Commission (NZCC); the figure shows the range and mean.

71 Two additional points are relevant to the interpretation of the evidence set out in Figure 2. The New Zealand Commerce Commission (NZCC) estimates are based on a sample that includes:

a. The Australian firms that have already been taken into account elsewhere in the estimation process; and

b. A number of very small U.S. listed firms that trade so infrequently that their betas cannot be estimated reliably, as explained by SFG (2013 Beta).

72 Clearly, this international evidence supports an equity beta estimate materially above the 0.7 estimate that is proposed in the Guidelines.

73 In its recent decisions, the AER states that:

> In the Guideline, we set out a number of international empirical equity beta estimates that ranged from 0.5 to 1.3[49]

and the AER has concluded in its recent final decisions that the international evidence supports estimates in the range of 0.3 to 1.3 (if SFG's re-levered global estimates are included).[50]

---

48 Note that the figure does not contain estimates from prior to 2010, such as the 2007 and 2008 Damodaran estimates that were referenced by McKenzie and Partington (2012).

49 TransGrid Final Decision, p. 3-409.

International evidence considered in recent draft and final decisions

74 The AER's recent decisions also present new evidence of contemporaneous estimates of equity beta from international comparators, and the AER confirmed its reliance on that evidence in its recent final decisions. However, there are some severe problems with a number of these estimates. For example:

a. Some of the estimates have not been regeared using a consistent gearing assumption of 60% and therefore cannot be compared with the proposed estimate of 0.7. The level of gearing is an important component of equity beta and all of the domestic estimates of equity beta that the AER has ever relied upon have been regeared to 60%, including the recent Henry (2014) estimates where the AER's terms of reference required beta estimates to be regeared to 60% and all of the estimates in Henry's report were in fact regeared to 60%.[51] It would be a clear error to make an apples-with-oranges comparison of regeared equity beta estimates with raw equity beta estimates. Such an error results in a beta estimate for the benchmark efficient entity that is lower than would be the case, had the estimates been regeared properly using a consistent gearing assumption of 60%[52]; and

b. Some of the estimates are based on the analysis of only three comparator firms using only one year of daily data. In our view, the analysis of such a small and short-term data set cannot possibly produce a reliable beta estimate. In this regard, we note that the AER's terms of reference for Henry (2014):

   i. Instructed the consultant to use a minimum data period of five years;

   ii. Instructed the consultant to use a minimum return frequency of weekly data; and

   iii. Instructed the consultant to use a minimum sample size of nine companies.

   Hence, some of the estimates that the AER has relied on do not meet even the minimum requirements that it set.

---

50 TransGrid Final Decision, p. 3-415; ENERGEX Final Decision, p. 3-128.

51 Henry (2014) sets out some raw beta estimates in the final appendix to his report, but the 30 tables in the body of the report all contain estimates that have been regeared to 60%.

52 A comparator firm with less than 60% gearing would produce a higher equity beta estimate when regeared to 60%.

75 In the remainder of this section we consider each of the new pieces of international evidence reported in the AER's recent decisions and note the AER's endorsement of that evidence in those decisions:

a. **Damodaran (2013).** The AER reports an updated estimate from Damodaran of 0.83 (regeared to 60%) using data through to the end of 2013. This estimate is for U.S. comparators only. Beta estimates for three comparator groups are:

   i. U.S. comparators (20 firms): 0.83;

   ii. European comparators (20 firms): 1.30; and

   iii. Global comparators (55 firms): 0.90.

b. **FTI (2012**). This report provided raw beta estimates for three comparators using daily data over one- and two-year periods. For the reasons set out above, it is our view that it would be a gross error to place any weight on the resulting figures when seeking to estimate the regeared equity beta for the benchmark efficient entity.

   Moreover, the AER's recent draft decisions only report the raw equity betas for the three comparators and imply that they can be compared with its regeared equity beta estimate of 0.7. The AER does not mention that the FTI (2012) study itself notes that the estimates that are cited by the AER are just one of the pieces of evidence that are used to inform the estimate of beta. The FTI report notes that Ofgem has previously adopted a beta range of 0.9 to 0.95[53] after considering all of the relevant evidence and that "[r]ecent regulatory precedent suggests a range of 0.9 to 1.1".[54] The FTI report itself then concludes that:

> We have not identified any evidence to suggest that Ofgem should update its range for beta in light of either recent regulatory precedent or recent market conditions[55]

and that:

> We consider that, similarly, Ofgem should not take into consideration recent market evidence indicating that the equity beta has fallen, as this may reflect the effects of unusual market conditions during the credit crisis, which may not be representative of the future.[56]

---

53 FTI Consulting (2012), Paragraph 4.3.

54 FTI Consulting (2012), Paragraph 4.46.

55 FTI Consulting (2012), Paragraph 4.57.

56 FTI Consulting (2012), Paragraph 4.49.

The AER's recent decisions also do not mention that Ofgem has subsequently adopted equity betas of 0.95 for National Grid Electricity Transmission (with 60% gearing) and 0.91 for National Grid Gas Transmission (with 62.5% gearing) after considering the FTI (2012) study.[57]

Even more telling is the fact that the AER's response to this point in its recent final decisions is as follows:

> We consider international empirical estimates of equity beta in this section, not other regulators' equity beta decisions. Therefore, Ofgem's decisions on equity beta are not relevant for this analysis.[58]

Nowhere in the AER's recent final decisions does the AER return to address the point that the FTI estimates were disavowed by both FTI and Ofgem.

c. **Alberta Utilities Commission (2013).** This report documents *submissions* to the regulator in relation to equity beta – it does not present any *estimates* of beta. Unsurprisingly, user groups such as the Canadian Association of Petroleum Producers (CAPP) submitted that a low equity beta should be used. The report provides no information at all about the basis for the equity beta submissions. There is no information about how many, or which comparator firms were used. There is no information about what statistical techniques were employed or how the range of resulting estimates was distilled into a point estimate or range.

   Moreover, the process for determining the allowed return on equity in Alberta is fundamentally different from the process that is adopted by the AER. Specifically, the Alberta process begins with the assignment of an equity beta. The regulator then checks whether the allowed revenue will be sufficient to satisfy three key credit rating metrics. If these metrics are not achieved, the regulator will adjust the assumed level of gearing and/or add an increment to the allowed return on equity – the so-caller "adder" premium to ensure that the metrics are achieved. The equity beta estimates that form the lower bound of the range that was submitted to the Alberta regulator involve material adder adjustments. That is, the role and the use of the equity beta are very different in Alberta than in the Australian regulatory setting.

   For the reasons set out above, it is our view that the Alberta Utilities Commission report does not contain any evidence that is

57 Ofgem (2012) Paragraphs 3.45 and 3.47.

58 Ausgrid Final Decision, p. 3-424.

relevant to the regeared equity beta for use in the Australian regulatory framework.

d. **PwC (2014).** In its recent decisions, the AER summarises the evidence from an annual report published by PwC for New Zealand:

PwC's June 2014 report presents the following raw equity beta estimates for two New Zealand energy network firms as at 31 December 2013:1614

o raw:

- 0.6 for the average of individual firm estimates

o re-levered to 60 per cent gearing:[1615]

- 0.87 for the average of individual firm estimates.[59]

The AER implies that this estimate of 0.6 can be compared with its allowed equity beta of 0.7. However, such a comparison would be an error for the reasons set out below. First, the 0.6 estimate does not appear anywhere in the PwC report in relation to utilities. The beta estimates set out in the "Utilities" section of the report are set out in the table below.

Table 1. PwC (2014) beta estimates for the Utilities sector in New Zealand

Company	Raw beta	Leverage	Regeared beta (gearing = 60%)
Contact	0.9	0.27	1.64
Horizon	0.5	0.31	0.86
NZ Windfarms	0.5	0.33	0.84
NZ Refining	0.8	0.17	1.66
TrustPower	0.5	0.36	0.80
Vector	0.7	0.50	0.88

Notes: The regeared beta estimates are our computations.

The AER's estimate of 0.6 appears to be the average of the raw beta estimates for Horizon and Vector,[60] the "New Zealand energy network firms" referred to by the AER. As the AER itself recognises, the average of the regeared estimates for these two firms is 0.87. It is misleading to suggest that the PwC (2014) report provides any support at all for the AER's regeared equity beta of 0.7.

59 TransGrid Final Decision, pp. 3-411 and 3-412.

60 TransGrid Final Decision, footnote 1614, p.3-411.

e. **Brattle Group (2013).** This report examined seven European comparators and three U.S. comparators using daily data over three years. In our view, three years is too short a period to provide reliable beta estimates. Nevertheless, the AER reports re-geared equity beta estimates from this report of:

   i. 0.71 for the average of European individual firm estimates;

   ii. 1.01 for the average of U.S. individual firm estimates; and

   iii. 0.80 for the average of European and U.S. individual firm estimates.

   The Brattle Group (2013) also notes that the relevant regulatory rules require that the set of comparators must include at least ten firms – in contrast to the AER's set of domestic comparators, which now numbers just four.

76 In summary:

a. The Damodaran estimates all support an equity beta materially above the AER's estimate of 0.7;

b. The FTI (2012) analysis of three companies using one year of daily data is incapable, by itself, of producing a reliable estimate of equity beta. FTI (2012) and Ofgem (2012) conclude that the appropriate equity beta is in excess of 0.9;

c. The Alberta Utilities Commission (2013) report does not contain beta estimates, but rather beta submissions. Since there is no information about the basis of those submissions, it would be an error to place any material weight on them;

d. The PwC (2014) report indicates that the relevant regeared equity beta estimate is 0.87;

e. The Brattle Group (2013) estimates are based on such a short period of data that they are unreliable. The average re-geared equity beta estimate reported by the AER is 0.80, which is materially above the AER's estimate of 0.7.

Adjustment for "low-beta bias" and the Black CAPM

77 There is strong evidence that the SL-CAPM systematically underestimates the required return on equity for low-beta stocks. This evidence is set out in some detail in Section 2 of SFG (2014 Black). This evidence shows that, relative to the SL-CAPM prediction, the observable relationship between beta and returns has a higher intercept and a flatter slope. This evidence is so well accepted that it now appears in standard finance textbooks, as illustrated in Figure 3 below.

Figure 3. The relationship between excess returns and beta

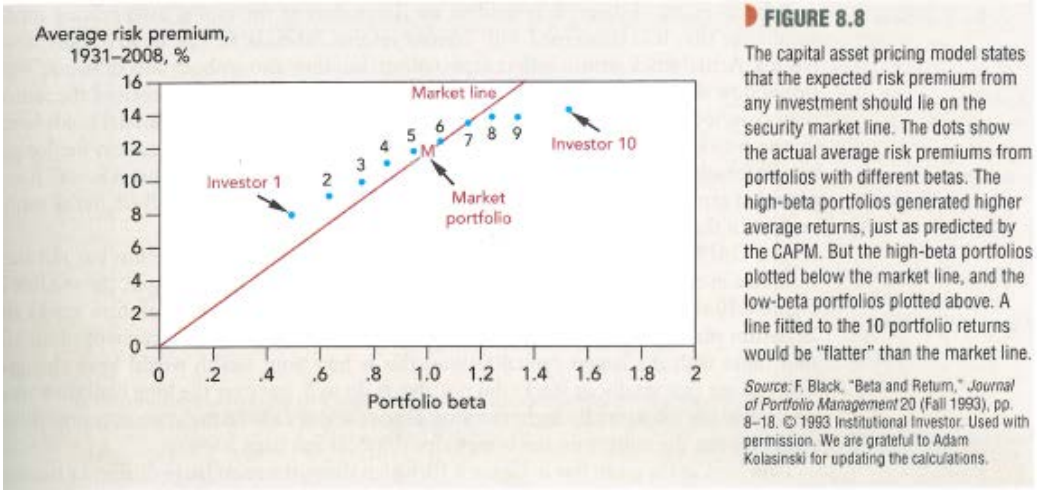


FIGURE 8.8

The capital asset pricing model states that the expected risk premium from any investment should lie on the security market line. The dots show the actual average risk premiums from portfolios with different betas. The high-beta portfolios generated higher average returns, just as predicted by the CAPM. But the high-beta portfolios plotted below the market line, and the low-beta portfolios plotted above. A line fitted to the 10 portfolio returns would be "flatter" than the market line.

Source: F. Black, "Beta and Return," *Journal of Portfolio Management* 20 (Fall 1993), pp. 8–18. © 1993 Institutional Investor. Used with permission. We are grateful to Adam Kolasinski for updating the calculations.

Source: Brealey, Myers, and Allen (2011), p. 197.

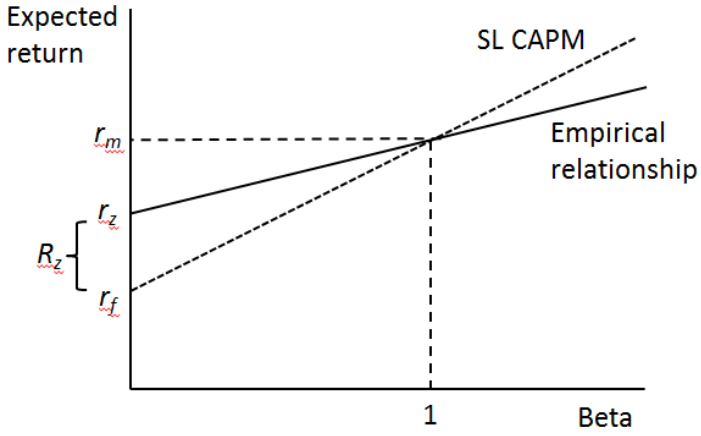
78 In its recent final decisions, the AER appears to accept the evidence of a low-beta bias. It attempted to account for using the "the theoretical principles underpinning the Black CAPM" to justify a point estimate at the top end of its estimated range.[61] However, the AER performed no quantitative analysis to determine the size of the adjustment that would be required to correct for the low-beta bias of the SL-CAPM. The AER has not even stated what adjustment it did make to its beta estimate in relation to the low-beta bias. Consequently, it is impossible to determine whether any adjustment that may have been made was sufficient to correct for the low-beta bias and the evidence in relation to the Black CAPM.

79 By contrast, SFG (2014 Black) quantifies the low-beta bias by estimating the zero-beta premium in the Black CAPM to be 3.34%, which the AER and its consultants consider to be "plausible."[62] The zero-beta premium is the extent to which the intercept needs to be increased above the risk-free rate in order to fit the observed data, as illustrated in Figure 4 below.

61 TransGrid Final Decision, p. 3-422.

62 TransGrid Final Decision, p. 3-252; ENERGEX Final Decision, p. 3-306.

Figure 4. Sharpe-Lintner CAPM vs. empirical relationship.



80 In its Guideline materials, the AER showed how the SL-CAPM equity beta can be adjusted to account for the Black CAPM evidence of a low-beta bias.[63] Specifically, the AER shows how an estimate of the zero-beta premium can be used to derive the adjusted SL-CAPM beta. The process is as follows:

a. Estimate the SL-CAPM equity beta;

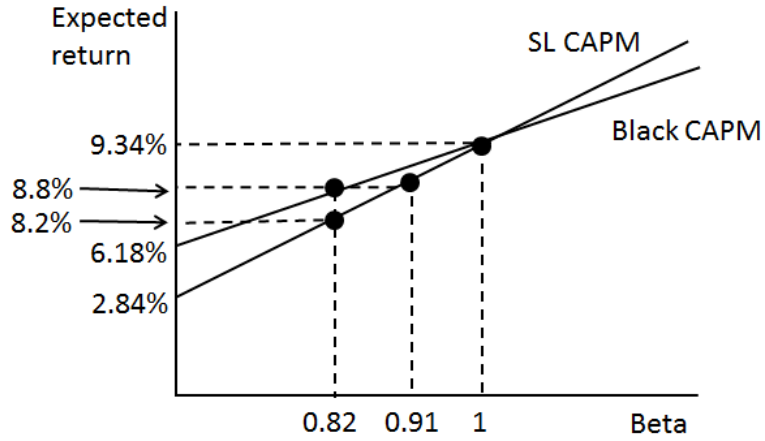
b. Estimate the required return on equity under the Black CAPM, using the equity beta from (a) above;

c. Derive the equity beta that would have to be inserted into the SL-CAPM to obtain an estimate of the required return on equity equal to that in (b) above.

81 Beginning with the SL-CAPM equity beta of 0.82 (from above) the adjustment to correct the low-beta bias produces a revised beta of 0.91, as illustrated in Figure 5 below. In this case, the unadjusted equity beta is 0.82. When that beta is inserted into the Black CAPM, the resulting estimate of the required return on equity is 8.7% (adopting the AER's 6.5% estimate of the MRP). To obtain the same estimate of the required return from the SL-CAPM would require a beta of 0.91. Thus, the adjusted estimate, corrected for low-beta bias is 0.91.

63 AER Rate of Return Guideline, Explanatory Statement, Appendix C, Table C.11.

Figure 5. Derivation of adjusted equity beta.



$8.2\% = 2.84\% + 0.82 \times 6.5\%$
$6.18\% = 2.84\% + 3.34\%$
$8.8\% = 6.18\% + 0.82 \times (6.5\%-3.34\%)$
$8.8\% = 2.84\% + 0.91 \times 6.5\%$
$9.34\% = 2.84\% + 1 \times 6.5\%$

Adjustment for book-to-market bias and the Fama-French model

82 Just as the Black CAPM overcomes one of the systematic biases that have been documented for the SL-CAPM, the Fama-French model overcomes another systematic bias. The SL-CAPM has been shown to systematically under-estimate the required return on "value" stocks – those that have a high book-to-market value, such as regulated energy distribution networks.

83 In its Guideline, the AER concludes that the Fama-French model is a relevant financial model that it must have regard to. However, the AER concludes that it will not apply any weight to that model.

84 The arguments for assigning at least some weight to the Fama French model have been set out at length in SFG (2014 FFM) and SFG (2015 FFM). The main reasons are the following:

a. Professor Fama was awarded the 2013 Nobel Prize in Economics. The Prize Committee stated that:

> …the classical Capital Asset Pricing Model (CAPM) – for which the 1990 prize was given to William Sharpe – for a long time provided a basic framework. It asserts that assets that correlate more strongly with the market as a whole carry more risk and thus require a higher return in compensation. In a large number of studies, researchers have attempted to test this proposition. Here, Fama provided seminal methodological insights and carried out a number of tests. It has been found that an extended model with three factors – adding a

stock's market value and its ratio of book value to market value – greatly improves the explanatory power relative to the single-factor CAPM model.[64]

and:

…following the work of Fama and French, it has become standard to evaluate performance relative to "size" and "value" benchmarks, rather than simply controlling for overall market returns.[65]

b. The leading Australian study, Brailsford, Gaunt and O'Brien (2012) conclude that:

Our study provides two advances. Firstly, the study utilizes a purpose-built dataset spanning 25 years and 98% of all listed firms. Secondly, the study employs a more appropriate portfolio construction method than that employed in prior studies. With these advances, the study is more able to test the three-factor model against the capital asset-pricing model (CAPM). The findings support the superiority of the Fama–French model, and for the first time align the research in this area between Australia and the USA.[66]

and:

This evidence is important for a number of reasons. Firstly, the findings appear to settle the disputed question as to whether the value premium is indeed a positive and significant factor in the Australian market. Given the growing trend to utilize the three-factor model in asset-pricing tests and in practical strategies of portfolio formation in the funds management industry, these findings provide direction. Secondly, the evidence continues the decline of the single-factor model, which has obvious implications for future research. This future research should include the added benefits of using a multifactor model to estimate cost of capital for firms.[67]

c. NERA (2015) consider the assessment of the relevant empirical evidence by the AER and its advisers. NERA concludes that:

A recurring theme is that the AER's advisers cite selectively from the work that they discuss.[68]

For example, NERA notes that papers that actually provide evidence against the Sharpe-Lintner CAPM have been interpreted by the AER's advisers as supporting the AER's implementation of the Sharpe-Lintner CAPM:

---

64 Economic Sciences Prize Committee, 2013, Understanding Asset Prices, p. 3.

65 Economic Sciences Prize Committee, 2013, Understanding Asset Prices, p. 44.

66 Brailsford, Gaunt and O'Brien (2012a), p. 261.

67 Brailsford, Gaunt and O'Brien (2012a), p. 279.

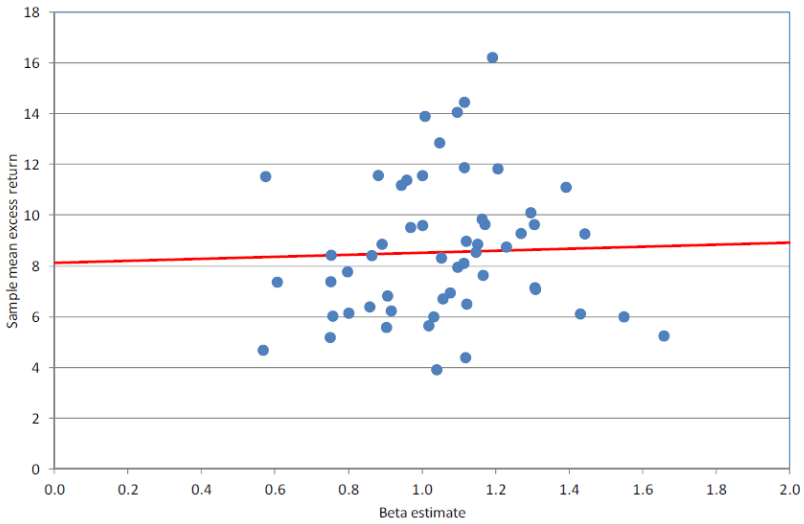
68 NERA (2015 Emp), p. iv.

> …while Davis (2011), Handley (2014) and McKenzie and Partington (2014), in reports written for the AER, endorse the use of the Sharpe-Lintner CAPM and review, favourably, the work of Lewellen, Nagel and Shanken [LNS],[69] the evidence that Lewellen, Nagel and Shanken provide indicates that the Sharpe-Lintner CAPM does not generate unbiased estimates of the cost of equity.[70]

Specifically, NERA demonstrates that the LNS data supports no relation at all between beta estimates and stock returns, as summarised in Figure 6 below.

Figure 6: Lewellen, Nagel and Shanken (2010) analysis of Sharpe-Lintner CAPM

Sample mean excess return against beta estimate for 25 US size and book-to-market sorted portfolios and 30 US industry portfolios: Quarterly data from 1963 to 2004



Notes: Data are from Ken French's web site and are those used by Lewellen, Nagel and Shanken (2010). The red line plots Lewellen, Nagel and Shanken's estimate of the relation between mean return and beta constructed from the 25 portfolios formed on the basis of size and book-to-market and the 30 industry portfolios.

Sources: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

Lewellen, J., S. Nagel and J. Shanken, A skeptical appraisal of asset pricing tests, Journal of Financial Economics, 2010, Table 1, pages 188.

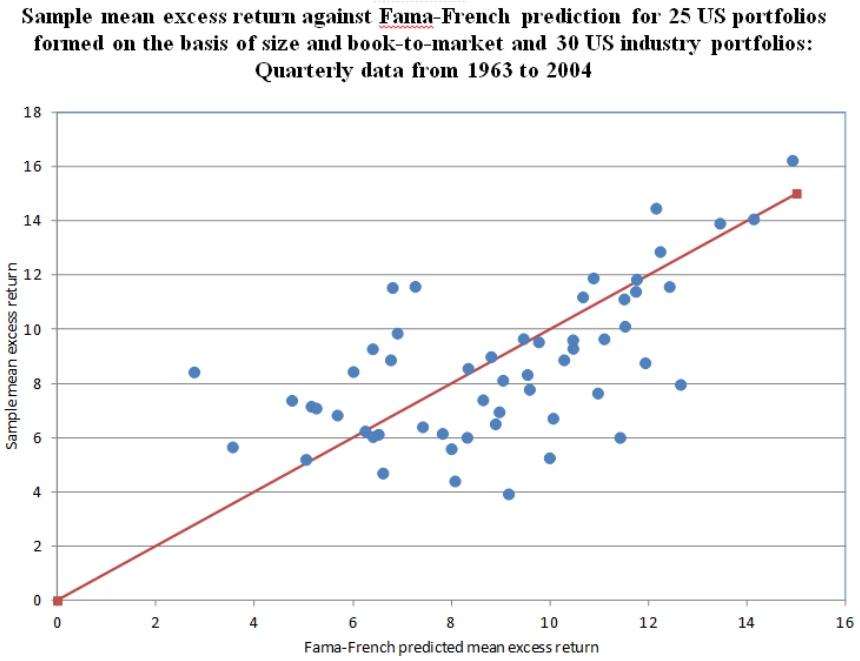
Source: NERA (2015 Lit), Figure 1, p. v.

Moreover, the LNS data supports a strong relationship between the predictions of the Fama-French 3-factor model and subsequent stock returns, as summarised in Figure 7 below.

69 Lewellen, Nagel and Shanken (2010).

70 NERA (2015 Lit), p. iv.

Figure 7: Lewellen, Nagel and Shanken (2010) analysis of Fama-French three factor model



Notes: Data are from Ken French's web site and are those used by Lewellen, Nagel and Shanken (2010). The red line plots a line with slope one that passes through the origin. Sample mean excess returns and the Fama-French predictions have been annualised by multiplying the quarterly returns by four and are in per cent per annum.

Sources: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

Lewellen, J., S. Nagel and J. Shanken, A skeptical appraisal of asset pricing tests, Journal of Financial Economics, 2010, Table 1, pages 188.

Source: NERA (2015 Lit), Figure 2, p. vii.

d. LNS consider a number of different metrics by which one might test or rank the performance of a number of asset pricing models. They develop one metric under which no models receive a high absolute score. This leads Handley (2015 JGN) and Partington and Satchell (2015) to conclude that models other than the Sharpe-Lintner CAPM should not be used. However, there are two problems with this conclusion:

Under every single metric that LNS examine, the SL-CAPM finishes last. Indeed there is no evidence of the SL-CAPM providing any explanatory power whatsoever. Indeed Handley (2015 JGN) recognises that:

> Lewellen, Nagel and Shanken (2010) show that the CAPM has zero explanatory power.[71]

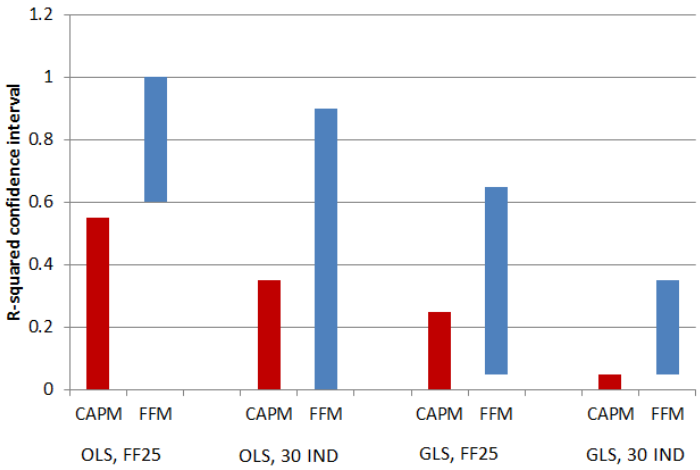
71 Handley (2015 JGN), p. 10.

Similarly, SFG (2015 FFM, Figure 1, p. 23) summarise the LNS test results in the figure that is reproduced below. In every case, the performance statistic for the Fama-French model is materially superior to that of the SL-CAPM. This leads Lewellen, Nagel and Shanken (2010) to conclude that:

> The confidence interval provides a good summary measure of just how poorly the CAPM works.[72]

In our view, it is quite unreasonable to rely upon the work of LNS to reject the Fama-French model, and then retain the exclusive use of the SL-CAPM. The selective focus on one aspect of one paper is no substitute for a reasoned holistic consideration of the relevant literature. A holistic consideration of just this *one paper* would have led the AER to a very different conclusion.

Figure 8. SL-CAPM and Fama-French explanatory power



Source: Lewellen, Nagel and Shanken (2010), Table 1, p. 188.
OLS=Ordinary least squares; GLS=Generalised least squares.
FF25=The Fama and French size and book-to-market portfolios.
30 IND=The 25 FF portfolios plus 30 industry portfolios.

85 For the reasons set out above, and in SFG (2014 FFM) and SFG (2015 FFM), our view is that the Fama-French model should be afforded real weight in the process of estimating the required return on equity. Under the AER's foundation model approach, the only way that the Fama-French model can have any real weight is via an adjustment to the equity beta that is used in the SL-CAPM. SFG (2015 FFM) demonstrate that the adjusted beta that is required for

72 Lewellen, Nagel and Shanken (2010), p. 187.

the SL-CAPM to produce an estimate of the required return on equity that is consistent with the Fama-French evidence is 0.92.[73]

The DGM

86 The AER uses DGMs to estimate the required return on the broad market, but does not use these models to estimate the required return for the benchmark efficient firm.

87 We have previously provided DGM estimates of the required return on equity for the benchmark efficient firm in SFG (2014 DDM) and SFG (2015 DDM). In those previous reports, we have also responded to the AER's rejection of those estimates. The main points of contention have been:

a. **Sensitivity to input assumptions**. Like all financial models, the DGM requires a number of parameters to be estimated and, like all financial models, the final estimate that is produced is sensitive to the estimates that are inserted for each parameter. However, this does not justify ruling out consideration of the DGM even before it has been estimated. By way of comparison, in its recent draft decisions, the AER concludes that the reasonable range for beta is 0.4 to 0.7 and that the reasonable range for the MRP is 5.1% to 7.8%. For a risk-free rate of 3.55%, these estimates imply a range for the required return on equity of 5.59%[74] to 9.01%.[75] Thus, according to the AER's own estimates, the SL-CAPM is also very sensitive to input assumptions. This sensitivity might then be one of the matters in the AER's consideration of the estimates from the financial models that it considers to be relevant.

b. **Sensitivity to changes in the risk-free rate**. Whereas the AER argues that DGMs are highly sensitive to changes in the risk-free rate, in fact the opposite is true. Indeed the AER makes this very point itself in its Guideline materials:

> …our implementation of the Sharpe–Lintner CAPM will result in estimates of the return on equity that may vary over time. Alternatively, the DGM and the Wright approach (for implementing the Sharpe–Lintner CAPM) will result in estimates of the return on equity that may be relatively stable over time. The informative use of these implementations of the Sharpe–Lintner CAPM, in addition to

73 SFG (2015 FFM), Table 2, p. 28.

74 3.55+0.4×5.1.

75 3.55+0.7×7.8.

the DGM and other information, is expected to lead to more stable estimates of the return on equity than under our previous approach.[76]

c. **Models may generate volatile and conflicting results.** Logically, the fact that *some* DGM specifications are internally inconsistent and produce volatile and implausible results is not a reason for rejecting *all* DGMs. Each specification should be considered on its own merits. If a particular specification can be shown to be internally inconsistent or to produce implausible results, there would be a basis for disregarding *that* specification. Problems with *one* specification, however, do not provide a valid reason for rejecting *all other* specifications.

d. **The AER's use of preconceived views**. One of the reasons for the AER's rejection of industry DGMs is as follows:

> The very high return on equity estimates from SFG's DGM model, equating to an equity beta of 0.94 in the SLCAPM, appear inconsistent with the low risk nature of regulated natural monopoly businesses with very low elasticity of demand for their services, and the results in Professor Olan Henry's 2014 report.[77]

In our view, there are a number of fundamental problems with the AER's reasoning set out above:

i. The AER begins its reasoning with the claim that the return on equity estimates from the SFG DGM are "very high," but the AER does not say what this is relative to. The AER presents no basis or explanation for its claim that the return on equity estimates are "very high." The return on equity estimates from the SFG DGM are in fact lower for the benchmark firm than for the average firm – they are equivalent to the use of an equity beta of 0.94 in the SL-CAPM;

ii. The AER proposes that the SFG DGM can be rejected because it produces outcomes that are equivalent to the use of an equity beta of 0.94 which is "inconsistent with the low risk nature of regulated natural monopoly businesses." This seems to suggest that the AER has some preconceived notion of what the equity beta should be, and that any evidence that is inconsistent with this preconceived notion can be rejected for no other reason than that. The equivalent beta of 0.94 implies that the

---

76 AER Rate of Return Guideline, Explanatory Statement, p.66.

77 TransGrid Final Decision, p. 3-259.

benchmark firm has lower than average equity risk (even though it has double the average level of gearing) – but this is apparently not commensurate with the AER's preconceived views about the risk of regulated natural monopoly businesses. If it is the case that any piece of evidence can be dismissed if found to be inconsistent with the AER's preconceived notion of what is reasonable, there would be no point in gathering any evidence at all because the evidence would either support the preconceived position or be dismissed.

iii. The AER also proposes that the SFG DGM can be rejected because it produces outcomes that are equivalent to the use of an equity beta of 0.94 which is inconsistent with "the results in Professor Olan Henry's 2014 report." This is similar to the previous point. If any evidence that is inconsistent with the Henry beta estimates is to be dismissed for the reason that it is inconsistent with the Henry estimates, there would appear to be no point in gathering any other evidence.

88 For all of the reasons set out above, it is our view that the DGM estimates of the required return on equity should be afforded some weight. SFG (2014 DDM) and SFG (2015 DDM) demonstrate that an equity beta of 0.94 would have to be inserted into the SL-CAPM in order to produce an estimate of the required return on equity that was consistent with the DGM evidence.

3.2.4 Summary and conclusions in relation to equity beta

We have a number of estimates of equity beta from a range of approaches as summarised in Table 2 below. All of these approaches have different strengths and weaknesses. For example:

a. The SL-CAPM has the disadvantage of producing estimates of expected returns that have little or no relationship with actual returns – that is, it provides a poor fit to the observed data. Further, the SL-CAPM does not account for all priced risks and its parameter estimates from standard empirical analysis have limited reliability. However, the SL-CAPM is commonly used in practice, albeit often in a modified form and we agree that systematic risk is a useful way to think about risks incorporated into market prices. Consequently, our view is that the SL-CAPM estimate of the required return is relevant evidence and some regard should be given to it.

b. The Black CAPM provides a better fit to the empirical data than the SL-CAPM and it is commonly used in rate of return

regulation cases in other jurisdictions (where it is known as the "empirical CAPM"). The Black CAPM is also more theoretically sound than the SL-CAPM because it does not rely upon the assumption that investors can borrow at the risk-free rate, but rather that investors can sell short. The Black CAPM does not, however, overcome a major disadvantage of the SL-CAPM, which is that there is no statistically significant relationship between beta estimates and stock returns. In our view, the fact that the Black CAPM requires the estimation of an additional parameter does not diminish the relevance of evidence derived from it, and some regard should be given to it.

c. The Fama-French model has the advantage of providing an unambiguously better fit to the data than the SL-CAPM. Whereas it is commonly used as an estimate of required returns in academic studies, it is less commonly used in valuation and regulatory practice. However, that does not diminish relevance of the estimates derived using the Fama-French model, and some regard should be given to it.

d. The DGM approach has the advantage of not requiring any assumptions about what factors drive required returns – it simply equates the present value of future dividends to the current stock price. It is also commonly used in industry and regulatory practice in some jurisdictions overseas. Whereas the Guideline materials identify some concerns with the DGM approach, the specification adopted in this report addresses most of those concerns. Consequently, our view is that the DGM estimate of the required return is relevant evidence and some regard should be given to it.

89 Because all of the approaches have different strengths and weaknesses along different dimensions, it is impossible to identify one superior approach that alone would out-perform the combined evidence. This is consistent with the AEMC's views that:

> …no one method can be relied upon in isolation to estimate an allowed return on capital that best reflects benchmark efficient financing costs[78]

and that the NEO and RPP can only be achieved by obtaining:

> …the best possible estimate of the benchmark efficient financing costs

which in turn requires the use of a range of approaches.[79]

---

78 AEMC Final Determination, p. 49.

79 AEMC Final Determination, p. 43.

90 Consequently, our view is that any approach that adopts a single foundational model, and which effectively disregards empirical estimates from other relevant financial models, will not provide the best possible estimate of "the best possible estimate of the benchmark efficient financing costs." Any sub-standard estimate of financing costs will inevitably lead to investors being either under- or over-compensated – neither of which are in the long-run interests of consumers.

91 We recommend that estimates from all of the models discussed above should be derived, and combined through a weighting scheme, to derive an overall estimate of the equity beta.

92 The rationale for the weights we propose is as follows:

a. 25% weight is applied to the DGM approach and a total of 75% weight is applied to the three asset-pricing models. As all four approaches have different strengths and weaknesses as set out above, our default starting point would be to assign 25% weight to each estimate. We then adjust weights among the asset pricing estimates for the reasons set out below;

b. Of the 75% weight that is applied to asset-pricing models, we apply half to the Fama-French model and half to the CAPM. That is the question of whether the value premium is a proxy for a risk factor or a statistical aberration is addressed by applying equal weight to each possibility;

c. A total of 37.5% weight is applied to the CAPM. The two forms of the CAPM differ only in terms of the intercept that is used (since the same values of beta and the required return on the market are used for both models). The Black CAPM uses an empirical estimate of the intercept – selected to provide the best possible fit to the observed data. The SL-CAPM uses a theoretical lower bound for the intercept (i.e., the intercept cannot possibly be lower than the risk-free rate). Thus, we do not have two estimates to choose between – we have an empirical estimate and a theoretical lower bound. It is for this reason that we apply twice as much weight to the Black CAPM. This approach is equivalent to setting the CAPM intercept two-thirds of the way between the theoretical lower bound and the empirical estimate.

Table 2: Equity beta estimates for use in SL-CAPM

Approach	Equity beta estimate	Weight
Unadjusted SL-CAPM estimate	0.82	12.5%
Adjusted to correct for low-beta bias/Black CAPM evidence	0.91	25.0%
Adjusted to correct for book-to-market bias/Fama-French evidence	0.92	37.5%
Adjusted to reflect DGM evidence	0.94	25.0%
Weighted average	**0.91**	**100%**

93 Our weighted-average estimate of the equity beta is 0.91. We note that a simple average of the four estimates set out above would produce an equity beta estimate of 0.90.

3.3 Market risk premium

3.3.1 The AER's Guideline approach

94 In its Guideline Factsheet, the AER states that:

> As at December 2013, our market risk premium (MRP) point estimate is 6.5, chosen from within a range of 5 to 7.5 per cent. The MRP compensates an investor for the systematic risk of investing in a broad market portfolio. Analysis of historical estimates of the MRP show a long term average of about 6 per cent. We also have regard to another financial model, the dividend growth model, to determine whether we should adopt an estimate above, below or consistent with the historical estimate. This is a symmetric consideration. As at December 2013, the dividend growth model is above the historical average—leading to an estimate above 6 per cent.[80]

95 The AER provides more detail on its selection of a point estimate in its Explanatory Statement as follows:

> …we give greatest consideration to historical averages. We consider 6.0 per cent an appropriate estimate of this source of evidence. This represents the starting point for our determination of a point estimate. We note that while a point estimate of 6.0 per cent is common, the choice of the averaging period and judgments in the compilation of the data result in a range for plausible estimates of about 5.0–6.5 per cent.

80 AER Rate of Return Guideline Factsheet, p. 2.

> We also give significant consideration to DGM estimates of the MRP. Using our preferred application of these models, we estimate a range of 6.1–7.5 per cent…
>
> We consider an MRP estimate of 6.5 per cent provides an appropriate balance between the various sources of evidence. This point estimate lies between the historical average range and the range of estimates produced by the DGM. This reflects our consideration of the strengths and limitations of each source of evidence.[81]

96 In summary, the AER's Guideline approach involves estimating ranges from the historical excess returns and DGM approaches, merging those two ranges into a single combined range, and then using judgement to select an estimate from within the combined range.

97 In relation to historical excess returns, the AER states that:

> …we give some weight to geometric mean estimates. Therefore, we consider a lower bound estimate of 5.0 per cent appropriate. The arithmetic average provides a range of 5.7 to 6.4 per cent.[82]

98 The AER has also been very clear about the fact that its Guideline does not set out an estimate of the MRP that is fixed for the Guideline period, but rather that it has set out a process that will be applied at the time of each determination. For example, the AER states that:

> Evidence suggests the MRP may vary over time.[83]

99 The AER also notes that the example estimate that appears in its Guideline materials should not be considered to fix the estimate of the MRP for the entire Guideline period:

> This example is provided as a guide only. We intend to consider and review a range of material on the MRP, as it becomes available. We will draw on this material and will consider more up to date information when determining the MRP at each determination.[84]

3.3.2 Estimates in recent decisions

100 In its November 2014 draft decisions, the AER states that:

> We adopt a point estimate of 6.5 per cent for the MRP for this final decision. This is from a range of 5.1 to 8.6 per cent. We place most reliance on historical excess returns. However, DGM estimates, survey evidence and conditioning

81 AER Rate of Return Guideline, Explanatory Statement, p. 97.

82 AER Rate of Return Guideline, Explanatory Statement, p. 93.

83 AER Rate of Return Guideline, Explanatory Statement, p. 91.

84 AER Rate of Return Guideline, Explanatory Statement, p. 89.

> variables also inform this estimate. We also have regard to recent decisions by Australian regulators.[85]

101 The primary data that the AER considers is historical excess returns, wherein the AER considers that:

a. Geometric mean estimates range between 3.9% and 4.9%;

b. Arithmetic mean estimates range between 5.8% and 6.4%; and

c. The evidence on historical excess returns supports an overall range of 5.1% to 6.5%.[86]

102 The AER also considers that its DGM estimates support a range of 7.4% to 8.6% as at February 2015.[87] This range is created by implementing the AER's DGM six times – applying three different dividend growth rates to a two-stage and then a three-stage specification. The AER considers that more weight should be applied to the (higher) estimates from its three-stage specification, stating that:

> A three stage model may be conceptually better than a two stage model.[88]

and that:

> We use a three stage model because we consider the three stage model more plausible. This is because we expect it to take some time for the short term growth in dividends to transition to the long term growth.
>
> In addition to the three stage model, we also consider a two stage model…given the way the short term growth rate is calculated, the two stage model should be used as a cross check.[89]

103 The AER appears to place less weight on survey responses, conditioning variables, and past regulatory decisions,[90] which is consistent with the views set out in the AER's Guideline materials that:

> We place some reliance on survey estimates in estimating the MRP. Our assessment of survey evidence against our criteria informs our use of this information[91]

and:

> We do not consider conditioning variables provide reliable estimates of the MRP on their own. However, this information is relevant and may be useful for

---

85 TransGrid Final Decision, p.3-108.

86 TransGrid Final Decision, p.3-109.

87 TransGrid Final Decision, p.3-109.

88 TransGrid Final Decision, p.3-283.

89 TransGrid Final Decision, pp.3-282 and 3-283.

90 TransGrid Final Decision, p.3-319.

91 TransGrid Final Decision, p.3-322.

> indicating changes in general market conditions. This can be valuable in complying with the NER and NGR requirement to have regard to the prevailing conditions in the market for equity funds. Our assessment of conditioning variables against our criteria informs this position. From this assessment, we found there are some important limitations to this source of evidence. However, we also found this information valuable for detecting changes in market conditions.[92]

3.3.3 Comparison of the AER's Guideline and November 2014 draft decision estimates

104 We note that the additional data available to the AER for its November 2014 draft decisions supported slightly higher excess returns estimates of the MRP. Specifically, the arithmetic mean estimate in the Guideline was 5.7-6.4% whereas the corresponding estimate in the November 2014 draft decisions is 5.9-6.5%.

105 In its November 2014 draft decisions, the AER noted that its DGM:

> …estimates k, the expected return on equity for the market portfolio.[93]

106 The AER then subtracted the contemporaneous risk-free rate to obtain an estimate of the MRP.

107 The combined effect of the AER's estimate of the required return on the market and the movements in the AER's estimate of the risk-free rate is a material change in the AER's estimates of the MRP, as summarised in Table 3 and Figure 9 below.

Table 3: AER DGM estimates of the required return on the market

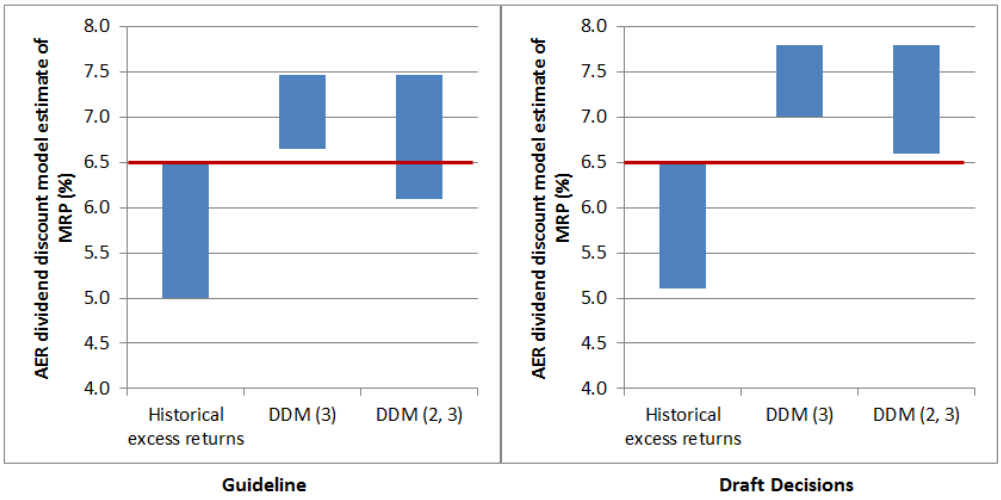
	Growth rate (%)	Two stage model (%)	Three stage model (%)
Guideline	4.0	6.10	6.65
	4.6	6.66	7.10
	5.1	7.13	7.47
Draft Decisions	4.0	6.6	7.0
	4.6	7.2	7.4
	5.1	7.7	7.8

Source: AER Rate of Return Guideline Appendices, p. 87; JGN Draft Decision, Attachment 3, p. 200.

92 AER Rate of Return Guideline, Explanatory Statement, p. 97.

93 JGN Draft Decision, Attachment 3, p. 199.

Figure 9: Range of AER DGM estimates of the required return on the market



Source: AER Rate of Return Guideline Appendices, p. 87; JGN Draft Decision, Attachment 3, p. 200.

108 Figure 9 summarises the information that the AER used to estimate the MRP at the time of its Guideline (left hand panel) and at the time of its recent draft decisions (right hand panel).

109 The AER has indicated that it considers historical excess returns to be the "best source of evidence available to estimate the MRP"[94] and the AER has indicated that it now considers that evidence to support a range of 5.1 to 6.5%.[95] Since the historical excess returns estimate is based on a long-run average of historical data, the small amount of additional data that has become available since the Guideline has had only a small effect the AER's estimated range, increasing the bottom of the range by 10 basis points.

110 At the time of its Guideline, the AER noted that the maximum of its DGM estimates was approximately 7.5%. Thus, the AER concluded that the final range for MRP was 5.0% (the lower bound of the historical excess returns range) to 7.5% (the upper bound of the DGM range).

111 From within its final range, the AER selected a point estimate of 6.5%. The considerations that appear to have influenced that decision are the following:

94 AER Rate of Return Guideline, Explanatory Statement, p. 95.

95 We note that there is considerable debate about whether that range properly reflects the historical excess returns evidence. The issues that are in contention are summarised in SFG (2015 Equity). However, the purpose of this report is to apply the AER's Guideline, so we adopt the AER's interpretation of the evidence here.

a. 6.5% is within the excess returns range and the DGM range (when two-stage and three-stage models are considered);[96]

b. Estimates at the lower end of the excess returns range pertain to geometric averages and the AER notes that "there are concerns with using the geometric mean."[97] Consequently, estimates more towards the top of that range (which are based on the more appropriate arithmetic mean) are likely to be more reliable;

c. The 6.5% estimate is within the range of DGM estimates (so long as two-stage estimates are included); and

d. Although the 6.5% estimate is slightly below the range estimated by the three-stage DGM (minimum of 6.65%) that the AER considers to be conceptually better and more plausible, the AER also considers that the excess returns approach provides the best available evidence.

112 The right hand panel of Figure 9 summarises the estimates from the AER's November 2014 draft decisions. The AER has adopted a slightly higher range for historical excess returns (5.1-6.5%) and its DGM estimates have increased materially.

113 In the November 2014 draft decisions, the AER continued to adopt a 6.5% point estimate for the MRP even though its own estimates of the MRP, derived using excess returns and the DGM, have increased. Moreover:

a. 6.5% is below even the lowest two-stage DGM estimate; and

b. 6.5% is 50 basis points below the lowest three-stage DGM estimate.

114 In its November 2014 draft decisions, the AER did not explain what led it to adopt the same point estimate even though the set of relevant evidence has changed materially. There appear to be two possible explanations to consider.

115 The first potential explanation is that the AER considers the excess returns range to provide an immutable boundary such that the only role of DGM evidence is to inform the selection of a point estimate from within that range. In this case, the DGM evidence would have precisely the same effect whether it suggested an MRP slightly or materially above the top of the excess returns range.

116 The second potential explanation is that between the Guideline and its November 2014 draft decisions, the AER increased the weight that it has applied

---

96 Whereas the AER Guideline materials refer to a maximum excess returns estimate of 6.4%, the Guideline sets out an excess returns range of 5.0-6.5%. Thus, 6.5% can be interpreted as either within the excess returns range or close to it.

97 AER Rate of Return Guideline, Explanatory Statement, p. 93.

to excess returns evidence and (correspondingly) decreased the weight that it has applied to DGM evidence. However, the AER did not disclose the weights that it applied to each of these pieces of evidence and its draft decisions offer no explanation of whether it has changed the weights it has assigned to each piece of evidence or why any such change to the weights might have been appropriate.

117 Although, in its November 2014 draft decisions, the AER clearly reduces the weight that it assigns to its DGM evidence, it claims to have followed its Guideline. Thus, in its November 2014 draft decisions, the AER's approach appeared to be that:

a. The excess returns and DGM evidence will be combined to form a combined range; and

b. The AER will use its judgment to select a point estimate within that range.

118 The AER has indicated that, in exercising its judgment, it considers that:

a. When considering excess returns, arithmetic means should be given more weight as "there are concerns with using the geometric mean;"[98]

b. When considering DGM evidence, the three-stage model should be given more weight than the two-stage model on the basis that it is "conceptually better"[99] and "more plausible;"[100]

c. Relatively more weight should be applied to the historical excess returns evidence on the basis that the AER considers it to be the "best source of evidence available to estimate the MRP."[101]

119 All of the considerations above apply generally. None provide any indication of what factors might lead the AER to alter the relative weight it applies to evidence over time. For example, there will always be the same conceptual concern with the use of a geometric mean – it is not the case that the geometric mean might receive more or less weight in different market conditions. This leaves us with little guidance about how, or why, the AER will vary the exercise of its judgment over time as market conditions change.

3.3.4 Application of the AER approach to current evidence

120 The AER has further updated its DGM estimates of the MRP in its October 2015 final decisions. The evolution of the AER's DGM estimates of the MRP

98 AER Rate of Return Guideline, Explanatory Statement, p. 93.

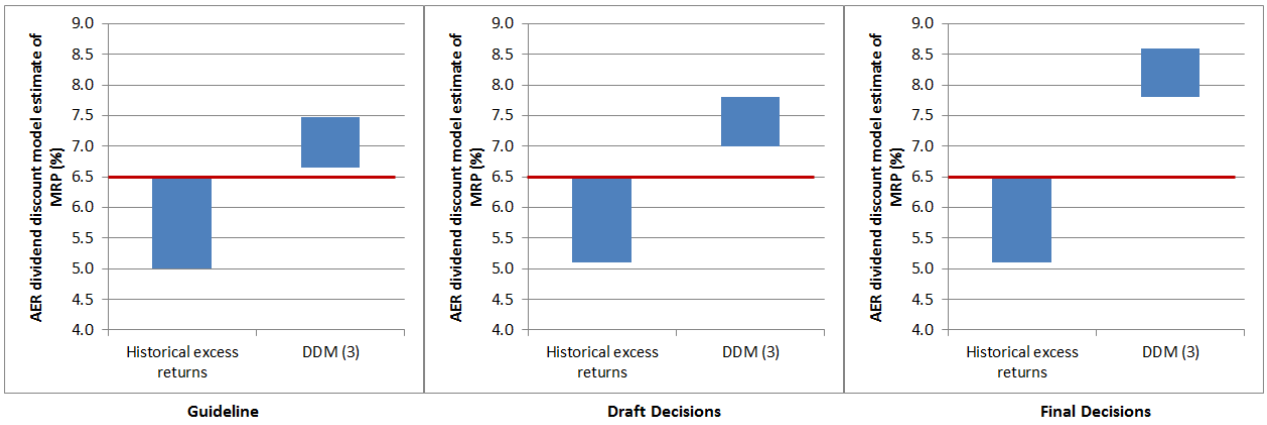
99 JGN Draft Decision, p.3-222.

100 JGN Draft Decision, p.3-222.

101 AER Rate of Return Guideline, Explanatory Statement, p. 95.

(from the Guideline, to the November 2014 draft decisions, to the October 2015 final decisions[102]) are summarised in Figure 10 below.

Figure 10: AER estimates of MRP from historical excess returns and the DGM



Source: AER Rate of Return Guideline (Dec 2013), AER draft decisions (Nov 2014), AER final decisions (Oct 2015).

121 Figure 10 shows that:

a. The AER's primary range from historical excess returns has remained relatively stable, as would be expected for a long-term historical average;[103]

b. The AER's DGM estimate has increased materially from Guideline to draft decisions to final decisions;[104] and

c. The AER's point estimate for the MRP has remained fixed at the 6.5% upper bound of its primary range throughout.

122 The AER's preferred DGM estimate of MRP is based on its three-stage model and its mid-point 4.6% estimate of long term growth.[105] Using this approach, the AER's MRP estimates are:

a. 7.1% in its Guideline;[106]

b. 7.4% in its draft decisions in November 2014;[107] and

102 AER Final Decisions for ENERGEX, Ergon and SA Power Networks.

103 The AER increased the lower bound of its primary range from 5.0% to 5.1% between the Guideline and its November 2014 draft decisions, reflecting the additional annual observation that became available. The upper bound has remained fixed at 6.5% throughout.

104 Figure 10 shows the AER's range for its preferred three stage DGM. The AER state that it has lesser regard to estimates from its two stage model (the AER states this is used as a cross check), which also increase materially between the Guideline and the recent final decisions.

105 TransGrid Final Decision, Table 3-36, p. 301 and Table 3-40, p. 3-305.

106 AER Rate of Return Guideline, Appendix D, p. 87.

c. 8.2% in its October 2015 final decisions.[108]

123 That is, the AER's DGM estimates of MRP have increased materially since the Guideline and are now well above the AER's 6.5% upper bound of the AER's primary range. However, the AER has maintained its MRP point estimate at 6.5% throughout. This is consistent with the primary range from historical excess returns being treated as immutable, whereby the AER's 6.5% upper bound is apparently treated as a maximum that cannot be exceeded even as the weight of relevant evidence evolves. In our view, there is no other way to explain the AER's decision to maintain its MRP estimate of 6.5% even in the face of the material increase in its own DGM estimates.

124 In our view, the AER's approach of capping the MRP estimate to the top of the range set by historical excess returns has no logic to it because:

a. The historical excess returns approach provides an estimate of the MRP over average market conditions.[109] Thus, the range that is generated from this approach encompasses the statistical uncertainty about the MRP for long-run average market conditions. There is no basis at all for constraining an estimate of the MRP for the prevailing market conditions on the basis of statistical uncertainty about the estimate of the MRP for long-run average market conditions;[110] and

b. Such an approach would be inconsistent with the AER's own DGM evidence, which suggests that the MRP in the prevailing market conditions has increased materially since the publication of its Guideline.

125 In summary, our view is that:

a. The AER's approach appears to be one of setting the MRP to the top of the historical excess returns range if the other relevant evidence (particularly the AER's DGM evidence) suggests a contemporaneous MRP above 6.5%;

---

107 TransGrid Draft Decision, Attachment 3, p. 200.

108 ENERGEX Final Decision, Table 3-41, p. 3-355.

109 That is, the average conditions over the particular historical period that was used.

110 That is, the arithmetic mean estimates that the AER considers are estimates of the average risk premium over the relevant sampling periods. Those estimates range from 5.9% to 6.5%. This does *not* imply that the MRP could be as low as 5.9% in some market conditions or as high as 6.5% in other market conditions. It *does* imply that a point estimate for the MRP in *average* market conditions should come from the range of 5.9% to 6.5%.

b. The application of that approach would currently produce an MRP estimate of 6.5% (as indicated in the AER's recent final decisions; and

c. The approach of capping the MRP estimate at 6.5% has no logic to it and does not produce the best estimate, as explained in the previous paragraph.

126 Rather, our view is that:

a. The DGM evidence should not be constrained by a cap of 6.5% that is based on the long-run mean of historical excess returns. As shown above, that approach has produced a fixed MRP of 6.5% even as the AER's own DGM evidence suggests that the contemporaneous MRP is further and further above 6.5%; and

b. Regard should be given to other relevant evidence, in particular MRP estimates derived using historical real returns. We address this issue below.

3.3.5 Other estimates of the market risk premium

127 There is broad agreement between stakeholders that historical excess returns and DGM estimates of the MRP are relevant and should be considered. The main point of contention between stakeholders and the AER is whether the historical real returns should also be used to estimate the MRP – a method that the AER refers to as the "Wright" approach.

128 Under that approach, the MRP is estimated by:

a. Estimating the mean of the real market return over an historical period;

b. Grossing-up that estimate for current expected inflation; and

c. Subtracting the current risk-free rate.

129 Whereas the excess returns approach assumes that the MRP is constant over all market conditions and the required return on equity varies one-for-one with changes in the risk-free rate, the historical real returns approach assumes that the real required return on equity is more stable and the MRP varies (inversely with changes in the risk-free rate) over different market conditions.

130 These two approaches are the end points of the theoretical spectrum. At one extreme is the excess returns approach, which implies that the MRP is constant across the whole range of market conditions that occurred over the relevant historical period. At the other end of the spectrum is the historical real returns approach, which implies that the MRP varies inversely with the risk-free rate such that the overall required return on equity is stable over time.

131 In its April 2015 final decisions, the AER concludes that the historical real returns approach produces an estimate of the MRP of 7.5%[111] to 10.2%[112] with a midpoint of 8.8%.

132 For the reasons set out in SFG (2015 ROE) we also consider that the MRP estimates adopted in independent expert valuation reports are relevant evidence that should be afforded some weight. SFG (2015 ROE) also explains the basis for the estimate of 6.9% from that evidence.

3.3.6 Summary and conclusions

133 The analysis above considers four approaches for estimating the MRP and the resulting estimates are summarised in Table 4 below. In our view, the approaches set out in Table 4 have different relative strengths and weaknesses:

a. The historical excess return and historical real returns approaches each represent end points of a spectrum when using historical data to estimate the required return on the market. The historical real returns approach assumes that the real required return on equity is constant across different market conditions and the excess returns approach assumes that the MRP is constant so that the required return on equity rises and falls directly with changes in the risk-free rate. We agree with the conclusion in the Guideline materials that there is no compelling statistical evidence to support one or the other of these assumptions and that regard should be had to both. However, that is no reason to place exclusive reliance on one approach to the exclusion of the other; both approaches should be used to formulate an overall estimate of the MRP. We note that both approaches are used in practice, including in regulatory practice. We also note that it is common in practice to have some regard to long-run historical data when estimating the required return on the market.

b. We agree with the Guideline's assessment that DGM evidence is relevant and should be considered when estimating the required return on the market. The DGM is theoretically sound in that simply it equates the present value of future dividends to the current stock price and it is commonly used for the purpose of estimating the required return on the market. This approach is also the only approach that provides a current estimate of MRP.

---

111 (7.77% - 2.55%)/0.7 = 7.5%.

112 (9.66% - 2.55%)/0.7 = 10.2%.

c. Independent expert valuation reports provide an indication of the required return on equity that is being used in the market for equity funds. We agree with the Guideline's conclusion that this information is relevant and should be considered. However, we note that certain assumptions must be made when seeking to extract an appropriate MRP estimate from an independent expert report (in particular, the extent to which various uplift factors should be incorporated into the MRP estimate). It is for this reason that we adopt a conservative ex-imputation MRP estimate of 6% in this report.

134 Taking account of the relevant strengths and weaknesses of the different estimation approaches, we propose the weighting scheme set out in Table 4 below. Our reasons for proposing this weighting scheme are as follows:

a. We apply 50% weight to the forward-looking DGM estimate and 50% weight to the approaches that are based on historical averages;

b. We apply equal weight to the historical excess returns and historical real returns approaches for deriving MRP estimates using the historical market return data. Those two approaches represent the two ends of the spectrum in relation to the processing of that data; and

c. We apply some weight to our estimate from independent expert valuation reports, noting that this is a conservative estimate in that it is not influenced by any uplift factors or adjustments to the historically low risk-free rate.

135 Our final weighted-average estimate of the MRP is 7.9%.

Table 4: Market risk premium estimates

Estimation approach	Estimate	Weight
AER estimate from mean historical excess returns	6.5%	20%
AER estimate from the historical real returns approach	8.8%	20%
AER estimate from the DGM approach	8.2%	50%
Frontier estimate from independent expert valuation reports	6.9%	10%
Weighted average	**7.9%**	**100%**

4 Consideration of the AER's cross checks

4.1 Overview

136 In its recent draft and final decisions, the AER conducts a number of cross checks to determine the reasonableness of its allowed return on equity. In our view, the fact that the AER's allowed return on equity fails its cross checks should have led it to revisit the parameter estimates used in the SL-CAPM. Had it estimated the equity beta and MRP in the manner proposed in this report, the allowed return on equity would have passed these cross checks.

4.2 Consideration of MRP estimates derived using historical real returns

137 As noted above, the historical real returns approach is a method for estimating the MRP that is based on the mean of real returns on the market portfolio. In its Guideline materials and recent draft and final decisions, the AER has indicated that the historical real returns approach (referred to as the Wright approach by the AER) produces relevant evidence and that it will have some regard to that evidence. However, the AER does not use the historical real returns approach to inform its estimate of the MRP, but rather uses it as a cross-check on its final estimate of the allowed return on equity.

138 In Step 3 of its estimation approach in its April 2015 final decisions, the AER concludes that the appropriate equity beta is 0.7 and the appropriate MRP is 6.5%. This leads the AER to set the allowed return on equity to 7.1%. In Step 4 of its approach, the AER considers what the return on equity would be if it had used the historical real returns approach (rather than the approach it actually used) to estimate the MRP. The AER concludes that using its:

> …beta point estimate, the return on equity estimates fall within a range of 7.77 to 9.66 per cent.[113]

139 That is, the AER's calculations suggest that if the historical real returns approach is used to estimate the MRP, the estimate of the required return on equity will be materially above its allowed return of 7.1%.

140 However, in Step 4 of its estimation approach, the AER reintroduces an equity beta range of 0.4 to 0.7 for the sole purpose of evaluating the historical real returns approach. The only way the AER can obtain a range for the historical real returns approach that includes its proposed allowed return on equity is to combine the historical real returns estimate of MRP with a beta of 0.4, which the

---

113 TransGrid Final Decision, p.3-437.

AER has already discarded in the previous step of its estimation process. This enables the AER to conclude that:

> Our foundation model return on equity estimate falls within the range of estimates derived from the Wright approach.[114]

141 The historical real returns approach has nothing at all to do with beta – it is used only for estimating the MRP. The AER's own historical real returns estimate of MRP (7.5% to 10.2%) is unambiguously higher than its proposed estimate of 6.5%. It makes no sense for the AER to conclude that its proposed return on equity is consistent with the historical real returns evidence based on a comparison of:

a. The AER's proposed estimate of MRP (6.5%) multiplied by the AER's proposed estimate of beta (0.7); with

b. The AER's historical real returns estimate of MRP (7.5% to 10.2%) multiplied by an estimate of beta that the AER has already rejected in a previous step of its estimation process (0.4).

142 The outcome of such a comparison is that the AER says that it has had regard to the historical real returns approach, but regard is given to the historical real returns approach in such a manner as to ensure that it cannot have any effect on the allowed return.

4.3 Consideration of independent expert estimates of the return on equity

143 In one of its return on equity cross-checks, the AER compares estimates of the required return on the market from independent expert reports with the allowed return on the market from its approach of adding a fixed 6.5% MRP to the prevailing risk-free rate.

144 All of the AER's estimates include its assumed value of imputation credits. However, it combines *with-imputation* and *ex-imputation* estimates from independent experts to form a combined range. The AER then concludes that this combined range spans (and therefore supports) its own estimates:

> Overall, Figure 3.32 shows that the market return estimated by the SLCAPM using the AER's point estimate of the market risk premium is not inconsistent with the market returns estimated in valuation reports. [115]

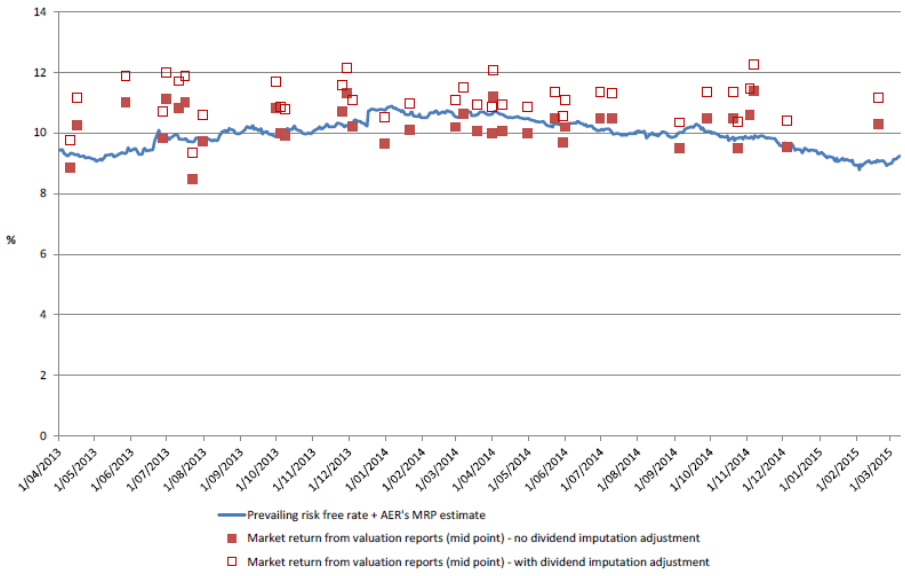
114 TransGrid Final Decision, p.3-133.

115 TransGrid Final Decision, p.3-460.

145 However, the comparison of with-imputation and ex-imputation returns is a clear error. It is equivalent to comparing pre-tax and post-tax returns as though they are like-with-like.

146 The AER's own analysis, reproduced in Figure 11 below, shows that the vast majority of independent expert with-imputation estimates are materially above its own with-imputation estimates.

Figure 11: AER comparison of independent expert estimates of the return on equity



Source: TransGrid Final Decision, Attachment 3, Figure 3.32, p. 461.

147 In justifying a comparison to the return on equity estimates that do not include an adjustment for imputation, the AER cites a lack of transparency in valuation reports.[116] The AER is effectively suggesting that the independent experts might have already incorporated an adjustment for imputation into their return on equity estimates, thereby allowing the AER to consider the red points in the figure. The AER makes this suggestion despite the clear statement from Grant Samuel that it has:

> …never made any adjustment for imputation (in either the cash flows or the discount rate) in any of our 500 plus public valuation reports.[117]

148 The AER interprets the earlier statement of Grant Samuel that it does not "incorporate any particular value for franking credits" as an indication that Grant Samuel might consider a value for franking credits cannot be reliably determined.[118] This interpretation of the approach taken by Grant Samuel has no

116 TransGrid Final Decision, p.3-439.

117 TransGrid Final Decision, p.3-453.

118 TransGrid Final Decision, p.3-453.

reasonable basis. And in any event there is no doubt that the discount rate adopted by Grant Samuel can only be compared to the AER's discount rates if it is altered to include a value for imputation credits.

149 Moreover, in performing this comparison, the AER notes the common practice of independent experts to apply an "uplift" in using a return on equity above the estimate that would be obtained from the CAPM.[119] However, the AER ignores all uplifts in its comparison above. That is, the estimates ultimately adopted by the independent experts were generally materially higher than those included in the AER's comparison above. In our view, these uplifts are relevant evidence because (a) they contribute to the return on equity that was adopted by the independent expert, and (b) they illustrate that independent experts do not implement the CAPM in the mechanistic fashion employed by the AER.

150 To make the consideration of uplifts clear, consider the following two situations.

a. The AER has acknowledged that the SL-CAPM has "shortcomings" and "empirical limitations." Exactly what the AER considers these shortcomings and empirical limitations to be is unclear, but nevertheless this is the rationale for giving some consideration to the Black CAPM. Further, the AER states that it uses this as a basis for determining equity beta (although as stated earlier we question whether the AER has, in effect, applied a process any different to what it adopted under the old NER).

b. Independent experts have acknowledged that if they merely apply the SL-CAPM the discount rate will often be understated, and so generally apply an uplift to their estimate of the cost of equity, rather than make an adjustment to the equity beta estimate.

c. Having observed this uplift the AER says that it should be ignored because the uplift reflects something other than the estimate of systematic risk. Then, the AER compares the AER's estimate of the cost of equity (which includes the beta estimate of 0.7, formed on the basis of the limitations of the SL-CAPM) to the independent experts' estimates of the cost of equity after stripping out the uplifts used by the experts to account for what is missing from the discount rate.

4.4 Consideration of broker reports

151 In its recent final decisions, the AER presents estimates of the cost of equity from broker reports issued over the period 1 October 2014 to 6 March 2015. The reports cover the four Australian-listed energy network businesses (AusNet

119 TransGrid Final Decision, p.3-460.

Services, Spark Infrastructure, APA Group and DUET Group) and are issued by Credit Suisse, JP Morgan, Morgan Stanley and Macquarie Bank.

152 The AER notes that the broker estimates that are adjusted for imputation are uniformly higher than its own allowed return on equity – indeed the broker estimates are up to 12% compared with the AER's allowed return of 7.1%.[120]

153 The AER then makes two adjustments. First, it includes *ex-imputation* broker estimates in the comparison with its own *with-imputation* estimates. We have discussed above why this is clearly an invalid comparison.

154 The second adjustment the AER makes is to subtract the contemporaneous risk-free rate from its own estimate and to compare the result with "risk premium" estimates that the AER derives from the broker reports. That is, the AER and broker estimates of the required return on equity can be disaggregated into a risk premium component and a "balance" component. The AER concludes that its risk premium component is broadly commensurate with its derivation of the risk premiums from the broker reports:

> The equity risk premium from the AER's foundation model of 4.55 per cent is within the range of premiums recently estimated by brokers.[121]

155 However, the broker reports uniformly use higher "balance" components relative to the AER. For its "balance" component the AER uses the contemporaneous risk-free rate. The broker reports uniformly adopt a higher number, reflecting the fact that they do not use a mechanistic implementation of the SL-CAPM the way the AER does.

156 In summary, the broker estimates of the return on equity are materially higher than the AER's estimates. Whereas the AER's derivation of the risk premium component is commensurate with its own risk premium, the other component is materially higher than the AER's estimate. The AER only compares the risk premium components.

157 In our view this produces a misleading picture of the relevant evidence. The broker reports are for the AER's set of domestic comparator firms and are current and timely. They adopt a return on equity that is materially higher than the AER's estimate. Yet the AER concludes that this evidence provides support for its own estimate.

4.5 Conclusions in relation to cross checks

158 The fact that the AER's allowed return on equity fails its cross checks should have led it to revisit the parameter estimates used in the SL-CAPM had the AER

---

120 TransGrid Final Decision, Table 3.58, p.3-444.

121 TransGrid Final Decision, p.3-444.

estimated the equity beta and MRP in the manner proposed in this report, the allowed return on equity would have passed the cross checks.

5 Inflation forecasts

159 This section presents:

a. The AER's most recent forecast of average annual inflation over the ten year period 2015-16 to 2024-25. These forecasts were presented by the AER in its recent final decision for Ergon Energy; and

b. The AER's most recent view of forecast inflation for each of the years 2015-16 and 2016-17. Once again, these estimates were published by the AER in its recent final decision for Ergon Energy.

c. Forecasts of average annual inflation for the ten year period 2015-16 to 2024-25, using the most up-to-date information available. This represents the time period closest to the window the AER would consider relevant to Powerlink Queensland's next regulatory period (commencing 1 July 2017) for which forecasts can feasibly be developed using data available at present. As Powerlink Queensland's next regulatory period approaches, it will be necessary to update these forecasts with the most current data at that time.

160 The AER's Guideline did not set out the AER's final position on how inflation should be forecast for the purposes of determining the allowed rate of return. The AER considered that these issues will need to be considered in upcoming determinations.[122]

161 In its April 2015 decisions, the AER accepted TransGrid's proposed approach to forecasting inflation. That approach involved taking the geometric average of the Reserve Bank of Australia's (RBA's) short term (i.e. over the next two years) inflation forecasts and the mid-point of the RBA's inflation targeting band. The approach that Ausgrid proposed is also consistent with the method that the AER has used in past decisions.

162 Table 5 summarises the AER's forecasts of inflation in its NSW draft decisions.

122 AER Rate of Return Guideline, Explanatory Statement, p. 21.

Table 5: AER's inflation forecasts in recent NSW draft decisions

Forecast inflation	2014–15	2015–16	2016–17	2017–18 to 2023–24	Geometric average
TransGrid's proposal	2.75 [a]	2.5 [a]	2.5	2.5	2.53
Draft decision update	2.0 [b]	3.0 [b]	2.5	2.5	2.50
AER final decision	1.25 [c]	2.75 [c]	2.75 [c]	2.5	2.38

Source: RBA, *Statement on Monetary Policy*, February 2014, p. 60; RBA, *Statement on Monetary Policy*, November 2014, p. 61; RBA, *Statement on Monetary Policy*, February 2015, p. 71.

(a) In February 2014, the RBA published a range of 2.25–3.25 per cent and 2–3 per cent for its June 2015 and June 2016 CPI inflation forecasts respectively. TransGrid selects the mid-points from these ranges.

(b) In November 2014, the RBA published a range of 1.5–2.5 per cent and a range of 2.5–3.5 per cent for its June 2015 and June 2016 CPI inflation forecasts respectively. We select the mid-points from these ranges.

(c) In February 2015, the RBA published 1.25 per cent, a range of 2.25–3.25 per cent and a range of 2.25–3.25 per cent for its June 2015, June 2016 and June 2017 CPI inflation forecasts respectively. Where the RBA published ranges, we select the mid-points.

Source: TransGrid Final Decision, Table 3-33

163 In its final decision for Ergon Energy (published in October 2015), the AER maintained the approach to forecasting inflation that it had used in its final decision for Transgrid. The AER's inflation forecasts in its final decision for Ergon Energy are summarised below in Table 6.

Table 6: AER's inflation forecasts in recent Ergon Energy final decision

Forecast inflation	2015–16	2016–17	2017–18 to 2024–25	Geometric average
AER preliminary determination	2.75 [a]	2.75 [a]	2.5	2.55
AER final decision update	2.5 [b]	2.5 [b]	2.5	2.5

Source: RBA, *Statement on Monetary Policy*, February 2015, p. 71; RBA, *Statement on Monetary Policy*, August 2015, p. 67

(a) In February 2015, the RBA published a range of 2.25–3.25 per cent and a range of 2.25–3.25 per cent for its June 2016 and June 2017 CPI inflation forecasts respectively. Where the RBA published ranges, we select the mid-points.

(b) In August 2015, the RBA published a range of 2–3 per cent for its June 2016 and June 2017 CPI inflation forecasts respectively. We select the mid-point from this range.

Source: TransGrid Final Decision, Table 3-33

164 The Table above shows that:

a. The AER's most recent forecast of average annual inflation over the ten year period 2015-16 to 2024-25 is **2.50%** (i.e., an increase of 12 basis points from its final decision for Transgrid).

Inflation forecasts

b. The AER's most recent view of average annual inflation for the particular year 2015-16, and the particular year 2016-17 (both based on the RBA's short-run inflation forecast) is **2.50%**.

165 Using data collected from the RBA's November 2015 Statement on Monetary Policy, Table 7 presents our forecasts of inflation for the period 2015-16 to 2024-25 using the AER's preferred methodology.

Table 7: Forecast inflation for the period 2015-16 to 2024-25 using the AER's preferred approach

	2015-16	2016-17	2017-18 to 2024-25	Geometric average
Forecast using AER's approach	2.00%	2.50%	2.50%	2.45%

Source: RBA's November 2015 Statement on Monetary Policy, Frontier calculations

Notes: The RBA's Statement on Monetary Policy presented a range of 1.50% to 2.50% for the year 2015-16, and a range of 2.00% to 3.00% for the year 2016-17. In keeping with the AER's approach, we adopted the midpoint of this range.

166 Our calculations suggest that the AER's methodology, applied using the most up-to-date information available, would produce forecast average inflation rate for the period 2015-16 to 2024-25 of **2.45%**, which is 5 basis points lower than the AER's forecast in its final decision for Ergon Energy.

6 Declaration

167 I confirm that I have made all the inquiries that I believe are desirable and appropriate and no matters of significance that I regard as relevant have, to my knowledge, been withheld from the Court.

Professor Stephen Gray

7 References

Alberta Utilities Commission, 2011, *Generic Cost of Capital*, December.

Australian Energy Market Commission, 2012, *Rule determination: National Electricity Amendment (Economic regulation of network service providers) Rule 2012 and National Gas Amendment (Economic regulation of gas services) Rule 2012,* November.

Australian Energy Regulator, 2015, *Final decision Ausgrid distribution determination,* April.

Australian Energy Regulator, 2015, *Final decision Energex distribution determination,* October.

Australian Energy Regulator, 2015, *Final decision for TransGrid Transmission 2015-16 to 2018-18, Attachment 3 – Rate of return,* April.

Australian Energy Regulator, 2014, *Draft decision, Jemena Gas Networks (NSW) Ltd Access Arrangement 2015–20,* November.

Australian Energy Regulator, 2013, *Rate of return guideline,* December.

Australian Energy Regulator, 2013, *Rate of return guideline – Equity beta issues paper,* October.

Australian Energy Regulator, 2013, *Rate of return guideline – Explanatory Statement,* December.

Brailsford, T., C. Gaunt, and M. O'Brien, 2012a. "Size and book-to-market factors in Australia," Australian Journal of Management, 37, 261–281.

Brattle Group, 2013, *The WACC for the Dutch TSOs, DSOs, water companies and the Dutch Pilotage Organisation*, March.

Brealey, R., S. Myers and F. Allen, 2015, *Principles of Corporate Finance*, 11th ed., McGraw-Hill.

CEG, 2013, *Information on Equity Beta from US Companies,* June.

Economic Sciences Prize Committee, 2013, *Understanding Asset Prices*, October.

Frontier Economics, 2015 Risks, *Review of the AER's conceptual analysis for equity beta*, May.

FTI Consulting, 2012, *Cost of capital study for the RIIO-T1 and GD1 price controls,* July.

Grant Samuel, 2015, *Grant Samuel response to AER draft decision*, January.

Handley, J.C., 2015 JGN, *Advice on the rate of return for the 2015 AER energy network determination for Jemena Gas Networks,* 20 May.

Henry, O., 2014, *Estimating β: An update, Report for the AER.*

Lewellen, J., S. Nagel and J. Shanken, 2010, "A Sceptical Appraisal of Asset Pricing Tests," *Journal of Financial Economics*, 96, 175–194.

NERA, 2015 Emp, *Empirical Performance of Sharpe-Lintner and Black CAPMs*, February.

NERA, 2015 Lit, *Review of the Literature in Support of the Sharpe-Lintner CAPM, the Black CAPM and the Fama-French Three-Factor Model*, March.

Nobel Prize Committee, 2013, *Understanding Asset Prices*, Royal Swedish Academy of Sciences, October.

Ofgem, 2012, "RIIO-T1: Final proposals for National Grid Electricity Transmission and National Grid Gas Transmission," 17 December.

PWC, 2014, *Appreciating Value New Zealand*, June.

Reserve Bank of Australia, 2015, *Statement on Monetary Policy*, February, www.rba.gov.au.

SFG Consulting, 2015 Beta, *Beta and the Black Capital Asset Pricing Model*, 13 February.

SFG Consulting, 2015 FFM, *Using the Fama-French model to estimate the required return on equity*, 13 February.

SFG Consulting, 2014, *The Fama French model*, May.

SFG Consulting, 2014 Beta, *An appropriate regulatory estimate of equity beta*, May.

SFG Consulting, 2013, *Regression-based estimates of risk parameters for the benchmark firm*, 24 June.

SFG Consulting, 2014 DDM, *Alternative versions of the Dividend Discount Model and the implied cost of equity*, May.

SFG Consulting, 2015 DDM, *Share prices, the Dividend Discount Model and the cost of equity for the market and a benchmark energy network*, February.

8 Appendix: Curriculum Vitae of Professor Stephen Gray

Stephen F. Gray

Professor of Finance
University of Queensland
Business School
Brisbane 4072
AUSTRALIA
Office: +61-7-3346 8032
Email: s.gray@business.uq.edu.au

Director
Frontier Economics
Email: Stephen.Gray@frontier-economics.com.au

Academic Qualifications

1995 Ph.D. (Finance), Graduate School of Business, Stanford University.
Dissertation Title: Essays in Empirical Finance
Committee Chairman: Ken Singleton
1989 LL.B. (Hons), Bachelor of Laws with Honours, University of Queensland.
1986 B.Com. (Hons), Bachelor of Commerce with Honours, University of Queensland.

Employment History

2000-Present Professor of Finance, UQ Business School, University of Queensland.
1997-2000 Associate Professor of Finance, Department of Commerce, University of Queensland and Research Associate Professor of Finance, Fuqua School of Business, Duke University.
1994-1997 Assistant Professor of Finance, Fuqua School of Business, Duke University.
1990-1993 Research Assistant, Graduate School of Business, Stanford University.
1988-1990 Assistant Professor of Finance, Department of Commerce, University of Queensland.
1987 Specialist Tutor in Finance, Queensland University of Technology.
1986 Teaching Assistant in Finance, Department of Commerce, University of Queensland.

Academic Awards

2014 E Yetton Prize for best paper in the Australian Journal of Management, Brailsford, T., S. Gray and S. Treepongkaruna, (2013), "Explaining the bid-ask spread in the foreign exchange market: A test of alternate models."
2006 Outstanding Professor Award, Global Executive MBA, Fuqua School of Business, Duke University.
2002 Journal of Financial Economics, All-Star Paper Award, for Modeling the Conditional Distribution of Interest Rates as a Regime-Switching Process, JFE, 1996, 42, 27-62.
2002 Australian University Teaching Award – Business (a national award for all university instructors in all disciplines).
2000 University of Queensland Award for Excellence in Teaching (a University-wide award).
1999 Outstanding Professor Award, Global Executive MBA, Fuqua School of Business, Duke University.
1999 KPMG Teaching Prize, Department of Commerce, University of Queensland.
1998 Faculty Teaching Prize (Business, Economics, and Law), University of Queensland.
1991 Jaedicke Fellow in Finance, Doctoral Program, Graduate School of Business, Stanford University.
1989 Touche Ross Teaching Prize, Department of Commerce, University of Queensland.
1986 University Medal in Commerce, University of Queensland.

Large Grants (over $100, 000)

- Institute of Teaching and Learning Innovation Grant 2016-17, Technology-enhanced Learning Grant ($200,000), with K. Benson, B. Oliver and J. Birt.

- Australian Research Council Linkage Grant, 2008—2010, Managing Asymmetry Risk ($320,000), with T. Brailsford, J.Alcock, and Tactical Global Management.
- Intelligent Grid Cluster, Distributed Energy – CSIRO Energy Transformed Flagship Collaboration Cluster Grant, 2008-2010 ($552,000)
- Australian Research Council Research Infrastructure Block Grant, 2007—2008, Australian Financial Information Database ($279,754).
- Australian Research Council Discovery Grant, 2006—2008, Capital Management in a Stochastic Earnings Environment ($270,000).
- Australian Research Council Discovery Grant, 2005—2007, Australian Cost of Equity.
- Australian Research Council Discovery Grant, 2002—2004, Quantification Issues in Corporate Valuation, the Cost of Capital, and Optimal Capital Structure.
- Australian Research Council Strategic Partnership Grant, 1997—2000, Electricity Contracts and Securities in a Deregulated Market: Valuation and Risk Management for Market Participants.

Current Research Interests

Benchmark returns and the cost of capital. Corporate Finance. Capital structure. Real and strategic options and corporate valuation. Financial and credit risk management. Empirical finance and asset pricing.

Publications

Faff, R., S. Gray, and H. Norton, (2015), "Yes, one-day international cricket 'in-play' strategies can be profitable!" *Journal of Banking and Finance*, forthcoming.

Gray, S. and J. Nowland, (2015), "The Diversity of Expertise on Corporate Boards in Australia," *Accounting and Finance*, forthcoming.

Darat, A., S. Gray, J. C. Park and S. Wu, (2014), "Corporate governance and bankruptcy risk" *Journal of Accounting, Auditing and Finance*, forthcoming.

Gray, S., I. Harymawan and J. Nowland, (2014), "Political and government connections on corporate boards in Australia: Good for business?" *Australian Journal of Management*, forthcoming.

Brailsford, T., S. Gray and S. Treepongkaruna, (2014), "Explaining the bid-ask spread in the foreign exchange market: A test of alternate models," *Australian Journal of Management*, 39, 4, 573-591.

Faff, R., S. Gray and M. Poulsen, (2014), "Financial inflexibility and the value premium," *International Review of Finance*, 13, 3, 327-344.

Fitzgerald, T., S. Gray, J. Hall and R. Jeyaraj, (2013), "Unconstrained estimates of the equity risk premium" *Review of Accounting Studies*, 18, 560-639.

Gray, S. and J. Nowland, (2013), "Is prior director experience valuable?" *Accounting and Finance*, 53, 643-666.

Chen, E. T., S. Gray and J. Nowland, (2012), "Family representatives in family firms" *Corporate Governance: An International Review*, 21(3), 242-263.

Treepongkaruna, S., R. Brooks and S. Gray, (2012), "Do Trading Hours Affect Volatility Links in the Foreign Exchange Market?" *Australian Journal of Management*, 37, 7-27.

Chen, E. T., S. Gray and J. Nowland, (2012), "Multiple founders and firm value" *Pacific Basin Finance Journal*, 20, 3, 398-415.

Chan, K-F., R. Brooks, S. Treepongkaruna and S. Gray, (2011), "Asset market linkages: Evidence from financial, commodity and real estate assets," *Journal of Banking and Finance*, 35, 6, 1415-1426.

Parmenter, B, A. Breckenridge, and S. Gray, (2010), 'Economic Analysis of the Government's Recent Mining Tax Proposals', *Economic Papers*: *A Journal of Economics and Policy*, 29(3), September, 279-91.

Gray, S., C. Gaunt and Y. Wu, (2010), "A comparison of alternative bankruptcy prediction models," *Journal of Contemporary Accounting and Economics*, 6, 1, 34-45.

Feuerherdt, C., S. Gray and J. Hall, (2010), "The Value of Imputation Tax Credits on Australian Hybrid Securities," *International Review of Finance*, 10, 3, 365-401.

Gray, S., J. Hall, D. Klease and A. McCrystal, (2009), "Bias, stability and predictive ability in the measurement of systematic risk," *Accounting Research Journal*, 22, 3, 220-236.

Treepongkaruna, S. and S. Gray, (2009), "Information volatility links in the foreign exchange market," *Accounting and Finance*, 49, 2, 385-405.

Costello, D., S. Gray, and A. McCrystal, (2008), "The diversification benefits of Australian equities," *JASSA*, 2008, 4, 31-35.

Gray, S. and J. Hall, (2008), "The Relationship Between Franking Credits and the Market Risk Premium: A Reply," *Accounting and Finance*, 48, 1, 133-142.

Gray, S., A. Mirkovic and V. Ragunathan, (2006), "The Determinants of Credit Ratings: Australian Evidence," *Australian Journal of Management*, 31(2), 333-354.

Choy, E., S. Gray and V. Ragunathan, (2006), "The Effect of Credit Rating Changes on Australian Stock Returns," *Accounting and Finance*, 46(5), 755-769.

Gray, S. and J. Hall, (2006), "The Relationship Between Franking Credits and the Market Risk Premium," *Accounting and Finance*, 46(3), 405-428.

Gray, S. and S. Treepongkaruna, (2006), "Are there non-linearities in short-term interest rates?" *Accounting and Finance*, 46(1), 149-167.

Gray, P., S. Gray and T. Roche, (2005), "A Note on the Efficiency in Football Betting Markets: The Economic Significance of Trading Strategies," *Accounting and Finance*, 45(2) 269-281.

Duffie, D., S. Gray and P. Hoang, (2004), "Volatility in Energy Prices. In V. Kaminski," (Ed.), *Managing Energy Price Risk: The New Challenges and Solutions* (3rd ed.). London: Risk Books.

Cannavan, D., F. Finn and S. Gray, (2004), "The Value of Dividend Imputation Tax Credits in Australia," *Journal of Financial Economics*, 73, 167-197.

Gray, S. and S. Treepongkaruna, (2003), "Valuing Interest Rate Derivatives Using a Monte-Carlo Approach," *Accounting and Finance*, 43(2), 231-259.

Gray, S., T. Smith and R. Whaley, (2003), "Stock Splits: Implications for Investor Trading Costs," *Journal of Empirical Finance*, 10, 271-303.

Gray, S. and S. Treepongkaruna, (2003), "On the Robustness of Short-term Interest Rate Models," *Accounting and Finance*, 43(1), 87-121.

Gray, S. and S. Treepongkaruna, (2002), "How to Value Interest Rate Derivatives in a No-Arbitrage Setting," *Accounting Research Journal* (15), 1.

Gray, P. and S. Gray, (2001), "A Framework for Valuing Derivative Securities," *Financial Markets Institutions & Instruments*, 10(5), 253-276.

Gray, P. and S. Gray, (2001), "Option Pricing: A Synthesis of Alternate Approaches," *Accounting Research Journal*, 14(1), 75-83.

Dahlquist, M. and S. Gray, (2000), "Regime-Switching and Interest Rates in the European Monetary System," *Journal of International Economics*, 50(2), 399-419.

Bollen, N., S. Gray and R. Whaley, (2000), "Regime-Switching in Foreign Exchange Rates: Evidence from Currency Options," *Journal of Econometrics*, 94, 239-276.

Duffie, D., S. Gray and P. Hoang, (1999), "Volatility in Energy Prices. In R. Jameson," (Ed.), *Managing Energy Price Risk* (2nd ed.). London: Risk Publications.

Gray, S. and R. Whaley, (1999), "Reset Put Options: Valuation, Risk Characteristics, and an Example," *Australian Journal of Management*, 24(1), 1-21.

Bekaert, G. and S. Gray, (1998), "Target Zones and Exchange Rates: An Empirical Investigation," *Journal of International Economics*, 45(1), 1-35.

Gray, S. and R. Whaley, (1997), "Valuing S&P 500 Bear Market Warrants with a Periodic Reset," *Journal of Derivatives*, 5(1), 99-106.

Gray, S. and P. Gray, (1997), "Testing Market Efficiency: Evidence from the NFL Sports Betting Market," *The Journal of Finance*, 52(4), 1725-1737.

Gray, S. (1996), "Modeling the Conditional Distribution of Interest Rates as a Regime- Switching Process," *Journal of Financial Economics*, 42, 27-62.

Gray, S. (1996), "Regime-Switching in Australian Interest Rates," *Accounting and Finance*, 36(1), 65-88.

Brailsford, T., S. Easton, P.Gray and S. Gray, (1995), "The Efficiency of Australian Football Betting Markets," *Australian Journal of Management*, 20(2), 167-196.

Duffie, D. and S. Gray, (1995), "Volatility in Energy Prices," In R. Jameson (Ed.), *Managing Energy Price Risk*, London: Risk Publications.

Gray, S. and A. Lynch, (1990), "An Alternative Explanation of the January Anomaly," *Accounting Research Journal*, 3(1), 19-27.

Gray, S. (1989), "Put Call Parity: An Extension of Boundary Conditions," *Australian Journal of Management*, 14(2), 151-170.

Gray, S. (1988), "The Straddle and the Efficiency of the Australian Exchange Traded Options Market," *Accounting Research Journal*, 1(2), 15-27.

Teaching

Fuqua School of Business, Duke University, Student Evaluations (0-7 scale):

- Financial Management (MBA Core): Average 6.5 over 7 years.
- Advanced Derivatives: Average 6.6 over 4 years.
- Empirical Issues in Asset Pricing: Ph.D. Class

1999, 2006 Outstanding Professor Award, Global Executive MBA, Fuqua School of Business, Duke University.

UQ Business School, University of Queensland, Student Evaluations (0-7 scale):

- Finance (MBA Core): Average 6.6 over 10 years.
- Corporate Finance Honours: Average 6.9 over 10 years.

2002 Australian University Teaching Award – Business (a national award for all university instructors in all disciplines).
2000 University of Queensland Award for Excellence in Teaching.
1999 Department of Commerce KPMG Teaching Prize, University of Queensland.
1998 Faculty Teaching Prize, Faculty of Business Economics and Law, University of Queensland.
1998 Commendation for Excellence in Teaching, University-wide Teaching Awards, University of Queensland.
1989 Touche Ross Teaching Prize, Department of Commerce, University of Queensland.

Board Positions

2012 - Present: Director, Children's Hospital Foundation, Queensland.
2002 - Present: Director, Financial Management Association of Australia Ltd.
2003 - 2012: Director, Moreton Bay Boys College Ltd. (Chairman from 2007).
2002 - 2007: External Risk Advisor to Board of Enertrade (Queensland Power Trading Corporation Ltd.)

Consulting

SFG Consulting: 1997-2014.
Frontier Economics: 2014-Present.

Twenty years' experience in consulting to companies, government-owned corporations, government and regulatory agencies. Examples include:

- *Regulatory cost of capital*: Preparation of submissions in regulatory determinations. Clients include all Australian energy transmission and distribution businesses, FOXTEL, Telstra, BBI, ACCC, IPART, ERA.

- *Corporate cost of capital reviews*: Review of cost of capital estimates for project evaluation and impairment testing purposes. Clients include QANTAS, Stanwell Corporation, Ecowise.

- *Executive stock option valuation*: Clients include Collins Foods Group, Ground Probe, Crater Gold Mining, Beach Petroleum.

- *New Project Evaluation*: Assisting companies and GOCs to evaluate proposed new projects. Particular focus is on quantifying risk and uncertainty and presenting possible outcomes in a probabilistic framework. Clients include Queensland Treasury Corporation, Queensland Accommodation Group, Stanwell, EnerTrade.

- *Financial modelling and forecasting*: Clients include ATO (forecasting delinquent payments), ASX (forecasting trading volumes), Compass Resources (integrated mine valuation model).

Retained as a valuation expert in many litigation cases; produced many expert witness reports; appeared in Court for cross examination many times including:

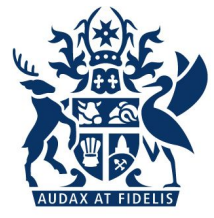
- *Macquarie Generation*: Witness for AGL in competition case.
- *Telstra v. ACCC*: Witness for Telstra in rate of return regulation case.
- *C7 Case*: Witness for PBL, Newscorp, Telstra re valuation of Seven's failed cable TV network.
- *Alcan v. NT Commissioner of Revenue*: Witness for Alcan re valuation of combined bauxite mine and alumina refinery for stamp duty purposes.

FRONTIER ECONOMICS | MELBOURNE | SYDNEY | BRISBANE
Frontier Economics Pty Ltd 395 Collins Street Melbourne Victoria 3000
Tel: +61 (0)3 9620 4488 Fax: +61 (0)3 9620 4499 www.frontier-economics.com
ACN: 087 553 124 ABN: 13 087 553 124

Return on debt transition analysis for Powerlink

PREPARED BY QUEENSLAND TREASURY CORPORATION

DECEMBER 2015



QUEENSLAND TREASURY CORPORATION

Executive summary

Queensland Treasury Corporation (QTC) has been asked by Powerlink to prepare a report on the Australian Energy Regulator's (AER) proposed return on debt transition approach. QTC's observations and conclusions are as follows:

Return on debt approach

- The AER will use a new trailing average approach to determine the allowed return on debt. The trailing average approach replicates the cost produced by a portfolio of fixed rate loans with annual maturities from 1–10 years. At a given point in time the portfolio cost of debt equals the 10-year trailing average of the 10-year benchmark debt yield.
- The trailing average approach will replace the previous 'on-the-day' approach. Under the on-the-day approach the allowed return on debt was fixed for the term of the regulatory control period based on the average 10-year benchmark debt yield during a 10-40 day rate reset period.

Efficient debt management under the on-the-day approach

- The AER has concluded that the hybrid debt management strategy was the most efficient strategy under the on-the-day approach.
- The hybrid strategy involves maintaining a portfolio of floating rate loans with annual maturities from 1–10 years. Maintaining this portfolio requires refinancing each maturing loan with a new 10-year floating rate loan. Over time, this will produce a cost of debt that reflects the 10-year trailing average of the 10-year debt risk premium (DRP).

Return on debt transition

- The main purpose of the return on debt transition is to allow a service provider to make the necessary changes to its debt portfolio to align its cost of debt with the allowed return on debt under the new trailing average approach.
- The AER accepts that an efficiently financed service provider will commence its next regulatory control period with a cost of debt that already reflects the 10-year trailing average of the 10-year DRP. As such, no transition is required for the DRP component of the allowed return on debt.
- Despite this, the AER intends to apply a 10-year transition to the base interest rate and DRP. The AER's transition starts with an on-the-day estimate of the total 10-year benchmark debt yield and gradually moves to a trailing average over a 10-year period.

AER's justification for a DRP transition

- The AER considers that not applying a transition to the DRP may be a reasonable approach and contribute to the allowed rate of return objective. The AER's main objection to this approach is based on the belief that it may violate the NPV=0 principle by locking in any accumulated windfall gain or loss due to past applications of the on-the-day approach.

- The AER argues that its proposed DRP transition is consistent with the NPV=0 principle because it is designed to neutralise the large one-off impact (positive or negative) of changing the return on debt approach.
  - This means that any accumulated windfall gain or loss is expected to be 'mitigated, eroded or squared-up' by the present value of future windfall gains and losses that occur during the 10-year DRP transition period.
- The AER has recently concluded that it is not possible to make a sufficiently accurate estimate of the historical accumulated windfall gain or loss since the start of regulation. Despite this, the AER is still satisfied that its DRP transition will neutralise whatever the accumulated windfall gain or loss is.

Allowed rate of return objective

- The AER is legally required to determine an allowed return on debt that is commensurate with the efficient financing costs of a benchmark efficient entity.
- Whether the AER is permitted to consider past windfall gains and losses when determining a return on debt that is consistent with the allowed rate of return objective and the other requirements in the NER is, in the first instance, a matter of law:
  - If the AER is not legally permitted to consider past outcomes, no DRP transition is required because the efficiently incurred cost of debt already reflects the 10-year trailing average of the 10-year DRP.
  - Even if the AER is legally permitted to consider past outcomes, it does not follow that the proposed DRP transition accurately accounts for those past outcomes. The allowed rate of return objective still requires the AER to determine a return on debt that is commensurate with the efficient debt financing costs of a benchmark efficient entity.
- This presents an interesting challenge for the AER given that it has concluded that a sufficiently accurate estimate of the cumulative windfall gain or loss since the start of regulation cannot be made.

Relationship between past and future gains and losses

- The AER's DRP transition depends on a strong negative relationship between historical accumulated windfall gains (losses) and the present value of expected future windfall losses (gains). The AER has not provided any empirical evidence to support the existence of this relationship.
- The results from QTC's simulation analysis, the empirical estimates for Ergon Energy, Energex and Powerlink, and the time value of money, suggest that there is no relationship between past and future windfall gains and losses.

Conclusion

- The additional windfall gains and losses that will occur under the AER's DRP transition serve no useful purpose and do not contribute to the achievement of the allowed rate of return objective.
- These gains and losses should be avoided by setting the starting value of the allowed return on debt to reflect the 10-year trailing average of the 10-year DRP.

Table of contents

1 The role of QTC 5

2 Return on debt approach 6
- 2.1 The trailing average approach 6
- 2.2 The on-the-day approach 6
- 2.3 Hybrid debt management strategy 6
  - 2.3.1 AER's view 7

3 Return on debt transition 8
- 3.1 Purpose 8
- 3.2 AER's proposed transition 8
  - 3.2.1 Justification 8
- 3.3 The hybrid transition 9
  - 3.3.1 AER assessment of the hybrid transition 9

4 Windfall gains and losses 11
- 4.1 Overview 11
- 4.2 Relationship with the AER's transition 11
- 4.3 Allowed rate of return objective 12
- 4.4 Fairness of returns in expectation 12
- 4.5 Reason for not applying the hybrid transition 14
  - 4.5.1 NPV principle 14
  - 4.5.2 QTC's assessment 15
- 4.6 Reversal of cumulative windfall gains and losses 16
  - 4.6.1 QTC's assessment 17
- 4.7 Mean reversion in the DRP 17
  - 4.7.1 Simulation results 18
  - 4.7.2 Empirical estimates of X1 and X2 18

5 The AER's current position 20
- 5.1 Background 20
- 5.2 Recent decisions 20
  - 5.2.1 Conceptual arguments 22
  - 5.2.2 Continued reliance on analysis of past windfall gains and losses 22
- 5.3 Reducing risk for the benchmark efficient entity 23

6 Analysis of windfall gains and losses for Powerlink 25
- 6.1 Approach 25
- 6.2 Results 25

7 Indicative return on debt estimates for FY2017–18 27
- 7.1 Estimates based on hybrid transition 27
  - 7.1.1 Swap transaction costs 27

Appendix A: The QTC method 28

A.1: Background 28
A.2: Rationale 28

Appendix B: QTC's analysis for Ergon and Energex 30
B.1: Background 30
B.2: Approach 30
B.3: Original estimates 31
B.4: Criticisms of QTC's analysis 31
B.4.1: Historical data availability 31
B.4.2: Treatment of allowed DRPs from previous determinations 32
B.4.3: Firm specific versus sectoral results 33
B.4.4: Clawback compensation process 33

Appendix C: DRP simulation analysis 35
C.1: Objectives 35
C.2: Mean reverting DRP model 35
C.2.1: Estimated model parameters 35
C.3: Approach 36
C.4: Results37
C.4.1: 50-year asset life 37
C.4.2: AER's 10-year DRP transition 38
C.5: Observations and conclusions 39

1 The role of QTC

QTC is the Queensland Government's central financing authority and corporate treasury services provider, with responsibility for:

- sourcing and managing the debt funding to finance Queensland's infrastructure requirements in the most cost-effective manner, and
- providing financial and risk management advice and services to the Queensland Government and Queensland's public sector bodies.

QTC is the largest Australian semi-government issuer of Australian dollar-denominated bonds in the domestic and offshore markets, with total outstandings of approximately $94 billion. Onlendings are made to a wide range of clients including regulated and unregulated government-owned corporations (GOCs), local government authorities, and Queensland Treasury.

QTC is active in the primary and secondary bond markets, and is a regular user of interest rate swaps, bank bill futures contracts and Commonwealth Government bond futures contracts to manage and hedge interest rate risk.

QTC is also responsible for managing the $9.8 billion QTC Capital Guaranteed Cash Fund, which invests in high quality assets including bank bills, commercial paper, corporate floating rate notes, and mortgage and asset-backed securities.

2 Return on debt approach

2.1 The trailing average approach

The AER will use a new trailing average approach to determine the allowed return on debt. The trailing average approach replicates the cost produced by a portfolio of fixed rate loans with annual maturities from 1–10 years. At a given point in time the portfolio cost of debt equals the 10-year trailing average of the 10-year benchmark debt yield.

2.2 The on-the-day approach

The trailing average approach replaces the previous 'on-the-day' approach. Under the on-the-day approach the allowed return on debt was fixed for the term of the regulatory control period based on the average 10-year benchmark debt yield during a 10-40 day rate reset period.

The decision to move to a trailing average approach was based on a proposal from a group of major energy users who were dissatisfied with the volatility in return on debt allowances under the on-the-day approach[1].

In addition to exposing consumers to unnecessary volatility, the on-the-day approach produced an annual return on debt that could not be replicated or approximated with a feasible debt management strategy. Attempting to replicate the on-the-day return on debt would have required a service provider to refinance its entire debt balance during the 10–40 day rate reset period prior to the start of each regulatory control period. This is not feasible as it would have exposed the service provider to an unacceptably high level of refinancing risk.

The lack of replicability and consumer dissatisfaction with the volatility created by the on-the-day approach, were important reasons for moving to the trailing average approach.

2.3 Hybrid debt management strategy

Most privately-owned service providers adopted what is known as the hybrid debt management strategy to manage interest rate risk and refinancing risk under the on-the-day approach. The hybrid strategy involves:

- maintaining a portfolio of floating rate loans with annual maturities from 1–10 years, and
- entering into a 5-year pay-fixed interest rate swap during each rate reset period to lock in a fixed base interest rate for the term of the regulatory control period.

A staggered maturity profile reduces refinancing risk as only 10 per cent of the total debt balance needs to be refinanced each year. The 5-year interest rate swap was intended to align the service provider's base rate with the base rate implicit in the allowed return on debt.

[1] Energy Users Rule Change Committee (October 2011), *Proposal to change the National Electricity Rules in respect of the calculation of the Return on Debt*.

Maintaining a staggered maturity profile out to 10 years requires refinancing each maturing loan with a new 10-year floating rate loan. Over time, this will produce a cost of debt that reflects the 10-year trailing average of the 10-year debt risk premium (DRP)[2].

2.3.1 AER's view

The AER and its consultants have concluded that the hybrid strategy was the most efficient strategy under the on-the-day approach[3].

> "We are satisfied that holding a staggered long term (10 years) debt portfolio and using interest rate swaps to hedge the base rate over the regulatory control period was an efficient financing practice for a benchmark efficient entity subject to the on-the-day approach … we do not expect all service providers would have adopted precisely this strategy. However, we consider it represents a reasonable approximation of the range of efficient financing practices that a benchmark efficient entity would have adopted under the on-the-day approach. This view is supported by Chairmont."

Some service providers disagree with this conclusion and argue that managing some or all of their debt using the strategy implied by the trailing average approach (ie, maintaining a portfolio of fixed rate loans with annual maturities from 1–10 years) was more efficient.

Service providers and the AER agree that a benchmark efficient entity will commence its next regulatory control period with a cost of debt that reflects the 10-year trailing average of the 10-year DRP. This has important implications for the AER's legal requirement to determine an allowed return on debt that contributes to the achievement of the allowed rate of return objective:

> "The allowed rate of return objective is that the rate of return for a service provider is to be commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk as that which applies to the service provider in respect of the provision of reference services (the allowed rate of return objective)."

Clause 6.5.2 (k)(1) of the National Electricity Rules (NER) requires the AER to have regard to:

> "the desirability of minimising any difference between the return on debt and the return on debt of a benchmark efficient entity referred to in the allowed rate of return objective."

An allowed return on debt that reflects a 10-year trailing average of the 10-year DRP is commensurate with the efficiently incurred debt financing costs of a benchmark efficient entity, and minimises the difference between the allowed and efficiently incurred cost of debt.

---

[2] Unless stated otherwise, the DRP is expressed as a margin to swap.
[3] AER (October 2015), *Preliminary Decision – Jemena distribution determination 2016 to 2020 – Attachment 3 – Rate of Return* (hereafter, JEN preliminary decision), p. 555

3 Return on debt transition

3.1 Purpose

The main purpose of the return on debt transition is to allow a service provider to make the necessary changes to its debt portfolio to align its cost of debt with the allowed return on debt under the new trailing average approach.

If the benchmark efficient entity is assumed to have adopted the hybrid strategy, a transition is required for the base rate because the initial base rate will not equal the 10-year trailing average of the 10-year base rate at the start of the next regulatory control period.

If the benchmark efficient entity is assumed to have adopted the trailing average strategy for some or all of its debt, no transition is required for the base rate because the efficiently incurred cost of debt already reflects the 10-year trailing average of the 10-year base rate.

No transition is required for the DRP regardless of whether a service provider enters its next regulatory control period with a portfolio of fixed rate debt, floating rate debt, or some mix of the two, because the efficiently incurred cost of debt will already reflect the 10-year trailing average of the 10-year DRP. As such, the correct starting value of the DRP in the allowed return on debt is the 10-year trailing average of the 10-year DRP.

3.2 AER's proposed transition

In recent decisions the AER has confirmed its use of the 'QTC method' to gradually transition to the trailing average approach over a 10-year period[4]. This method starts with an on-the-day estimate of the total 10-year benchmark debt yield and gradually moves to a trailing average of the 10-year benchmark debt yield over a 10-year transition period.

3.2.1 Justification

The AER accepts that an efficiently financed service provider will commence its next regulatory control period with a cost of debt that already reflects the 10-year trailing average of the 10-year DRP. However, the AER considers that a transition should apply to the DRP because it[5]:

- provides a benchmark efficient entity with a reasonable opportunity to recover its efficient debt financing costs over the life of its assets and therefore mitigates any impacts due to the change in the return on debt approach
- is unbiased because the averaging period is in the future when it is nominated by a service provider, and
- avoids practical problems associated with historical data, although this is now considered to be a relatively minor issue.

[4] Refer Appendix A.
[5] JEN preliminary decision, pp. 162–163

The first reason is an alternative way of expressing the AER's belief that a DRP transition avoids potential windfall gains or losses to service providers or consumers from changing the return on debt approach. The issue of windfall gains and losses is addressed in Section 4.

3.3 The hybrid transition

In response to the AER's views on the most efficient debt management strategy under the previous on-the-day approach, some service providers have proposed a transition that is consistent with moving from hybrid strategy to the trailing average strategy.

Under the 'hybrid transition' the starting value of the allowed return on debt equals the sum of:

- the 10-year trailing average of the 10-year DRP
- the average 1–10 year annualised swap rate, and
- swap transaction costs

The hybrid transition recognises that a service provider will commence its next regulatory control period with a cost of debt that already reflects the 10-year trailing average of the 10-year DRP. As such, no transition is applied to the DRP.

The hybrid transition recognises that a service provider can gradually transition its base interest rate to a 10-year trailing average by entering into a series of interest rate swaps with annual maturities from 1–10 years during its next rate reset period. Each swap converts an existing floating rate loan (of which there are 10 with annual maturities from 1–10 years) into a synthetic fixed rate loan. In each subsequent year the maturing floating rate loan is refinanced with a 10-year fixed rate loan and the corresponding swap matures[6].

At the end of the 10-year transition period the allowed return on debt equals the 10-year trailing average of the total 10-year benchmark debt yield, which is the same outcome under the AER's transition.

3.3.1 AER assessment of the hybrid transition

The AER considers that the hybrid transition may be a reasonable approach and contribute to the allowed rate of return objective. The AER's main objection to using the hybrid transition is based on the belief that it may violate the NPV=0 principle by 'locking in' any accumulated windfall gain or loss due to past applications of the on-the-day approach[7]. This issue is addressed in Section 4.

A 'backwards looking' approach

QTC notes the AER's repeated reference to the hybrid transition as being a 'backwards looking' approach. QTC considers this to be a clumsy attempt at implying that something is wrong with a transition that makes appropriate use of historical data. This is surprising given

[6] Alternatively, the service provider could refinance the maturing floating rate loan with a 10-year floating rate loan and overlay a 10-year pay fixed swap to create a synthetic 10-year fixed rate loan.
[7] JEN preliminary decision, p. 165

that the AER gives significant weight to historical estimates of the market risk premium and equity beta to estimate the allowed return on equity, but does not describe this as a backwards looking approach.

The AER also proposes to use a simple (ie, unweighted) trailing average to determine the allowed return on debt even though this approach assumes that a service provider can issue new debt at rates that prevailed over the last 10 years, which is impossible. This is clearly a 'backwards looking' approach as it makes inappropriate use of historical data (ie, it is wrong to initially compensate a borrowing that is made today at the average cost of debt over the last 10 years). Despite this, the AER still prefers a simple trailing average to an alternative approach that correctly assumes that new debt can only be issued at the prevailing cost of debt.

In QTC's view, the AER should not refer to a transition that is based on the debt management strategy that the AER considers to be the most efficient strategy under the previous on-the-day approach as being 'backwards looking'.

4 Windfall gains and losses

4.1 Overview

As explained in Section 2 there is no feasible debt management strategy that can be used to replicate the annual return on debt under the on-the-day approach. As a consequence, annual mismatches naturally occurred between the allowed and trailing average DRP. The AER describes these mismatches as windfall gains and losses because they are due to chance rather than a service provider's efficient or inefficient decisions[8]. The AER also suggests that the windfall gains and losses may violate the NPV principle under certain transitional arrangements[9].

4.2 Relationship with the AER's transition

The AER's proposed DRP transition is based on the following assumptions:

1. A consistent application of the on-the-day approach over the life of an asset is expected to produce windfall gains and losses that cancel out (on average).
2. Immediately adopting a new return on debt approach will cause the accumulated windfall gain or loss at that point in time to be locked in. This is considered to be undesirable because the accumulated gain (loss) would have been reversed by an expected future loss (gain) if the on-the-day approach had been consistently applied over the life of the asset.
3. A transition that starts with the on-the-day estimate of the DRP and gradually moves to a trailing average over a 10-year period should be applied because it:
    a. 'mimics the erosion' of the accumulated windfall gain or loss that would have occurred naturally under the previous on-the-day approach[10]
    b. 'largely neutralises' the one-off impact of changing the return on debt approach[11], and
    c. delays the introduction of the new return on debt approach and therefore allows the natural 'squaring up' process between past accumulated windfall gains and future windfall losses to operate[12].

Assumption 1 means that when an investment is made, the present value of the expected differences between the on-the-day and trailing average DRPs over the life of the asset is zero.

Assumption 2 is critical to the AER's justification for applying a transition to the DRP. Assumption 2 means that if a gain (loss) has accumulated up to a certain point during the life of an asset, the expected outcome over the remaining life of the asset is a cumulative loss (gain) of approximately the same amount in present value terms.

[8] JEN preliminary decision, p. 165
[9] JEN preliminary decision, p. 164
[10] Lally, M. (November 2014), *Transitional arrangements for the cost of debt*, p.22
[11] Lally, M. (April 2015), *Review of submissions on the cost of debt*, p. 5
[12] Lally, M. (October 2015), *Review of submissions on transition issues for the cost o debt*, p. 33

The sub-points in Assumption 3 are equivalent ways of stating that the present value of the windfall gains (losses) during the 10-year transition period is expected to largely offset the value of the windfall loss (gain) that has accumulated up to the date of the regime change.

The AER's DRP transition depends on a strong negative relationship between historical accumulated windfall gains (losses) and the present value of expected future windfall losses (gains) during the 10-year transition period.

The AER's DRP transition cannot be justified on the basis that it is expected to 'neutralise the one-off impact' of the regime change if the alleged reversal process in Assumption 2 is weak or non-existent.

4.3 Allowed rate of return objective

Whether the AER is permitted to consider past windfall gains and losses when determining a return on debt that is consistent with the allowed rate of return objective and the other requirements in the NER is, in the first instance, a matter of law:

- If the AER is not legally permitted to consider past outcomes, no DRP transition is required because the efficiently incurred cost of debt already reflects the 10-year trailing average of the 10-year DRP.
- Even if the AER is legally permitted to consider past outcomes, it does not follow that the proposed DRP transition accurately accounts for those past outcomes. The allowed rate of return objective still requires the AER to determine a return on debt that is commensurate with the efficient debt financing costs of a benchmark efficient entity.

The plain English meaning of commensurate is 'equal or similar to something in size, amount, or degree'. Even if the AER is legally permitted to consider past outcomes when determining the allowed return on debt, it must still demonstrate that the present value of the future windfall losses (gains) during a service provider's 10-year DRP transition period is 'equal or similar to' the cumulative windfall gain (loss) received by that service provider.

This presents an interesting challenge for the AER given its recent conclusion that a sufficiently accurate estimate of the cumulative historical windfall gain or loss from the start of regulation cannot be made.

4.4 Fairness of returns in expectation

The AER states that when an investment is made the present value of the expected differences between the on-the-day and trailing average DRPs over the life of the asset is zero[13]:

> "At the time a particular investment is made, it will not be known which periods will result in an over-recovery and which periods will result in an under-recovery through applying the on-the-day

[13] JEN preliminary decision, p. 180

approach. Accordingly, the allowed return on debt will be fair at the time it is set, and the allowed return on debt will be the same as the expected actual return on debt over the life of that asset. That is, in expectation, the allowed return on debt and the actual return on debt will correspond.

QTC agrees that it is not possible to determine which periods during the life of an asset will produce windfall gains or losses. As such, it is reasonable to assume that, at the time an investment is made, the expected windfall gain or loss in all future periods during the life of the asset is zero. For example, if the asset life is 50-years it is reasonable to assume that the expected windfall gain/loss in the first and last 25-year periods are both zero.

The actual outcome will gradually converge to a certain windfall gain or loss at the end of the asset life. Achieving a non-zero windfall gain or loss over the life of an asset is entirely consistent with the initial expectation of a zero windfall gain or loss over the life of the asset.

At any point during the life of the asset the expected gain or loss over the total life of the asset will depend on the cumulative historical windfall gain or loss at that point and the present value of the expected windfall gains and losses over the remaining life of the asset. It does not follow that the present value of the expected outcome over the life of the asset remains at zero during the life of the asset.

Example

To illustrate this point, consider an experiment where a fair coin is to be flipped 100 times. The total number of heads net of tails in the first (last) 50 flips is denoted X1 (X2). At the start of the experiment the expected values of X1, X2 and X1+X2 are zero. Due to the random nature of the experiment, X1 and X2 are uncorrelated.

During the first 50 flips the expected value of X1 changes as the outcomes from the coin flips become known. For example, if the first 30 flips produce 10 heads and 20 tails the expected value of X1 at this point is -10 because the expected number of heads net of tails in the next 20 flips is zero.

The value of X1 is known with certainty after the 50^{th} flip (assume the value is -8). At this point in the experiment the expected value of X1+X2 is now -8 because the expected value of X2 is still zero. The expected value of X2 does not increase to +8 to restore the initial expectation at the start of the experiment that the expected value of X1+X2=0.

The point to take from this example is that the expected outcome at the end of the experiment changes at each point during the experiment as the outcomes from the coin flips become known. These changing expectations during the experiment are not violations of the initial expectation formed at the start of the experiment (ie, that the expected value of X1+X2=0).

4.5 Reason for not applying the hybrid transition

The AER suggests that immediately adopting the hybrid transition may violate the NPV=0 principle because any accumulated windfall gain or loss at that time will still remain at the end of the asset life:[14]

> "However, when the method to estimate the return on debt changes during the life of regulated assets; the NPV principle is unlikely to hold automatically. Any existing accumulated differences between the allowed and actual return on debt of a benchmark efficient entity would remain. As a result, the service provider will receive a return on debt that is different from that of a benchmark efficient entity, and consumers will pay prices that reflect this difference."
>
> In these circumstances, departures from the NPV principle do not result from efficiency changes, but from changing the estimation method. For this reason, we consider the resulting benefits or detriments are windfall gains or losses that the regulatory regime should avoid. In other words, regardless of who faces the benefit or detriment, applying a hybrid transition from one return on debt approach to another could have undesirable consequences. "

QTC does not agree with the AER's assessment:

- The initial expectation of a zero NPV over the life of an asset only holds at the time the investment is made because the future differences between the allowed and trailing average DRPs are all uncertain. Given this uncertainty, the NPV principle clearly allows for the possibility of a cumulative windfall gain or loss occurring over the life of the asset and/or during the life of the asset.
  - Subsequent random outcomes that differ from the initial expected value of zero are not violations of the NPV principle provided they were not expected at the time the investment was made.
- The AER has concluded that the hybrid strategy was the most efficient strategy under the on-the-day approach. Therefore, an efficiently financed service provider that adopted the hybrid strategy will be in exactly the same position as a benchmark efficient entity in regards to its cost of debt. It follows that immediately adopting the hybrid transition cannot result in the service provider receiving a return on debt that is different from that of a benchmark efficient entity.
- The only windfall gains and losses that can be avoided are future windfall gains and losses. The AER's transition approximates a continuation of the on-the-day approach, which allows *additional* windfall gains and losses to occur during the 10-year transition period. In contrast, the hybrid transition avoids any future windfall gains and losses by setting the allowed DRP to match the efficiently incurred DRP.

4.5.1 NPV principle

The expectation of a zero windfall gain or loss over the life of an asset only holds at the time the investment is made. Beyond this point, actual differences between the on-the-day and trailing average DRP will start to accumulate. The gradual replacement of expected outcomes with actual outcomes will cause the present value of the expected outcome over the full life of

[14] JEN preliminary decision, p. 180

the asset to change at various points during the life of the asset. These changing expectations do not violate the initial expectation (formed at the time the investment was made) of a zero expected NPV over the life of the asset.

Example

Consider a regulated asset with a 50-year life that has been in operation for 25 years:

- When the investment was made the present value of the expected differences between the on-the-day and trailing average DRPs over the life of the asset was zero. The present value of the expected differences in the first and second half of the asset life was also zero.
- During the first 25 years the actual differences between the on-the-day and trailing average DRPs produced a cumulative windfall gain of $10 million.
- *At this point* in the life of the asset the present value of the expected outcome over the 50-year asset life is now equal to the $10 million windfall gain plus the present value of the expected differences between the on-the-day and trailing average DRPs over the remaining 25 years of the asset life.

Under the hybrid transition there are no future mismatches between the allowed and trailing average DRP. In this example the present value (as at year 25) of the actual outcome over the 50-year asset life equals the accumulated windfall gain of $10 million. The AER considers this to be a violation of the NPV principle because the $10 million windfall gain is 'locked in'.

The AER's preference for a DRP transition that approximates a continuation of the on-the-day approach suggests that the AER believes the $10 million windfall gain is not expected to remain if the on-the-day approach applies for the full life of the asset. The AER must therefore believe that the present value of the expected differences between the on-the-day and trailing average DRPs over the remaining 25 years of the asset life is now -$10 million despite initially being zero at the time the investment was made.

The AER's implied position is that the expected windfall gain or loss over the full life of an asset, when measured in present value terms at different points during the life of the asset, is approximately zero. More formally, the AER's implied position is:

> Under the consistent application of the on-the-day approach to an asset with an n-year life, the present value of the expected future differences between the on-the-day and trailing average DRPs over the last m-years of the asset life (where $m<n$) is approximately equal to the accumulated historical difference between the actual on-the-day and trailing average DRPs during the first $n-m$ years of the asset life × -1.

4.5.2 QTC's assessment

Due to the time value of money, the actual windfall gains/losses during the first half of the asset life will have a much greater impact on the total outcome than the actual windfall gains/losses in the second half of the asset life. For example, annual windfall gains of $1.00 during the first 25 years of a 50-year asset life will require annual windfall losses of $4.83 in the

last 25 years to produce a zero NPV over the life of the asset based on a 6.5 per cent discount rate.

Table 1 shows the windfall loss that would be required in each year of the last 35, 25 and 15 years of the asset life to offset (in present value terms) the cumulative value of a $1.00 windfall gain in each year of the first 15, 25 and 35 years of the asset life:

TABLE 1: NPV ANALYSIS

Length of first period (years)	Length of second period (years)	Annual gain in first period ($)	Annual loss in second period ($)	NPV over life of asset($)
15	35	1.00	(1.77)	0.00
25	25	1.00	(4.83)	0.00
35	15	1.00	(13.19)	0.00

The figures in Table 1 show that if a cumulative windfall gain (loss) occurs during the early stages of the asset life, the expected outcome over the full life of the asset is likely to be a cumulative windfall gain (loss). That is, there is unlikely to be a reversal of cumulative gains or losses during the life of the asset.

Despite having an expected value of zero when the investment is made, the expected outcome over the full life of the asset, when calculated in present value terms at different point during the life of the asset will differ from zero.

4.6 Reversal of cumulative windfall gains and losses

The AER's position regarding the reversal of windfall gains and losses is summarised in the following passages from Lally[15]. The AER has recently concluded that the relevant period for determining cumulative gains and losses is from the start of regulation, not the start of the GFC, so the length of Period 1 is longer than suggested by Lally.

> "To better appreciate this point, suppose that the present value of the accumulated net DRP allowance (allowance less incurred) from the commencement of the GFC in 2008 to the regime change in 2014 is denoted X1, and this period is denoted Period 1. Suppose further that the period from 2014 is denoted Period 2, and the present value of the expected accumulated net DRP allowance in this period had the old regime been maintained is denoted X2 ... the AER is referring to both periods 1 and 2 and claims that, in the absence of a regime change, the present value of the aggregate net DRP allowance over periods 1 and 2 is approximately zero, because **the excess accumulated in Period 1 is expected to reverse in Period 2.**" [emphasis added]
>
> "… in describing the effect of its proposed transitional regime and using the word "windfall", the AER is again referring to the aggregate effect over both Period 1 and Period 2; **with a**

[15] Lally (October 2015), p. 45

transitional regime, the aggregate effect would be approximately zero because X1 is largely offset by X2, and the same is true with continuation of the old regime." [emphasis added]

The value of X1 is known about one year prior to the start of the 10-year DRP transition period. As such, the AER's justification for a DRP transition depends on a strong negative conditional relationship between X1 and X2. Specifically, the expected value of X2 conditional on a given value of X1 is approximately equal to -X1 (ie, $E[X2 \mid X1] \approx -X1$).

It is important to note that the above relationship does not hold if X1 and X2 are uncorrelated or weakly correlated. If this is the case then the reversal/offset process referred to by Lally does not exist (ie, $E[X2 \mid X1] \approx 0$), and there is no basis for applying a transition to the DRP.

4.6.1 QTC's assessment

In QTC's view, it would be a remarkable coincidence if X1 was largely offset by X2 because:

- X1 is based on past PTRM debt balances and past differences between the allowed and trailing average DRPs from the start of regulation to the time of the regime change.
- X1 reflects the compounding effects of investing and funding past gains and losses, which may be significant when the period from the start of regulation and the start of the new regulatory regime is relatively long (as shown in Section 4.5.2).
- X2 is based on future PTRM debt balances over the next 10 years, the AER's on-the-day DRP estimate during the next rate reset period and the trailing average DRP.
- X2 is sensitive to the AER's on-the-day DRP estimate during the next rate reset period, whereas X1 is not affected by this estimate.

The alleged reversal process in Assumption 2 of the AER's DRP transition implies a very strong negative relationship between X1 and X2. The AER has not provided any evidence or analysis to suggest that such a relationship exists.

The AER is legally required to determine an allowed return on debt that is commensurate with the efficient debt financing costs of a benchmark efficient entity. Even if the AER is legally permitted to consider past outcomes when determining the allowed return on debt, the AER must still demonstrate that X2 is likely to be commensurate with -X1 to justify applying a transition to the DRP.

4.7 Mean reversion in the DRP

Mean reversion in the DRP may produce windfall gains and losses in consecutive 5-year regulatory periods that display a weak negative correlation, however this does not necessarily mean that the cumulative gains and losses over longer time periods will reverse.

4.7.1 Simulation results

If mean reversion in the DRP produces cumulative gains and losses that reverse over time it should be possible to simulate this outcome with a mean reverting model of the DRP. Appendix C sets out QTC's approach for using such a model to simulate the mismatch between the on-the-day and trailing average DRP over a large number of random scenarios.

The main results and observations from the simulation analysis are as follows:

- The average simulated values of X1, X2 and X1+X2 are approximately zero.
- The correlation between the simulated windfall gain/loss in consecutive 5-year regulatory periods is relatively weak (approximately -0.2).
- There is no conditional relationship between X1 and X2:
  - Conditional on a large positive or negative value of X1 over a 25 year period, the expected value of X2 over the next 25 years is approximately zero.
  - Conditional on a large positive or negative value of X1 over a three consecutive 5-year regulatory periods, the expected value of X2 under the AER's DRP transition period is approximately zero.
- The conditional values of X2 under the AER's DRP transition are volatile. This is an important consideration because the transition is a one-off event for each service provider.
- Service providers and the AER should be concerned with the potential range of outcomes under the AER's one-off DRP transition rather than just the expected outcome.

The AER's DRP transition is based on the assumption that $E[X2 \mid X1] \approx -X1$. The simulation results do not support this assumption. Rather, the results suggest that $E[X2 \mid X1] \approx 0$, which is consistent with the future outcomes under the hybrid transition.

The AER's DRP transition approximates a continuation of the on-the-day approach, so it allows future windfall gains and losses to occur during the 10-year transition period.

The additional windfall gains and losses that occur under the AER's DRP transition serve no useful purpose and do not contribute to the achievement of the allowed rate of return objective. They should be avoided by setting the starting value of the allowed return on debt to reflect the 10-year trailing average of the 10-year DRP.

4.7.2 Empirical estimates of X1 and X2

Table 2 shows QTC's estimates of X1 and X2 based on benchmark debt balances and DRPs for Ergon Energy, Energex and Powerlink. The values are expressed as a percentage of the PTRM debt balance. The values of X1 for Ergon Energy and Energex have been estimated over the period 2001–2015. The indicative value of X1 for Powerlink has been estimated over the period 2002–2017.

These estimates are consistent with the results from the simulation exercise, which show that no conditional relationship exists between X1 and X2. In fact, X2 adds to X1 rather than reversing or neutralising it.

TABLE 2: ESTIMATES OF X1 AND X2 BASED ON BENCHMARK DATA

Entity	**X1 (%)**	**X2 (%)**	**X1+X2 (%)**
Energex	(0.6)	(3.9)	**(4.5)**
Ergon Energy	(0.4)	(3.8)	**(4.2)**
Powerlink (indicative)	(3.0)	(0.7)	**(3.7)**

5 The AER's current position

5.1 Background

In its final decisions for the New South Wales electricity and transmission businesses and Jemena Gas Networks (JGN) the AER reached the following conclusions based on Lally's empirical analysis of windfall gains and losses[16]:

- Service providers received significant cumulative windfall gains under the on-the-day approach due to the GFC-induced spike in the DRP.
- These windfall gains would have been eroded by future windfall losses if the on-the-day approach was allowed to continue due to the natural 'squaring up' process that is inherent in the on-the-day approach.
- It is appropriate to apply a DRP transition that starts with an on the day estimate of the DRP and gradually moves to a trailing average because it 'mimics the erosion' of windfall gains that would have occurred under a continuation of the on-the-day approach.

In response to Lally's analysis QTC produced longer-term estimates of windfall gains and losses estimates using benchmark debt balances and DRPs for Ergon Energy and Energex[17]. The historical windfall gains and losses were estimated over the period 2001–2015. QTC's analysis showed that the estimates of X1 and X2 were both negative (ie, windfall losses), which means that X2 added to X1 rather than reversing or neutralising it.

After reviewing QTC's estimates the AER sought additional advice from Chairmont and Lally and concluded[18]:

- It is preferable to consider windfall gains and losses over the full period for which the assets are regulated rather than from the start of the GFC[19].
- Due to issues with the availability of historical data the correct treatment of past allowed DRPs it is not possible to produce an accurate estimate of cumulative windfall gains and losses since the start of regulation (ie, X1)[20].
- An accurate estimate of the present value of the future mismatches under the AER's transition (ie, X2) can be made because it is based on the difference between the trailing average DRP and the AER's on-the-day estimate at the time of the regime change[21].

5.2 Recent decisions

In its preliminary decision for the Victorian electricity distribution businesses the AER states[22]:

16 Lally (November 2014), p. 17–20
17 QTC (June 2015), *Return on debt transition analysis – a joint report for Ergon Energy and Energex*.
18 A detailed response to the AER's criticisms of QTC's analysis is set out in Appendix B.
19 JEN preliminary decision, p. 573
20 JEN preliminary decision, pp. 571–574
21 JEN preliminary decision, pp. 182–183
22 JEN preliminary decision, p. 571

> "... **we have not relied on analysis of whether our transitional approach will erode past windfall gains or losses in making this decision**. That is, in evaluating whether the transition approaches will allow the service provider the opportunity to recover at least its efficient costs, **we have not relied on analysis of past or future windfall gains or losses**." [emphasis added]

This is a significant change in the AER's position. Previously, the AER relied on Lally's empirical analysis of windfall gains and losses to justify applying a transition to the DRP. Lally specifically referred to a gradual erosion or neutralisation of accumulated past windfall gains in supporting the AER's DRP transition[23]:

> "Immediate adoption of the new regime at a time when the accumulated effect was positive or negative would prevent these accumulated gains or losses from being gradually eroded away and they would instead be retained by the BEE; this would be a 'windfall' benefit or loss to the investors in the BEE…. the AER's proposed transitional regime largely neutralizes this outcome not only for the average BEE (with averaging over different regulatory reset dates) but also for individual BEEs with different regulatory reset dates. So, again, since the one-off effect is large and the AER's proposed transitional regime largely neutralizes it, I therefore favour applying the AER's proposed transitional regime to the DRP component of the cost of debt."

Despite no longer relying on the analysis of past windfall gains upon which Lally based his support for the AER's DRP transition, the AER has still concluded that:[24]

> "We are satisfied our approach is designed to neutralize the one-off impact (positive or negative) of the regulatory regime change. This is consistent with the NPV principle"

The one-off impact referred to by the AER is just the accumulated windfall gain or loss from the start of regulation to the start of the new regime (ie, X1). Neutralising X1 means the AER still believes the present value of the future windfall gains or losses during the 10-year transition period (ie, X2) will largely offset X1.

In the absence of any analysis, it is unclear how the AER can be satisfied that its transition will offset or neutralise an accumulated gain or loss that cannot be accurately estimated.

The AER has maintained the same position regarding the DRP transition that it previously adopted based on Lally's analysis of windfall gains and losses from the start of the GFC.

It QTC's view, it is unreasonable for the AER to suggest that it has not relied on analysis of past and future windfall gains and losses while still accepting the conclusions drawn from its earlier reliance on analysis of the same windfall gains and losses.

The AER is legally required to determine an allowed return on debt that is commensurate with the efficient debt financing costs of a benchmark efficient entity. Even if the AER is legally permitted to consider past outcomes when determining the allowed return on debt,

[23] Lally (April 2015), p. 5–6
[24] JEN preliminary decision, p. 569

the AER must still demonstrate that X2 is likely to be commensurate with -X1 to justify applying a transition to the DRP.

This presents an interesting challenge given that the AER believes a sufficiently accurate estimate of the cumulative windfall gain or loss since the start of regulation (ie, X1) cannot be made.

5.2.1 Conceptual arguments

In the absence of any analysis of past windfall gains and losses, the AER's belief that its transition will neutralise the one-off impact of the regime change must be based on conceptual arguments. One possible argument is that mean reversion in the DRP will create a natural reversal of past and future gains and losses[25].

As shown in Appendix C, mean reversion in the DRP produces a weak negative correlation between the windfall gain/loss in consecutive 5-year regulatory periods. However, this correlation is too weak to produce cumulative windfall gains and losses that reverse over time.

For the reasons set out in Section 4 it would be a remarkable coincidence if X1 was approximately equal to -X2. QTC's empirical estimates for Ergon Energy, Energex and Powerlink support this conclusion, as do the simulation results in Appendix C which show that, conditional on a large positive or negative value for X1, the expected value of X2 under the AER's DRP transition is approximately zero.

5.2.2 Continued reliance on analysis of past windfall gains and losses

The AER still allows some analysis of past windfall gains to affect its decision regarding the return on debt transition[26]:

> "… **to the extent we rely on analysis of windfall gains or losses, we agree it is preferable that we should consider windfall gains or losses over the full period for which the assets are regulated.** Since we are persuaded that this exercise is not achievable to a sufficient degree of precision, we have not relied on analysis of whether our transitional approach will erode past windfall gains or losses in making our decision." [emphasis added]

This statement seems to be intended to provide some justification for the AER's combining of short-term windfall gain estimates over recent periods with a speculative statement about the 'likely' outcomes in prior periods to suggest that service providers have accumulated large windfall gains from the start of regulation[27]:

> "The consultant reports submitted by the service providers support the conclusion that the particular service providers accumulated substantial over-recoveries over this period. Further, Lally notes that the GFC represented an unprecedented shock to DRPs. This in turn might

[25] Lally (November 2014), p. 17
[26] JEN preliminary decision, p. 573
[27] JEN preliminary decision, p. 182

> suggest that any windfall gains or losses in the last regulatory period are abnormally significant compared to the likely outcomes in prior periods."

Similarly, the AER's conclusion that its DRP transition will contribute to the achievement of the allowed rate of return objective still refers to the conclusions drawn from Lally's original windfall gain/loss analysis:[28]

> "As Lally demonstrated through various interest rate sensitivity analyses, gradually transitioning from the on-the-day approach (Option 2) to the trailing average approach largely avoids the undesirable outcomes of changing the return on debt method. This allows the regulatory regime to account for accumulated differences between the return on debt estimate and the actual return on debt of a benchmark efficient entity, despite any change in method. This also means a benchmark efficient entity would receive a return on debt commensurate with its efficient financing costs over the life of its assets (rather than commensurate with windfall gains or losses). For these reasons, we are satisfied that gradually transitioning from the on-the-day approach to a trailing average approach (Option 2) will result in a return on debt that contributes to the achievement of the allowed rate of return objective."

A transition that 'allows the regulatory regime to account for accumulated differences between the return on debt estimate and the actual return on debt of a benchmark efficient entity' is just a different way of saying that the AER still believes that its transition will neutralise or mimic the erosion of those accumulated differences.

The AER has previously relied on empirical analysis of windfall gains and losses to support its claim that its DRP transition will largely erode the windfall gains that were alleged to have accrued to service providers due to the GFC-induced DRP spike.

After being presented with contrary longer-term estimates the AER changed its position and now states that it will not rely on analysis of past or future windfall gains or losses. However, the AER still proposes to apply the same DRP transition that was previously justified on analysis of past and future windfall gains or losses.

In QTC's view, it is unreasonable for the AER to retain a DRP transition that was previously justified on an analysis of short-term windfall gains and losses if the AER now believes that it is not possible to make accurate estimates of past windfall gains and losses over a longer historical period from the start of regulation.

5.3 Reducing risk for the benchmark efficient entity

Based on advice from Lally, the AER argues that it proposed DRP transition will reduce risk for the benchmark efficient entity[29]:

[28] JEN preliminary decision, pp. 180-181
[29] Lally (April 2015), p. 36

> "… a policy of immediately adopting a new regime in all cases would expose the BEE [benchmark efficient entity] to potentially very large risks, thereby discouraging investment. It would also expose the BEE to the possibility of an adverse shock so large as to threaten its financial viability, which would either lead to regulatory relief in such cases (and hence violation of the NPV = 0 principle) or the possibility of a supply disruption."

The AER notes that Lally is referring to an immediate adoption of the trailing average approach (ie, no transition), which may produce a mismatch relative to the cost of debt associated with hybrid strategy. However, the AER suggests that Lally's advice is also applicable to the hybrid transition[30].

Setting the allowed DRP to match the efficiently incurred DRP under the hybrid strategy will eliminate future mismatches between the allowed and efficiently incurred DRP (ie, it removes risk). By definition, this cannot expose a benchmark efficient entity to risk, let alone an adverse shock 'so large as to threaten its financial viability'. The AER's claim that its DRP transition reduces risk for the benchmark efficient entity is incorrect.

[30] JEN preliminary decision, p. 181

6 Analysis of windfall gains and losses for Powerlink

6.1 Approach

Powerlink has been subject to three consecutive determinations where the on-the-day approach was used to determine the allowed return on debt (Table 3):

TABLE 3: REGULATORY DETERMINATIONS FOR POWERLINK

Regulatory control period	Regulator	Allowed DRP to CGS (%)	Allowed DRP to swap (%)
1 Jan 2002 – 30 Jun 2007	ACCC	1.20	0.82
1 Jul 2007 – 30 Jun 2012	AER	1.14	0.62
1 Jul 2012 – 30 Jun 2017	AER	3.93	3.18
1 Jul 2017 – 30 Jun 2022	AER	tbc	tbc

QTC has estimated the annual mismatches between the allowed and efficiently incurred DRP under the hybrid strategy between January 2002–June 2017 for a benchmark efficient entity in Powerlink's circumstances. The calculations are set out in the spreadsheet that accompanies this report.

In estimating the historical outcomes, the allowed DRP in the January 2002–June 2007 regulatory control period has been increased to 1.16 per cent to correct for the ACCC's use of a 5½-year tenor rather than a 10-year tenor. The DRP of 1.16 per cent equals the 10-year DRP allowed by the Queensland Competition Authority (QCA) in the June 2001–June 2005 regulatory control period for Ergon Energy and Energex.

6.2 Results

Figure 1 shows the allowed and trailing average DRPs for the period 1 January 2002 to 30 June 2017. Table 4 shows the cumulative historical mismatch between the allowed and trailing average DRP and the indicative present value of the future mismatches between the allowed and trailing average DRP under the AER's proposed DRP transition.

FIGURE 1: ALLOWED AND TRAILING AVERAGE DRPS

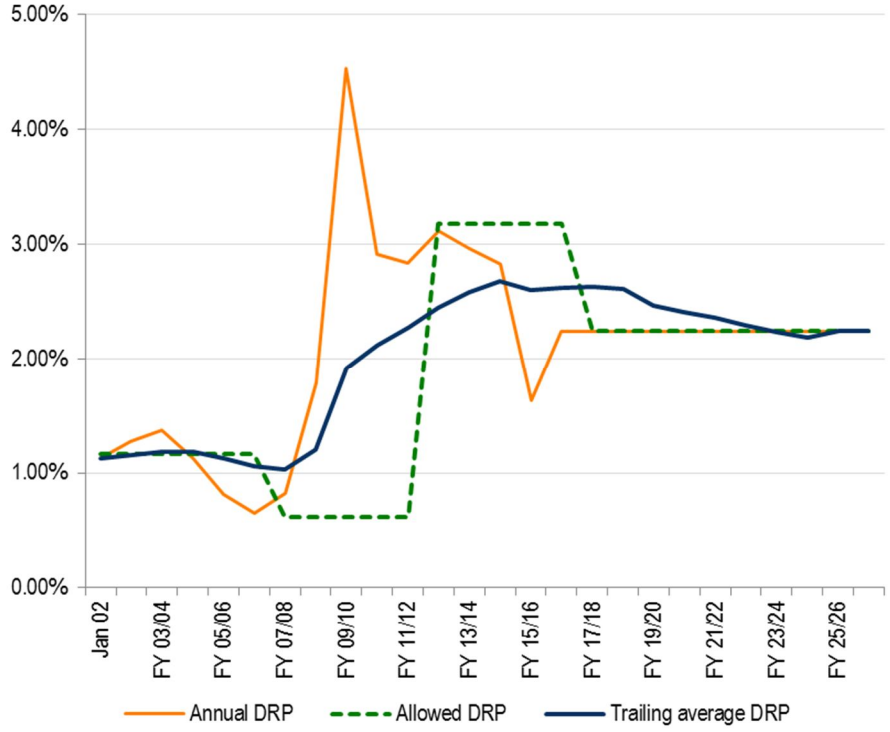


TABLE 4: PRESENT VALUES AS PERCENTAGE OF 2017 DEBT BALANCE

	X1 (%)	X2 (%)	X1+X2 (%)
Allowed DRPs from past determinations	(3.0)	(0.7)	**(3.7)**
Allowed DRPs based on data from the RBA and Bloomberg	(2.4)	(0.7)	**(3.1)**

The results in Table 4 show that a benchmark efficient entity in Powerlink's circumstances would have incurred a windfall loss due to past applications of the on-the-day approach. QTC notes that the historical loss (X1) is 5.1 per cent of the opening 2017 debt balance if the actual allowed DRP of 0.82 per cent from the ACCC's 2002 determination is used.

The present value of the future mismatches during the 10-year DRP transition period based on current rates is slightly negative; however the actual outcome will depend on the AER's on-the-day DRP estimate during the next reset period. For the AER's DRP transition to 'neutralise the one-off impact' of changing the return on debt approach, the prevailing DRP at that time would need to be about 3.5 per cent.

A DRP of 3.5 per cent is consistent with the levels experienced during the GFC. As such, it is highly unlikely that the AER's DRP transition will achieve what the AER believes it was designed to do.

7 Indicative return on debt estimates for FY2017–18

7.1 Estimates based on hybrid transition

QTC's indicative estimate of the allowed return on debt under the hybrid transition (including swap transaction costs of 0.23 per cent) for FY2017–18 is set out in Table 5. The swap rates are based on the average annualised 1–10 rates for the 40 business days to 30 November 2015:

TABLE 5: INDICATIVE RETURN ON DEBT ESTIMATE

Tenor	Swap rate including transaction costs (%)	PTRM-weighted DRP (%)	Total rate (%)
1 year	2.28	2.36	4.64
2 year	2.26	3.72	5.98
3 year	2.35	2.80	5.15
4 year	2.58	2.75	5.33
5 year	2.70	2.94	5.64
6 year	2.82	2.83	5.65
7 year	2.95	2.72	5.67
8 year	3.03	1.69	4.72
9 year	3.12	2.24	5.36
10 year	3.21	2.24	5.45
Average	**2.73**	**2.63**	**5.36**

7.1.1 Swap transaction costs

The AER has concluded that the hybrid debt management strategy (which is based on hedging with interest rate swaps) was the most efficient strategy under the previous on-the-day approach. It follows that the transaction costs associated with these swaps were efficient costs, so they should have been compensated through the allowed revenues. Historically, the AER provided this compensation indirectly by using a 10-year base rate to determine the on-the-day return on debt.

The only way for a benchmark efficient entity that previously used the hybrid strategy to transition its base interest rate to a 10-year trailing average is by entering into a series of swaps with annual maturities from 1–10 years during its next rate reset period. It follows that the transaction costs associated with these swaps are efficient costs, so they should be compensated through the allowed revenues.

Appendix A: The QTC method

A.1: Background

The QTC method was first proposed by QTC in 2012 as part of the Australian Energy Market Commission's (AEMC) review of proposed changes to the National Electricity Rules (NER) and National Gas Rules (NGR). One of the main proposals was for the allowed return on debt to be determined using a trailing average of historical benchmark debt yields. This proposal was made by a group of major energy users who were dissatisfied with the volatility in return on debt allowances under the on-the-day approach.

During the AEMC's consultation process a number of service providers and the AER expressed concerns over the implementation of a trailing average approach:

- Some service providers were concerned that their existing swap hedges would need to be unwound prior to maturity.
- The AER was concerned that service providers would opportunistically switch between the on-the-day and trailing average approaches based on differences between the prevailing and historical average benchmark debt yield.
- A continuous historical time series of the 10-year DRP was not available at the time.

A.2: Rationale

To address these concerns QTC designed a debt transition where the starting value of the allowed return on debt equals that average prevailing 10-year benchmark debt yield during a service provider's next reset period. The trailing average is gradually phased in over a 10-year transition period.

QTC's main objective at that time was to obtain broad stakeholder support for a trailing average approach that applies to the total 10-year benchmark debt yield. Without a transition that took into account the concerns identified above, it is unlikely that service providers and the AER would have supported the trailing average approach.

Given that the QTC method was designed to address specific concerns regarding the implementation and ongoing operation of the trailing average approach, it is difficult to understand the AER's reasons for making the following statement[31]:

> "Apart from trying to get all the stakeholders to accept the trailing average approach at the time, there were genuine issues in respect of how to commence this new approach. Energex and the QTC failed to acknowledge these issues."

[31] JEN preliminary decision, p. 578

Subsequent to the AER's proposal in the Final Rate of Return Guideline to apply the QTC method, the AER has suggested that this method is 'designed' to neutralise the large one-off impact of the change in the return on debt approach[32]. This is incorrect.

QTC did not produce any estimates of past windfall gains and losses when developing the QTC method in 2012, nor did the AER make any such estimates during the development of the Rate of Return Guideline. The first discussion of an on-the-day transition 'mitigating' past windfall gains and losses was in Lally's November 2014 report for the AER. The first discussion of neutralising the one-off impact of the regime change was is Lally's April 2015 report for the AER.

The AER has sought to retrospectively assign a design feature to a transition approach that it did not design to justify its decision to adopt that approach. The actual reasons for why the QTC method was proposed in 2012 are outlined above. Of these:

- The first reason is still relevant given the AER's conclusion that the hybrid strategy was the most efficient strategy under the previous on-the-day approach.
- The second reason has been addressed by the AER's decision to apply a trailing average of the total 10-year cost of debt to all service providers, and to not allow service providers to switch between return on debt approaches at each future rate reset period.
- The third reason is now a minor issue (as acknowledged by the AER) because good data is available back to 2001, and the AER only requires post-2005 data to determine an allowed return on debt that reflects the 10-year trailing average of the 10-year DRP.

[32] JEN preliminary decision, p. 569

Appendix B: QTC's analysis for Ergon and Energex

B.1: Background

In its final decisions for the New South Wales electricity and transmission businesses and Jemena Gas Networks (JGN) the AER reached the following conclusions based on Lally's empirical analysis of windfall gains and losses:

- Service providers received significant cumulative windfall gains under the on-the-day approach due to the GFC-induced spike in the DRP.
- These windfall gains would have been eroded by future windfall losses if the on-the-day approach was allowed to continue due to the natural squaring up process that is inherent in the on-the-day approach.
- It is appropriate to apply a DRP transition that starts with an on the day estimate of the DRP and gradually moves to a trailing average because it 'mimics the erosion' of the windfall gains that would have occurred under a continuation of the on-the-day approach.

Lally's analysis only extends back to the start of the GFC, so there was no consideration of the windfall gains and losses in prior periods. Lally's analysis also did not take into account the significant increase debt balances for most service providers over the last 10 years. QTC notes that the AER has concluded that the appropriate time period for measuring historical windfall gains and losses is from the start of regulation to the start of the new regulatory regime.

B.2: Approach

In a joint report for Ergon Energy and Energex QTC produced longer-term estimates of the cumulative historical mismatches between the allowed and trailing average DRP[33]. The historical estimates are for the period 2001–2015.

QTC's estimates are based on benchmark PTRM debt balances, benchmark DRPs from the RBA and Bloomberg, and the allowed DRPs from past determinations made by the QCA and the AER. The estimates are not based on the actual debt balances or costs of debt for Ergon Energy or Energex.

Due to the significant increase in the benchmark debt balance between 2001–2015, a PTRM-weighted trailing average was used to determine the trailing average DRP. QTC's approach was subsequently supported by Lally[34]:

> "The PTRM weighted trailing average recognizes the fact that increases in debt initially incur the prevailing DRP and gradually shift towards the simple trailing average whilst the simple trailing average acts as if new debt always incurs the simple trailing average. The QTC favours the former method. I agree."

[33] QTC (June 2015), *Return on debt transition analysis – a joint report for Ergon Energy and Energex.*
[34] Lally (October 2015), p. 28

B.3: Original estimates

QTC's original estimates are set out in Table 6.

TABLE 6: X1 AND X2 AS A PERCENTAGE OF OPENING 2015 PTRM DEBT BALANCE

Entity	X1 (%)	X2 (%)	X1+X2 (%)
Energex	(0.5)	(3.9)	**(4.4)**
Ergon Energy	(0.3)	(3.8)	**(4.1)**

These results do not support the reasons put forward by the AER for applying an on-the-day transition to the DRP.

B.4: Criticisms of QTC's analysis

The AER and Lally have criticised some aspects of QTC's analysis. These criticisms are not important and adjusting for them does not affect the conclusions from QTC's original analysis.

B.4.1: Historical data availability

Regarding the availability of historical data to estimate past outcomes under the on-the-day approach, Chairmont advised:[35]

> "Based on our research and the papers of Lally, QTC and CEG it is concluded that there is insufficient history of relevant BBB bond data to measure over and under compensation for an adequate time period to come to any definitive conclusion about the net result over the life of energy assets.
>
> All authors including Chairmont use good data going back to 2001. Prior to this date, the data used incorporated different asset types which at best can provide a rough approximation."

QTC accepts there are challenges in estimating the 10-year DRP prior to 2001. However, a reasonable estimate of the average DRP over this period can be made as follows:

- The RBA reports an average BBB DRP (to CGS) of 1.12 per cent for corporate bonds with tenors of 3–6 years (ie, an average tenor of about 5 years) for the period 31 December 1992 to 30 June 2007[36]. This is equivalent to an average 5-year DRP to swap of 0.76 per cent over the same period.
- The average 5-year BBB DRP to swap from Bloomberg fair value curve between 31 December 2001 and 30 June 2007 is 0.69 per cent.
- Collectively, the RBA and Bloomberg estimates imply an average 5-year DRP of 0.80 per cent for the period 31 December 1992 to 30 June 2001. This period covers 85 per cent of the period of interest.

[35] Chairmont (October 2015), *Financing practices under regulation: Past and transitional*, p. 38–39
[36] RBA (September 2012), *A History of Australian Corporate Bonds*, Table 3, p. 26.

- Based on the relationship between 5- and 10-year BBB+ DRPs from QTC's quarterly credit margin survey, a 5-year DRP of 0.80 per cent is consistent with a 10-year DRP of 1.13 per cent[37].
- This estimate is slightly lower than the 1.16 per cent figure used in QTC's original analysis.

B.4.2: Treatment of allowed DRPs from previous determinations

The AER has expressed concerns over QTC's treatment of allowed DRPs from previous regulatory determinations[38]:

> "In its analysis, QTC substituted prevailing estimates of the DRP made by regulators for market estimates for the same years. This means that the analysis did not only identify windfall gains or losses arising from the mismatch between allowed and actual DRPs that is caused by the use of the 'on the day approach'. Instead, it corrected for wider mismatches in the allowances set by past regulators. As a result of these corrections, the analysis required the problematic selection of competing alternative estimates."

The choice of DRP used in the trailing average for years when a determination is made is not important because any difference between competing estimates receives a relatively small weight in the trailing average calculation. Table 7 shows the results based on using the market-based DRPs in all years to determine the trailing average DRP. These results are virtually the same as the original results.

TABLE 7: TRAILING AVERAGE CALCULATED USING MARKET-BASED DRPS IN ALL YEARS

Entity	X1 (%)	X2 (%)	X1+X2 (%)
Energex	(0.6)	(3.9)	**(4.5)**
Ergon Energy	(0.4)	(3.8)	**(4.2)**

Lally suggests that an internally inconsistent approach is to use a single market-based DRP series to determine the allowed and trailing average DRP. Even if this adjustment is made the NPVs under the AER's proposed DRP transition are still significantly negative (Table 8):

TABLE 8: TRAILING AVERAGE AND ALLOWED DRP CALCULATED USING MARKET-BASED DRPS

Entity	X1 (%)	X2 (%)	X1+X2 (%)
Energex	0.7	(4.0)	**(3.3)**
Ergon Energy	1.0	(3.9)	**(2.9)**

QTC notes that the smallest loss of 2.9 per cent is significantly different from Lally's generic NPV loss estimate of 0.1 per cent for a service provider on a 2010–2015 regulatory cycle.

[37] Regressing the 10-year BBB+ DRP on the 5-year BBB+ DRP produced the following equation: *10-year DRP = 0.18% + 1.19 × 5-year DRP*

[38] JEN preliminary decision, p. 573

B.4.3: Firm specific versus sectoral results

The AER suggests that producing estimates of past and future mismatches for specific service providers may be contrary to the requirement for it to estimate the return on debt for a benchmark efficient entity[39].

The AER is required to estimate the return on debt for a benchmark efficient entity in the same circumstances as the service provider that is being regulated. The relevant circumstances are the timing of the service provider's regulatory cycle, its particular reset periods and the PTRM debt balances that are used to determine the dollar value of the return on debt allowance. QTC's analysis takes these circumstances into account, so it is consistent with estimating the outcomes for a benchmark efficient entity.

Lally suggests that past outcomes for the industry as a whole are relevant when considering the outcomes for specific service providers[40]:

> "In respect of the benefits to the industry as a whole, any alleged disadvantages to EE [Ergon Energy and Energex] must be considered in light of that benefit to the industry."

Lally does not explain why the alleged benefits to the industry are relevant to the AER's determination of the allowed return on debt for benchmark efficient entities in the same circumstances as Ergon Energy and Energex. Lally agrees that the benchmark efficient entity is a stand-alone entity[41], so it is unclear why the alleged past benefits to other service providers are relevant to the determination of the allowed return on debt for Ergon Energy and Energex.

QTC's windfall gain and loss estimates have been calculated using benchmark debt balances and DRPs as opposed to actual data. As such, the estimates are consistent with the outcomes for a benchmark efficient entity.

The benchmark efficient entity is a stand-alone entity. Even if the AER is legally permitted to consider past outcomes when determining the allowed return on debt, any alleged benefits to the industry or other service providers is not relevant to this determination.

B.4.4: Clawback compensation process

Lally states that the approach outlined in QTC's report is a clawback compensation process for past gains and losses[42]. This conclusion is based on the following section from QTC's report[43]:

> "Even if the AER can make an accurate estimate of the cumulative historical mis-match for each service provider, and even if offsetting this mis-match is legally permissible and consistent with the

[39] JEN preliminary decision, p. 575
[40] Lally (October 2015), p. 31
[41] Lally (October 2015), p. 33
[42] Lally (October 2015), p. 29
[43] QTC (June 2015), p. 12–13

allowed rate of return objective, the correct approach is not the AER's proposed transition. Rather, the correct approach would be to:

- not apply a transition to the DRP, and
- make an adjustment to the annual allowed revenues in the next regulatory control period with a present value equal to the cumulative historical mis-match, which may be positive or negative."

The above steps were included in the report to demonstrate what the AER would actually need to do to neutralise the one-off impact of the regime change, assuming that it is legally permissible to do so and consistent with the allowed rate of return objective.

QTC explained that there is no reason to expect the present value of the windfall gains and losses during the 10-year DRP transition period to bear any resemblance to cumulative historical gain or loss at the time of the regime change. The estimates in Table 3 of the joint report (reproduced in Table 6 of this report) confirm this point, as do the indicative estimates based on Powerlink's benchmark debt balances.

QTC agrees that the second step in the approach outlined above would be a clawback, which is why it was not used in the revised proposals for Ergon Energy and Energex.

The proposed annual allowed revenues in the revised proposals for Ergon Energy and Energex were not adjusted to compensate for any past losses. The proposed starting values for the allowed return on debt in both proposals were determined using the hybrid transition approach. The underlying calculations are clearly set out in the spreadsheets that were provided to the AER as part of the revised proposals.

Appendix C: DRP simulation analysis

C.1: Objectives

The objective of the simulation analysis is to provide answers to the following questions:

1. Does a consistent application of the on-the day approach over the life of an asset result in cumulative windfall gains and losses that reverse during the life of the asset?
2. Does the present value of the differences between the allowed and trailing average DRP under the AER's DRP transition largely offset the cumulative historical windfall gain or loss from the start of regulation to the time of the regime change?

Both questions are essentially tests of whether $E[X2 \mid X1] \approx -X1$.

C.2: Mean reverting DRP model

QTC has used the following model to produce random time series estimates of a mean reverting DRP:

$$\mathbf{DRP_t = DRP_{t-1} + \alpha \cdot (\theta - DRP_{t-1}) + \sigma \cdot N(0,1)} \qquad \textbf{[Equation 1]}$$

where:

DRP_t = DRP in year *t*
DRP_{t-1} = DRP in year *t-1*
α = speed of annual mean reversion
θ = long-term average DRP
σ = standard deviation of $(DRP_t - DRP_{t-1})$
$N(0,1)$ = a random draw form a normal distribution with a mean of zero and standard deviation of one.

Due to a lack of long-term historical data in the Australian market, the model parameters been estimated has been estimated using Moody's Seasoned 10-year Baa DRPs from the US market between April 1953 and November 2015. The DRPs are expressed as a margin to the yield on a 10-year US Treasury Security rather than a 10-year US interest rate swap. The data has been sourced from the Federal Reserve Bank of St. Louis.

C.2.1: Estimated model parameters

The model parameters have been estimated by regressing $(DRP_t - DRP_{t-1})$ on DRP_{t-1}. As the DRPs are available on a monthly basis, the annual changes have been estimated from Jan–Jan, Feb–Feb etc. The regression results are shown in Table 9:

TABLE 9: MEAN REVERSION MODEL PARAMETERS

Annual period	Intercept	Slope (-α)	t-stat	θ (%)	σ (%)
January	0.0085	-0.43	-4.05	1.97	0.74
February	0.0069	-0.36	-3.59	1.93	0.66
March	0.0071	-0.37	-3.64	1.94	0.69
April	0.0076	-0.40	-3.89	1.92	0.68
May	0.0068	-0.36	-3.68	1.89	0.63
June	0.0048	-0.25	-2.94	1.96	0.50
July	0.0046	-0.24	-2.82	1.94	0.49
August	0.0046	-0.24	-2.79	1.93	0.50
September	0.0048	-0.24	-2.80	1.97	0.54
October	0.0078	-0.36	-3.57	2.00	0.70
November	0.0074	-0.36	-3.59	2.04	0.73
December	0.0087	-0.43	-4.04	2.01	0.78
Average	**0.0066**	**-0.34**	**-3.45**	**1.96**	**0.64**

The slope estimates (-α) are statistically less than zero for all measurement periods, which confirms that the DRP displays mean reversion. The long-term average DRP (θ) is 2.0 per cent.

It is well known that the DRP displays large infrequent 'spikes' that gradually reverse over time. To incorporate this effect into Equation 1, annual spikes equal to 1.5, 2.5 and 3.5 per cent are assumed to occur with probabilities of 0.01, 0.03 and 0.05[44].

To avoid over-stating the volatility, the value of σ has been reduced to 0.35 per cent. This figure was estimated using trial-and-error to produce a standard deviation of about 0.60 per cent after allowing for a spike of 2.5 per cent with a probability of 0.03.

C.3: Approach

The model has been used to simulate the annual mismatch between the on-the-day and trailing average DRPs across 10,000 random scenarios. The on-the-day DRP is reset once every 5 years and the trailing average is calculated over a 10-year period.

To address Question 1, the annual mismatches are simulated over a 50-year asset life. For each simulation the cumulative mismatch over the first 25 years (X1) is recorded along with the present value (as at year 25) of the annual mismatches over the last 25 years (X2). The cumulative and present values are based on a cost of capital of 6.5 per cent.

[44] This is achieved by producing a random draw from a uniform distribution between 0 and 1. The spike value is added to the simulated DRP from Equation 1 if the random draw is less than or equal to the spike probability.

To address Question 2, the annual mismatches are simulated over three consecutive 5-year regulatory periods, and the AER's 10-year DRP transition period. For each simulation the cumulative mismatch over the consecutive 5-year regulatory periods (X1) is recorded along with the present value (as at year 15) of the annual mismatches during the transition period (X2). The cumulative and present values are based on a cost of capital of 6.5 per cent.

As the AER is likely to be most concerned about situations where X1 is relatively large, the values of X2 have been recorded conditional on observing a large positive or negative value of X1. A large positive (negative) outcome is defined as a value of X1 that is in the top (bottom) 10 per cent of the 10,000 simulated values of X1 for a each combination of model parameters.

All values are expressed as a percentage of the debt balance, which is assumed to be constant throughout the analysis period.

C.4: Results

The average simulated values of X1, X2 and X1+X2 are approximately zero. The average correlation between the simulated windfall gain/loss in consecutive 5-year regulatory periods is approximately -0.2.

C.4.1: 50-year asset life

The simulation results based on a 50-year asset life are shown in Tables 10 and 11.

Based on a spike probability and size of 0.03 and 2.5 per cent respectively, the average value of the largest 1,000 simulated values of X1 is 20.1 per cent. The average value the simulated values of X2 associated with these estimates of X1 is (0.6) per cent. This means that, conditional on experiencing a relatively large positive value of X1, the expected value of X2 is (0.6) per cent.

TABLE 10: CONDITIONAL ESTIMATES OF X2 (UPPER 10 PER CENT OF X1)

Prob (spike)	Spike size (%)	X1 (%)	X2 (%)	X1+X2 (%)
0.01	1.5	12.8	(0.2)	12.6
0.01	2.5	14.6	(0.4)	14.2
0.01	3.5	17.6	(0.7)	16.9
0.03	1.5	14.8	(0.4)	14.4
0.03	***2.5***	***20.1***	***(0.6)***	***19.5***
0.03	3.5	25.4	(1.0)	24.4
0.05	1.5	16.5	(0.4)	16.1
0.05	2.5	23.4	(0.8)	22.6
0.05	3.5	30.9	(0.8)	30.1

TABLE 11: CONDITIONAL ESTIMATES OF X2 (LOWER 10 PER CENT OF X1)

Prob (spike)	Spike size (%)	X1 (%)	X2 (%)	X1+X2 (%)
0.01	1.5	(12.0)	0.2	(11.8)
0.01	2.5	(13.2)	0.3	(12.9)
0.01	3.5	(15.2)	0.1	(15.1)
0.03	1.5	(13.5)	0.3	(13.2)
0.03	2.5	(16.4)	0.2	(16.2)
0.03	3.5	(20.4)	0.1	(20.3)
0.05	1.5	(14.5)	0.4	(14.1)
0.05	2.5	(19.6)	0.3	(19.3)
0.05	3.5	(25.1)	0.2	(24.9)

These results show that under a consistent application of the on-the-day approach, the cumulative windfall gains and losses during the life of an asset do not reverse over the life of the asset. This conclusion holds across a range of spike sizes and probabilities.

C.4.2: AER's 10-year DRP transition

The simulation results based on three consecutive 5-year regulatory periods and the AER 10-year DRP transition are shown in Tables 12 and 13. The values of X1 and X2 are interpreted in the same way as the values in Tables 10 and 11.

The Lower and Upper values of X2 represent the 95 per cent confidence interval for the simulated conditional values of X2. These estimates are important because the return on debt transition is a one-off event for each service provider. As such, the range of potential outcomes for X2 is more important than the expected outcome.

TABLE 12: CONDITIONAL ESTIMATES OF X2 (UPPER 10 PER CENT OF X1)

Prob (spike)	Spike size (%)	X1 (%)	X2 (%)	X1+X2 (%)	Lower X2 (%)	Upper X2 (%)
0.01	1.5	8.7	(0.4)	8.3	(3.7)	3.2
0.01	2.5	10.5	(0.5)	10.0	(4.2)	3.9
0.01	3.5	12.5	(0.8)	11.7	(4.8)	3.5
0.03	1.5	10.5	(0.5)	10.0	(3.8)	3.6
0.03	2.5	14.2	(0.9)	13.3	(5.0)	6.1
0.03	3.5	18.8	(0.9)	17.8	(6.4)	10.5
0.05	1.5	11.9	(0.6)	11.3	(4.4)	4.8
0.05	2.5	16.9	(0.9)	16.0	(5.8)	7.8
0.05	3.5	22.5	(1.3)	21.2	(7.0)	10.3

TABLE 13: CONDITIONAL ESTIMATES OF X2 (LOWER 10 PER CENT OF X1)

Prob (spike)	Spike size (%)	X1 (%)	X2 (%)	X1+X2 (%)	Lower X2 (%)	Upper X2 (%)
0.01	1.5	(8.2)	0.4	(7.8)	(2.7)	3.7
0.01	2.5	(8.8)	0.4	(8.4)	(2.8)	4.2
0.01	3.5	(9.7)	0.3	9.4	(3.3)	3.7
0.03	1.5	(9.1)	0.4	(8.7)	(3.2)	4.7
0.03	2.5	(11.0)	0.5	(10.5)	(3.4)	8.0
0.03	3.5	(13.4)	0.2	(13.3)	(4.6)	9.4
0.05	1.5	(9.8)	0.3	(9.5)	(3.2)	5.2
0.05	2.5	(12.6)	0.2	(12.4)	(4.0)	8.9
0.05	3.5	(15.6)	0.3	(15.3)	(5.2)	12.0

The AER's DRP transition is based on the assumption that $E[X2 \mid X1] \approx -X1$. The simulation results do not support this assumption. Rather, they suggest that $E[X2 \mid X1] \approx 0$, which is consistent with the future outcomes under the hybrid transition.

This conclusion holds across a range of spike sizes and probabilities.

C.5: Observations and conclusions

The main results and observations from the simulation analysis are as follows:

- The average simulated values of X1, X2 and X1+X2 are approximately zero.
- The correlation between the simulated windfall gain/loss in consecutive 5-year regulatory periods is relatively weak (approximately -0.2).
- There is no conditional relationship between X1 and X2:

- Conditional on a large positive or negative value of X1 over a 25 year period, the expected value of X2 over the next 25 years is approximately zero.
- Conditional on a large positive or negative value of X1 over a three consecutive 5-year regulatory periods, the expected value of X2 under the AER's DRP transition period is approximately zero.

- The conditional values of X2 under the AER's DRP transition are volatile, as shown by the Lower and Upper X2 values in Tables 12 and 13.
  - This volatility is an important consideration because the transition is a one-off event for each service provider.
  - Service providers and the AER should be concerned with the potential range of outcomes under the AER's one-off DRP transition rather than just the expected outcome.

PTRM-weighted trailing average approach

A REPORT FOR POWERLINK – DECEMBER 2015

Summary

Queensland Treasury Corporation (QTC) has been asked by Powerlink to provide advice on whether a simple or Post-Tax Revenue Model (PTRM) weighted trailing average should be used to determine the allowed return on debt.

This report is intentionally brief as the AER has indicated that it will give proper consideration to the PTRM-weighted trailing average approach in the first review of the Rate of Return Guideline.

QTC's observations and conclusions are as follows:

- A simple trailing average initially compensates increases in the PTRM debt balance at the average historical cost of debt over the last 10 years. This approach will not contribute to the achievement of the allowed rate of return objective because any meaningful estimate of efficient debt financing costs must reflect the costs that can actually be achieved.
- A simple trailing average is internally inconsistent because it compensates two new benchmark debt transactions that are made at the same time at different costs of debt:
  - The annual refinancing of 10 per cent of the existing debt balance is compensated at the AER's estimate of the prevailing 10-year cost of debt.
  - The annual increase in the PTRM debt balance is initially compensated at the historical average 10-year cost of debt over the last 10 years.
- A PTRM-weighted trailing average correctly compensates increases in the PTRM debt balance at the prevailing cost of debt, which is the cost that can be realistically achieved.
- Regardless of how the return on debt is calculated, the dollar value of the return on debt allowance is based on the forecast PTRM debt balances. As such, both approaches provide compensation 'as if' the benchmark efficient entity follows the forecast borrowing profile in the PTRM. The only difference is the cost of debt that is initially used to compensate these additional borrowings.
- Unless the AER believes the corporate debt market is inefficient, there is no reason to initially compensate increases in the PTRM debt balance at the historical average cost of debt rather than the prevailing (and efficiently priced) cost of debt.
- If the debt funded actual capex of the benchmark efficient entity is consistently greater than 50 per cent of the AER's approved forecast debt funded capex, a PTRM-weighted trailing average will produce a better estimate of the return on debt and provide better capex incentives compared to a simple trailing average.
- Based on 10-year benchmark debt yields and Powerlink's PTRM debt balances since January 2002, the annual difference between a simple and PTRM-weighted trailing average

would have frequently exceeded the materiality threshold of 1 per cent of the annual revenue requirement. More importantly, the annual differences display a strong positive correlation (+0.88), which produces large and persistent cumulative mismatches over time, especially when the cost of funding the mismatches is taken into account.

  - Between 2002–2017 the outcome for a benchmark efficient entity in the same circumstances as Powerlink has been a cumulative loss equal to 2.9 per cent of the 2017 opening PTRM debt balance.
  - The cumulative mismatch has been consistently negative since 2008–09.

A PTRM-weighted trailing average is an internally consistent approach as it compensates new borrowings (ie, the annual refinancing of 10 per cent of the existing debt balance and the annual increase in the PTRM debt balance) at the same prevailing 10-year cost of debt.

In QTC's view, a PTRM-weighted trailing average will produce an allowed return on debt that contributes to the achievement of the allowed rate of return objective.

The role of QTC

QTC is the Queensland Government's central financing authority and corporate treasury services provider, with responsibility for:

- sourcing and managing the debt funding to finance Queensland's infrastructure requirements in the most cost-effective manner, and
- providing financial and risk management advice and services to the Queensland Government and Queensland's public sector bodies.

QTC is the largest Australian semi-government issuer of Australian dollar-denominated bonds in the domestic and offshore markets, with total outstandings of approximately $94 billion. Onlendings are made to a wide range of clients including regulated and unregulated government-owned corporations (GOCs), local government authorities, and Queensland Treasury.

QTC is active in the primary and secondary bond markets, and is a regular user of interest rate swaps, bank bill futures contracts and Commonwealth Government bond futures contracts to manage and hedge interest rate risk.

QTC is also responsible for managing the $9.8 billion QTC Capital Guaranteed Cash Fund, which invests in high quality assets including bank bills, commercial paper, corporate floating rate notes, and mortgage and asset-backed securities.

Trailing average approaches

The simple and PTRM-weighted trailing average approaches aim to replicate the cost produced by a benchmark debt portfolio that is equally funded by 10 fixed-rate loans with annual maturities from 1–10 years. The only difference between the approaches is how increases in the PTRM debt balance are initially compensated.

A simple trailing average assumes that a benchmark efficient entity:

- refinances 10 per cent of the existing debt balance each year at the prevailing 10-year cost of debt, and

- issues new debt at the same time to fund the annual increase in the PTRM debt balance at the historical average 10-year cost of debt over the previous 10 years.

A PTRM-weighted trailing average assumes that a benchmark efficient entity:

- refinances 10 per cent of the existing debt balance each year at the prevailing 10-year cost of debt, and
- issues new debt to fund the annual increase in the PTRM debt balance at the same prevailing 10-year cost of debt that applies to the annual refinancing transaction.

The allowed rate of return objective

The allowed rate of return objective requires the AER to determine a return on debt that is commensurate with the efficient financing costs of the benchmark efficient entity.

A return on debt approach that compensates new borrowings at historical rather than prevailing rates will not contribute to the achievement of the allowed rate of return objective because any meaningful estimate of efficient debt financing costs must reflect the costs that can be realistically achieved. Compensating new borrowings at historical rates is also inconsistent with the AER's views on allocative efficiency[1]:

> 'Allocative efficiency can be achieved by setting the allowed return on debt such that it reflects the lowest debt financing cost that a benchmark efficient entity could realistically achieve.'

As it is not possible for a borrower to issue new debt at historical interest rates, a simple trailing average will not contribute to the achievement of the allowed rate of return objective when the PTRM debt balance is increasing over time.

Choosing between approaches

Regardless of how the return on debt is calculated, the dollar value of the return on debt allowance is based on the forecast PTRM debt balances. As such, both approaches provide compensation 'as if' the benchmark efficient entity follows the forecast borrowing profile in the PTRM. The only difference is the cost of debt that is initially used to compensate these additional borrowings.

In choosing between the simple and PTRM-weighted trailing average approach, the main decision for the AER is determining whether the additional borrowings should be initially compensated at the historical or prevailing cost of debt.

Materiality

The definition of materiality in the National Electricity Rules (NER) refers to a change in costs in a regulatory year that exceeds 1 per cent of the annual revenue requirement for that regulatory year.

Figure 1 show the differences between the simple and PTRM-weighted trailing average for a benchmark efficient entity in the same circumstances as Powerlink. Table 1 shows the differences as a percentage of the annual revenue requirement.

[1] AER (August 2013), *Better Regulation Explanatory statement – Draft rate of return guideline*, p. 77

FIGURE 1: SIMPLE VS PTRM-WEIGHTED TRAILING AVERAGES

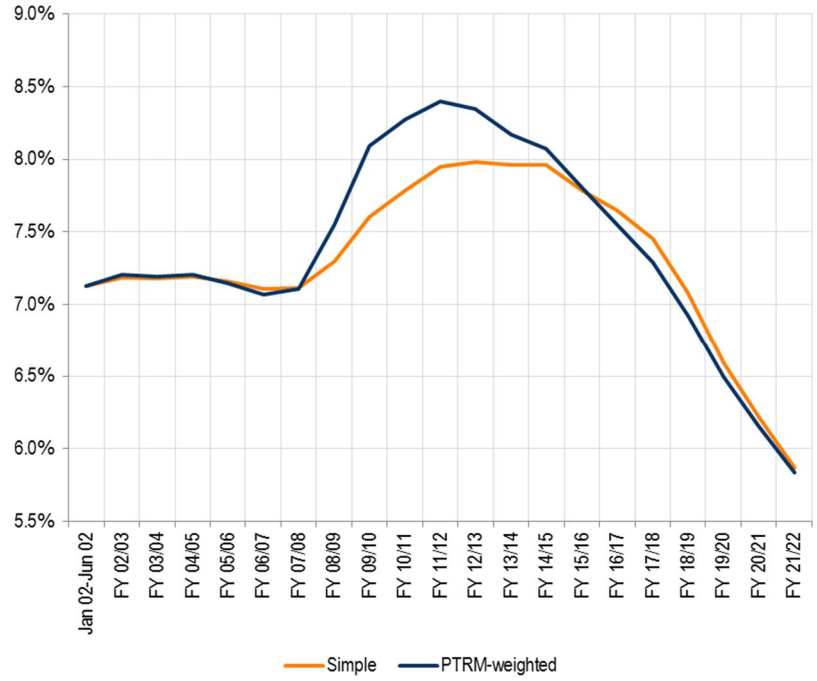


TABLE 1: MISMATCH AS A PERCENTAGE OF ANNUAL REVENUES

Year	Annual mismatch as % of revenue
Jan 02–June 02	0.0
2002–03	(0.1)
2003–04	(0.1)
2004–05	(0.1)
2005–06	0.0
2006–07	0.1
2007–08	0.0
2008–09	(1.1)
2009–10	(2.2)
2010–11	(2.2)
2011–12	(1.9)
2012–13	(1.7)
2013–14	(1.0)
2014–15	(0.5)
2015–16	(0.1)
2016–17	(0.4)
2017–18	0.9
2018–19	0.9
2019–20	0.5

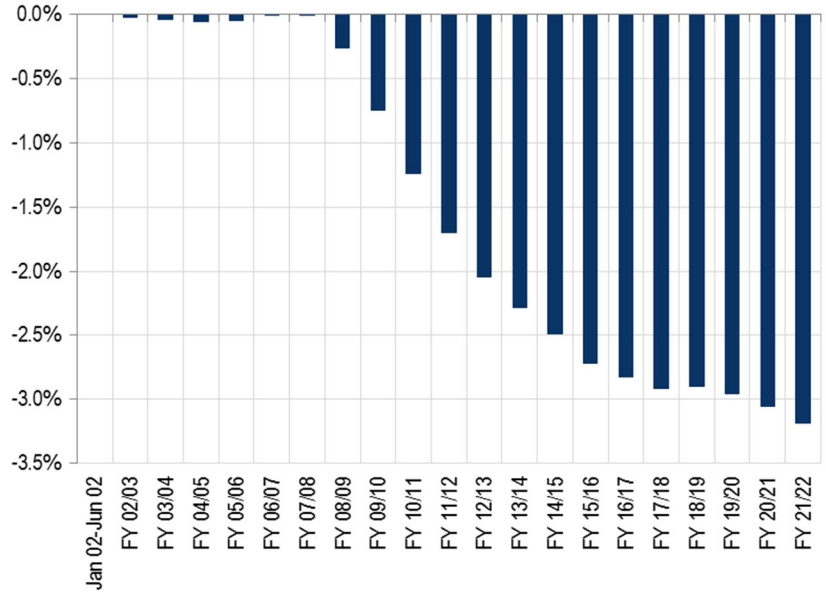
Year	Annual mismatch as % of revenue
2020–21	0.3
2021–22	0.2

Cumulative differences

An important consideration is the strong positive correlation (+0.88) between the annual differences between the simple and PTRM-weighted trailing average.

The strong positive correlation produces large cumulative differences that persist over time. Figure 2 shows the cumulative mismatches as a percentage of the opening PTRM debt balance in the relevant years. The annual mismatches are funded at the allowed WACC.

FIGURE 2: CUMULATIVE MISMATCH AS A PERCENTAGE OF DEBT



Recent issues raised by the AER

The AER raised a number of issues with the PTRM-weighted trailing average approach in its final decisions for Ergon Energy and Energex. These issues are addressed in the following sections.

Impact of forecast depreciation

The AER claims that QTC did not address the impact of depreciation on forecast RAB growth[2]. This claim is based on the following quote from QTC's original report for Ergon Energy and Energex:

> "If the prevailing cost of debt is higher than the average cost of debt over the last 10 years, a simple trailing average will:
>
> – under-compensate a service provider for funding capex at the prevailing cost of debt"

[2] AER (October 2015), *Final Decision – Ergon Energy determination 2015–16 to 2019–20, Attachment 3 – Rate of Return*, p. 586–587

By referring to the funding of capex 'at the prevailing cost of debt' QTC is clearly referring to the debt-funded portion of capex (ie, the amount in excess of regulatory depreciation, and adjusted for benchmark gearing of 60 per cent). As such, QTC's statement is factually correct and does take into account the impact of depreciation on forecast RAB growth.

In response, the AER stated:

> "We do not agree that this is correct in all cases. The PTRM-weighted average and the simple trailing average will produce identical results where the RAB remains constant over time. This means that, holding all else constant, **the simple average will fully or over-compensate a service provider for funding capex at prevailing rates up to the level of depreciation**." [emphasis added]

QTC agrees that both approaches produce the same outcome if the RAB is constant over time. However, it is unclear why a service provider would fund capex at prevailing rates (ie, issue new debt) *up to* the level of depreciation. New debt is only required for 60 per cent of the capex requirement *beyond* the regulatory depreciation allowance. If this debt is issued when the prevailing cost of debt is higher than the average cost of debt over the last 10 years, a simple trailing average will under-compensate the service provider, which is the point being made in the quote from QTC's report.

Materiality

In regards to the materiality of the annual differences between a simple and PTRM-weighted trailing average the AER concluded[3]:

> "While the choice of approach leads to annual revenue differentials that occasionally exceed 1 per cent of revenue, the average materiality over the full sample is approximately 0.4 per cent. QTC submits that the choice of approach is material on the basis that the implied materiality over individual years or periods of years exceeds 1 per cent. However, we consider it is more relevant to consider the impact of the choice of approach over time."

QTC does not agree that materiality can be properly assessed by only focussing on the average annual mismatch.

The annual mismatches based on Powerlink's benchmark debt balances display a very strong positive correlation of +0.88. This produced large and persistent cumulative mismatches over time, especially when the cost of funding the mismatches is taken into account. As shown in Figure 2, the cumulative mismatch based on Powerlink's benchmark debt balances has been consistently negative since 2008–09 and will equal to 2.9 per cent of the 2017 opening PTRM debt balance.

Capex incentives

In assessing the issue of capex incentives, it is important to keep in mind that under both trailing average approaches, the dollar value of the return on debt allowance is based on the PTRM debt balance. As such, both approaches provide compensation 'as if' the benchmark efficient entity follows the forecast borrowing profile in the PTRM. In choosing between the simple and PTRM-weighted trailing average approach, the main decision for the AER is determining whether the additional borrowings should be initially compensated at the historical or prevailing cost of debt.

[3] Ergon Energy final decision, p. 588

The AER suggests that better capex incentives can be created by initially compensating all increases in the PTRM debt balance at the historical cost of debt rather than its own estimate of the prevailing cost of debt:[4]

> "… we are satisfied it is appropriate that the benchmark efficient entity should face some incentive to defer capex where the prevailing cost of debt is high relative to historical costs. Conversely, we are satisfied it is appropriate that the service provider should face some incentive to accelerate capex where the prevailing costs of debt is low in order to take advantage of market opportunities."

In QTC's view, there are two problems with the AER's assessment:

- If the corporate debt market is efficient, the margin between the prevailing and historical cost of debt is irrelevant. As the prevailing cost of debt will be fairly priced, it should be used to initially compensate the new borrowings associated with capex.
- Even if a service provider believes that the margin between the prevailing and historical cost of debt contains information about future funding costs, it is free to reflect this in its borrowing decisions. This decision is of no relevance to the allowed return on debt.
  - However, it is inappropriate for the AER to incorporate the same implicit interest rate view into its determination of the allowed return on debt, which is what happens under a simple trailing average.

The allowed return on debt should be determined on the basis that the corporate debt market is efficient. This means that the AER's estimate of the prevailing cost of debt will be fairly priced when the benchmark efficient entity borrows for the debt-funded portion of its capex. There is no reason for initially compensating these new borrowings at the historical cost of debt in an efficient market.

By using a simple trailing average approach the AER:

- is over-riding its own estimate of the prevailing cost of debt each year when providing initial compensation for increases in the PTRM debt balance, and therefore
- assumes that the historical cost of debt is a better indicator of the true cost of debt than the prevailing cost of debt, except for the annual refinancing of 10 per cent of the existing debt balance, which is compensated at the AER's estimate of the prevailing cost of debt.

In QTC's opinion, it cannot be argued that initially compensating all increases in the PTRM debt balance at the historical cost of debt will result in capex incentives that are 'at least as good' as those produced by the PTRM-weighted trailing average approach[5].

[4] Ergon Energy final decision, p. 596
[5] Ergon Energy final decision, p. 594

Questions for the AER

1. The allowed rate of return objective requires the AER to determine a return on debt that is commensurate with the efficient financing costs of the benchmark efficient entity. In the AER's view, is it reasonable to assume that efficient debt financing costs should reflect the costs that can be realistically achieved in the market?
2. Under a trailing average approach, two benchmark debt transactions will occur at the same time each year. First, 10 per cent of the existing PTRM debt balance is refinanced with new 10-year debt. Second, an additional borrowing equal to the annual increase in the PTRM debt balance is made. As the AER will apply its estimate of the prevailing cost of debt to the first transaction, is it appropriate to apply the same prevailing cost of debt to the second transaction?
3. Will a simple or PTRM-weighted trailing average produce a better estimate of the return on debt and provide better capex incentives if actual debt funded capex is consistently greater than 50 per cent of the AER's approved forecast debt funded capex?
4. Does the AER agree that for the vast majority of the time the prevailing cost of debt will be fairly priced when the benchmark efficient entity borrows to fund planned capex? If the answer is yes, is it more appropriate to compensate these new borrowings at the prevailing (and efficiently priced) cost of debt or the historical average cost of debt over the last 10 years?

Benchmark debt yield Bloomberg vs RBA curve

PREPARED FOR POWERLINK QUEENSLAND – DECEMBER 2015

Purpose

Powerlink has requested Queensland Treasury Corporation's (QTC's) advice on how to estimate the 10-year benchmark debt yield to be used in its preliminary regulatory proposal to the Australian Energy Regulator (AER).

Data providers

Generic corporate yield estimates are currently produced on a month-end basis by the Reserve Bank of Australia (RBA) and on a daily basis by Bloomberg.

Reserve Bank of Australia

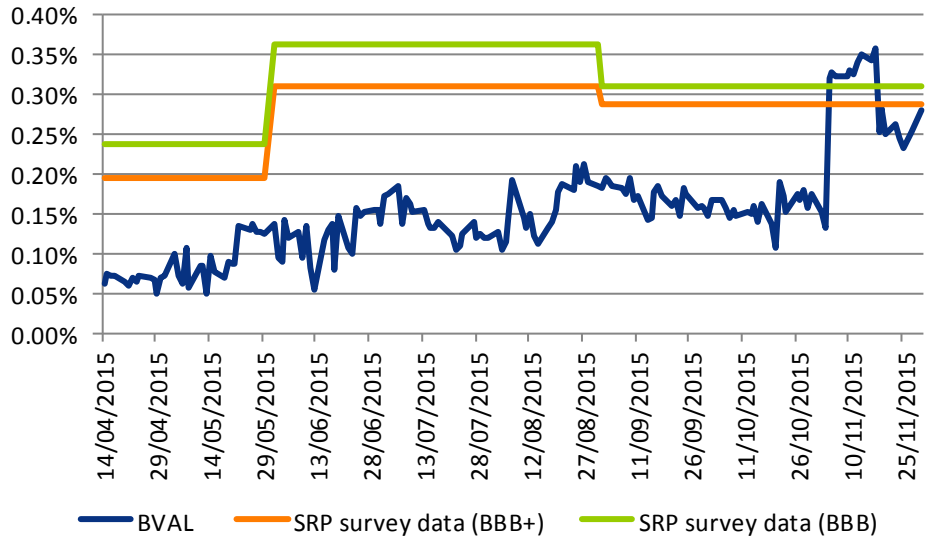
- The RBA produces non-financial corporate yield estimates for A and BBB credit ratings and target tenors of 3, 5, 7 and 10 years. The estimates are derived from the yields on domestic fixed rate bonds and bonds issued by Australian non-financial corporates in offshore markets.
- The RBA's estimates are currently used by the AER, Independent Regulatory and Pricing Tribunal (IPART) and Economic Regulation Authority of Western Australia (ERA) to estimate a 10-year benchmark debt yield.
- Although the RBA produces estimates for a 10-year target tenor, the effective tenor of the underlying bonds has been consistently shorter than 10 years. However, there are several simple methods that can be used to extrapolate the RBA's estimates to a true 10 year tenor. It is also straightforward to derive daily estimates from the RBA's month-end estimates.
- The RBA's methodology is fully disclosed and the yield estimates are publicly available on the RBA's website at no cost.

Bloomberg Valuation Series (BVAL)

- On 14 April 2015 Bloomberg started publishing estimates of generic 10-year BBB corporate yields (referred to as 'BVAL'). Prior to this date the longest BVAL estimate was for a 7-year tenor.
- Bloomberg does not disclose the methodology used to produce its BVAL estimates, although it is likely that some type of curve-fitting process is used based on observable corporate bond yields.

To determine if the new 10-year BVAL estimates are reasonable QTC has compared the difference between the 7- and 10-year BVAL margins to swap with similar data from QTC's SRP survey data (Figure 1). Margins to swap are used rather than yields to account for changes in the slope in the underlying swap yield curve.

FIGURE 1: DIFFERENCE BETWEEN 7- AND 10-YEAR MARGINS TO SWAP



The main observations are as follows:

- The AER has previously used a 'paired bond' method to extrapolate the 7-year BVAL margin to swap to a 10-year tenor. This method has typically resulted in a margin of about 0.3 per cent being added to the 7-year BVAL margin, which is consistent with the results from QTC's credit margin survey.
- Compared to QTC's SRP survey data, the difference between the 7- and 10-year BVAL margins to swap up to November 2015 is too small.
- From November 2015 the BVAL BBB swap spread has widened significantly and it is more in line with survey data.
- Based on current observations it is appropriate to consider giving equal weight to the RBA and Bloomberg estimates. QTC will continue to monitor the BVAL performance going forward.

Recommendations

- QTC considers the RBA's non-financial yields to be appropriate for the purpose of estimating the benchmark debt yield that will be used to determine Powerlink's allowed return on debt.
- If the BVAL margin is maintained to a level that is consistent with QTC's credit margin survey data and the AER's past extrapolations, it would be appropriate to give equal weight to the RBA and Bloomberg estimates. Otherwise, sole reliance should be placed on the RBA estimates.