

# Review of the method for estimating the Weighted Average Cost of Capital for the Regulated Railway Networks

Final Decision

18 September 2015

**Economic Regulation Authority**

WESTERN AUSTRALIA

© Economic Regulation Authority 2015

This document is available from the Economic Regulation Authority's website at [www.erawa.com.au](http://www.erawa.com.au). For further information, contact:

Economic Regulation Authority  
Perth, Western Australia  
Phone: (08) 6557 7900

## Contents

<b>Executive Summary</b>	<b>ix</b>
<b>1 Introduction</b>	<b>1</b>
1.1 The Code requirement	1
1.2 The rail WACC method review	1
<b>2 The broad regulatory framework</b>	<b>3</b>
2.1 Submissions	3
2.2 Considerations of the Authority	4
2.2.1 Regulatory objective	4
2.2.2 Criteria	5
2.3 Final Decision	6
<b>3 The WACC framework</b>	<b>7</b>
3.1 Current approach	7
3.2 Revised Draft Decision	8
3.3 Submissions	8
3.4 Considerations of the Authority	8
3.4.1 Form of the WACC	8
3.4.2 Components of the rate of return	9
3.4.3 The term of the WACC	10
3.4.4 Point estimates or ranges for estimates?	12
3.5 Final Decision	14
3.5.1 Components of the WACC	14
3.5.2 Term of the WACC	15
3.5.3 Point estimates or ranges for estimates?	15
<b>4 The benchmark efficient entity and risk</b>	<b>16</b>
4.1 Current approach	16
4.2 Revised Draft Decision	16
4.3 Submissions	17
4.4 Considerations of the Authority	17
4.4.1 Risk and the benchmark efficient entity	17
4.4.2 Defining risk	18
4.4.3 Conceptual definition of the benchmark efficient entity	19
4.4.4 Implementation issues	20
4.5 Final Decision	35
<b>5 Gearing</b>	<b>36</b>
5.1 Current approach	36
5.2 Revised Draft Decision	39
5.2.1 PTA	39
5.2.2 Brookfield Rail	39
5.2.3 TPI	40
5.3 Submissions	40
5.3.1 The Pilbara Infrastructure	40

5.3.2	Brockman Mining Australia	40
5.3.3	Cooperative Bulk Handling	41
5.4	Considerations of the Authority	41
5.4.1	Theoretical Considerations	41
5.4.2	Regulatory Practice	42
5.4.3	Empirical evidence regarding gearing	44
5.4.4	PTA	44
5.4.5	Brookfield	45
5.4.6	The Pilbara Infrastructure	47
5.5	Final Decision	48
5.5.1	PTA	48
5.5.2	Brookfield Rail	48
5.5.3	TPI	48
<b>6</b>	<b>Return on debt</b>	<b>49</b>
6.1	Current approach	49
6.2	Revised Draft Decision	49
6.3	Submissions	49
6.4	Considerations of the Authority	49
6.4.1	Approach to estimating the cost of debt	50
6.4.2	Components of the return on debt estimate	52
6.4.3	The averaging period	52
6.5	Final Decision	53
<b>7</b>	<b>Risk free rate of return</b>	<b>54</b>
7.1	Current approach	54
7.2	Revised Draft Decision	54
7.3	Submissions	54
7.3.1	TPI	54
7.3.2	Brookfield Rail	54
7.3.3	Brockman Mining Australia	55
7.4	Considerations of the Authority	55
7.4.1	Term of the estimates	55
7.4.2	Estimate of the risk free rate	55
7.5	Final Decision	56
<b>8</b>	<b>Benchmark credit rating</b>	<b>57</b>
8.1	Current approach	57
8.2	Revised Draft Decision	58
8.2.1	PTA	58
8.2.2	Brookfield Rail	58
8.2.3	TPI	59
8.3	Submissions	60
8.3.1	Brookfield Rail	60
8.3.2	TPI	60
8.4	Considerations of the Authority	61
8.4.1	PTA	61

8.4.2	Brookfield Rail	61
8.4.3	TPI	61
8.5	Final Decision	65
<b>9</b>	<b>Debt risk premium</b>	<b>66</b>
9.1	Current Approach	66
9.2	Revised Draft Decision	67
9.3	Submissions	68
9.3.1	TPI	68
9.3.2	Brookfield Rail	68
9.3.3	Brockman Mining Australia	69
9.4	Considerations of the Authority	70
9.4.1	The use of RBA Estimates	70
9.4.2	ERA estimates as at 30 July 2015	78
9.4.3	Robustness	83
9.5	Final Decision	95
9.5.1	PTA	95
9.5.2	Brookfield	96
9.5.3	TPI	98
9.5.4	Comparison of determinations across time	99
<b>10</b>	<b>Return on equity</b>	<b>100</b>
10.1	Current approach	100
10.2	Revised Draft Decision	100
10.3	Submissions	101
10.3.1	The Pilbara Infrastructure	102
10.3.2	CBH	102
10.3.3	Brookfield Rail	103
10.3.4	Brockman Mining Australia	103
10.4	Considerations of the Authority	104
10.4.1	Theoretical considerations for determining the return on equity	104
10.4.2	Estimating the return on equity for regulated rail businesses	106
10.4.3	Models for the rate of return	108
10.4.4	Estimate of the return on equity	120
10.5	Final Decision	125
<b>11</b>	<b>Market risk premium</b>	<b>126</b>
11.1	Current approach	126
11.2	Revised Draft Decision	127
11.3	Submissions	128
11.3.1	CBH	128
11.3.2	Brookfield Rail	128
11.3.3	Brockman Mining Australia	129
11.4	Considerations of the Authority	129
11.4.1	The MRP in the short and long term	130
11.4.2	A wider range of approaches/methods in estimating the MRP	131
11.4.3	Estimates of the forward looking MRP	136

11.5	Final Decision	144
<b>12</b>	<b>Equity beta</b>	<b>146</b>
12.1	Current approach	146
12.1.1	The PTA rail network	146
12.1.2	Brookfield Rail	147
12.1.3	The Pilbara Infrastructure	147
12.2	Revised Draft Decision	148
12.2.1	PTA Rail Network	148
12.2.2	Brookfield Rail	148
12.2.3	The Pilbara Infrastructure	149
12.3	Submissions	150
12.3.1	CBH	150
12.3.2	Brookfield Rail	150
12.3.3	Brockman Mining Australia	151
12.4	Considerations of the Authority	152
12.4.1	The benchmark sample	153
12.4.2	The robustness of the estimates	156
12.4.3	Use of the benchmark estimates	160
12.4.4	Estimating the betas	161
12.5	Final Decision	171
<b>13</b>	<b>Debt raising costs</b>	<b>172</b>
13.1	Current approach	172
13.2	Revised Draft Decision	172
13.3	Submissions	172
13.4	Considerations of the Authority	172
13.5	Final Decision	174
<b>14</b>	<b>Gamma</b>	<b>175</b>
14.1	Current approach	175
14.2	Revised Draft Decision	176
14.3	Submissions	176
14.4	Considerations of the Authority	177
14.4.1	Definition of the domestic capital market	178
14.4.2	Interpretation of gamma	178
14.4.3	Utilisation rate	180
14.4.4	Distribution rate	204
14.5	Final Decision	206
14.5.1	Approach	206
14.5.2	Estimate of gamma	207
<b>15</b>	<b>Inflation</b>	<b>209</b>
15.1	Current approach	209
15.2	Revised Draft Decision	209
15.3	Submissions	209
15.4	Considerations of the Authority	209
15.5	Final Decision	210

---

<b>Appendix 1</b>	<b>Econometric estimation of the equity beta</b>	<b>212</b>
<b>Appendix 2</b>	<b>Adjustments to Bloomberg’s reporting of data</b>	<b>217</b>
<b>Appendix 3</b>	<b>The bond yield approach’s extended benchmark sample</b>	<b>218</b>
<b>Appendix 4</b>	<b>Converting Foreign Currency Yields into Australian Dollar Equivalents</b>	<b>220</b>
<b>Appendix 5</b>	<b>The 2015 WACC for the regulated rail businesses</b>	<b>222</b>

## Tables

Table 1	Comparator companies for PTA	27
Table 2	Comparator companies for Brookfield Rail	30
Table 3	Comparator companies for TPI Network	34
Table 4	Public Transport Authority gearing: Allen's Consulting Group's sample recommendation and decision 2008.	37
Table 5	WestNet Gearing: Allen's Consulting Group Sample Recommendation and Decision 2008	38
Table 6	Public Transport Authority: Benchmark Sample of Toll Road Firm Gearing 2015	45
Table 7	Brookfield: Benchmark Sample Gearing 2015	46
Table 8	The Pilbara Infrastructure: Benchmark Sample Gearing 2015	47
Table 9	Standard and Poor's Risk Profile Matrix	62
Table 10	Standard and Poor's Example Financial Risk Indicative Ratios Table	63
Table 11	Indicative Corporate Measures and Ratios	64
Table 12	Regression of Average of 20 interpolated estimates vs End of Month Estimates	73
Table 13	Revised Bond Yield Approach Selection Criteria	79
Table 14	Nelson-Siegel-Curve Constraints	81
Table 15	Estimated Cost of Debt for A, BBB+ and BBB- Credit Ratings	82
Table 16	BBB BVAL Curve Constituent Industry Sectors and Tenors	84
Table 17	A+/A/A- Sample 10 Year Yield Estimates	85
Table 18	A+/A/A- Sample by Tenor	85
Table 19	BBB+/BBB Sample 10 Year Yield Estimates	86
Table 20	BBB+/BBB Sample by Tenor	86
Table 21	BBB/BBB- Sample 10 Year Yield Estimates	87
Table 22	BBB/BBB- Sample by Tenor	88
Table 23	A+/A/A- Rating Estimates excluding observations with low BVAL score	90
Table 24	BBB+/BBB Rating Estimates excluding observations with low BVAL score	92
Table 25	BBB/BBB- Rating Estimates excluding observations with low BVAL score	94
Table 26	Applications of the Fama French three-factor model in Australia	117
Table 27	Models adopted by Australian and international regulators for estimating the return on equity	118
Table 28	The 2015 WACC for the regulated rail businesses – Final Decision	120
Table 29	Other regulators' recent decisions	124
Table 30	BHM and NERA long run historic nominal and real annual average market returns for 1883 to 2014 (excluding imputation credits)	137
Table 31	Average annual imputation credit yields and grossed up arithmetic average returns (nominal, consistent with the estimate of gamma of 0.4)	138
Table 32	Estimates of bill and bond-based 10 year grossed up nominal average Market Risk Premiums	139
Table 33	Recent estimates of the MRP using the DGM, per cent	141
Table 34	Stock exchange Index for benchmark sample companies	162



---

Table 35	Public Transport Authority asset beta sample 2015	163
Table 36	Brookfield Rail asset beta sample 2015	165
Table 37	TPI asset beta sample 2015	168
Table 38	The Authority's estimate of debt raising costs (bppa), 2013	174
Table 39	Pricing Waterfall Set in Bloomberg for AUD Equivalent Yield Conversion	221
Table 40	The 2015 WACC for the regulated rail businesses – Final Decision	223

## Figures

Figure 1	Proposed approach to estimating the return on equity	xiv
Figure 2	Time Series - Linear Interpolation versus Simple Average of RBA End of Month Estimates	72
Figure 3	Conceptual distance between Linear Interpolation and Simple Average of RBA End of Month Estimates	74
Figure 4	Reserve Bank of Australia Corporate Bond Yield and Spread 10 Year Estimates - Effective Tenor	75
Figure 5	Extrapolating 10 year Estimates from Reserve Bank of Australia Data	76
Figure 6	Reserve Bank of Australia BBB Rated Spread to Swap	77
Figure 7	Composition of A+/A/A- Sample	86
Figure 8	Composition of BBB+/BBB Sample	87
Figure 9	Composition of BBB/BBB- Sample	88
Figure 10	Distribution of A+/A/A- Sample BVAL Scores	89
Figure 11	Low BVAL Score Distribution around A+/A/A- Curve	90
Figure 12	Distribution of BBB+/BBB Sample BVAL Scores	91
Figure 13	Low BVAL Score Distribution around BBB+/BBB Curve	91
Figure 14	Distribution of BBB/BBB- Sample BVAL Scores	93
Figure 15	Low BVAL Score Distribution around BBB/BBB- Curve	94
Figure 16	A Rated Cost of Debt Estimates – Various Methods and Sources	95
Figure 17	RBA Analysis of Average Number of Valid Securities by Credit Rating	96
Figure 18	BBB+ Rated Cost of Debt Estimates – Various Methods and Sources	97
Figure 19	BBB- Rated Cost of Debt Estimates – Various Methods and Sources	98
Figure 20	Comparison of Rail WACC Determinations: Debt Risk Premium Basis	99
Figure 21	Approach to estimating the return on equity	101
Figure 22	Dividend Growth Model implied return on equity: All Ordinaries Index (monthly, grossed up)	143
Figure 23	ERA asset beta estimates	151
Figure 24	Genesee & Wyoming equity beta estimates by day of the week 2014 and 2015	157
Figure 25	Aurizon equity beta estimates by day of the week 2015	157
Figure 26	Rolling 5 year equity beta estimates for key comparables	159
Figure 27	Share of domestic ownership in listed and unlisted equities – excluding government ownership and refined to account for use of imputation credits	190

## Executive Summary

Clause 3 of Schedule 4 of the *Railways (Access) Code 2000* (**Code**) requires the Economic Regulation Authority (**Authority**) to make an annual determination of a weighted average cost of capital (**WACC**) to be applied in the determination of capital costs for each of the following:

- the railway infrastructure described in items 49, 50 and 51 in Schedule 1 (hereafter referred to as the **PTA network**);
- the railway infrastructure associated with the railways network described in other items in Schedule 1 (hereafter referred to as the **Brookfield Rail network**), except item 52;
- the railway infrastructure associated with that part of the railways network described in item 52 in Schedule 1 (hereafter referred to as the **TPI network**).

Clause 3 of Schedule 4 of the Code further requires that in every fifth year subsequent to 2003, the Authority undertake a public consultation program prior to determining the WACC values for that year.

The Authority commenced its review of the rail WACC method in 2013. On 28 November 2014, the Authority decided to revise and re-issue the rail WACC method review Draft Decision – which it had previously released on 5 June 2014 – in order to account for changes in approach stemming from its draft decision on the rate of return for the Mid-West and South-West Gas Distribution System (**GDS**). The delay in release of the rail WACC method decision was required to allow regulatory consistency between gas and rail. With this Final Decision, the Authority's approach to determining rail and gas regulated rates of return are aligned, once the key differences in the two regimes are accounted for (differences relate to, for example, the term of the estimates, related judgments underpinning the return on equity, as well as the credit ratings and benchmark samples for the cost of debt).

The Authority has now finalised its decision relating to the rail WACC method. The resulting parameter estimates and WACC results for the three Western Australian regulated rail networks – derived through application of the Authority's approach as set out in this Final Decision, as at 30 June 2015, and to apply for the 2015-16 financial year – are at Appendix 5. The 2015-16 real pre-tax WACCs for the regulated networks, providing the 2015 annual update, are summarised as follows:

- PTA – 4.25 per cent;
- Brookfield Rail – 7.59 per cent; and
- TPI – 10.74 per cent.

### *The broad regulatory framework*

The Authority's primary task in developing the rail WACC estimates is to achieve the object of the *Railways (Access) Act 1998*. This implies that the prime consideration is to achieve rail WACC estimates that:

- are consistent with and deliver efficient use of and investment in railway facilities; and
- facilitate a contestable market for rail operations.

## The rate of return framework

### Components of the WACC

The Authority retains the real pre-tax approach to estimating the rail WACC.

The nominal pre-tax WACC can be expressed, following the Officer/Monkhouse WACC framework, as:

$$WACC = E(R_e) \times \frac{E}{V} \times \frac{1}{(1 - T_c(1 - \gamma))} + E(R_d) \times \frac{D}{V}$$

where:

- $E(R_e)$  is the nominal post-tax expected rate of return on equity – the cost of equity (grossed up for the value of imputation credits);
- $E(R_d)$  is the nominal pre-tax expected rate of return on debt – the cost of debt;
- $\frac{E}{V}$  is the proportion of equity in the total financing (which comprises equity and debt);
- $\frac{D}{V}$  is the proportion of debt in the total financing;
- $T_c$  is the tax rate; and
- $\gamma$  (gamma) is the value of franking credits created (as a proportion of their face value).

The Authority retains the market transformation method for converting the nominal post-tax WACC to the real pre-tax WACC.

With the market transformation method, the real pre-tax WACC is obtained by removing expected inflation  $\pi_e$  from the nominal pre-tax WACC as follows:

$$WACC_{\text{real pre-tax}} = \frac{(1 + WACC_{\text{nominal pre-tax}})}{1 + \pi_e} - 1$$

### Term of the WACC

The Authority considers that a WACC with a term that is consistent with the long economic lives of the assets will best meet the requirements of the *Railways (Access) Act 1998* and the Code. Accordingly, the Authority utilises the longest term reliable data to inform the rail WACC. Generally, given the availability of data, this is a 10 year term. However, where appropriate, longer term data may be used to inform the estimates of the component parameters of the WACC formulas (for example, the use of long term averages of the real return on equity).

The Authority notes that the longer term estimates developed for the rail WACC are not directly comparable to the five year forward looking estimate of the rate of return used for its gas decisions. The term of the gas rate of return is conditioned by the five year term of the regulatory period, which requires a five year term for the rate of return estimate in order to maintain the present value (“NPV=0”) condition. In contrast, the term of the rail WACC is conditioned by the explicit requirement for a ‘gross replacement value’ annuity, which is paid over the ‘economic life’ of the rail assets. This is a different regulatory framework to that utilised for the Authority’s gas pipeline regulation. As the weighted average life of typical rail infrastructure assets approaches 50 years or more, the WACC is long term.

### **Point estimates or ranges for estimates?**

The use of a single point estimate for the return on equity and the return on debt leads to a single point estimate for the rate of return. The single point estimate of the rate of return is facilitated by a single point estimate of the gearing level.

### *The benchmark efficient entity and risk*

The benchmark efficient entity is defined as:

A ‘pure-play’ regulated rail facility operating within Australia without parental ownership, with a similar degree of risk as that which applies to the service provider in respect of the provision of the rail services.

The Authority bases its estimates of efficient financing costs on the observations from a sample of comparator firms, with efficient financing costs, that are judged to be ‘similar’ to the rail services provider.

There are a range of costs and benefits to be evaluated when considering whether to adopt a domestic or international form of any particular model of the rate of return or its components. On balance, the Authority considers that the regulatory costs of moving to a full international approach would be significant, with uncertain benefits in terms of potentially more accurate estimates. Therefore, the Authority is of the view that it should continue to base its estimates of the rail WACC on domestic financial markets. This still allows for the influence of international investors in Australian markets for equity, as well as the influence of international lenders supplying debt finance directly to Australian firms.

However, in recognition of the small data sets for some parameters in the rail WACC – in particular for the gearing, credit rating and equity beta – the Authority utilises international comparators for the gearing, credit rating and equity beta parameters.

### *Gearing*

The Authority considers gearing of:

- 50 per cent, at the higher end of the observed gearing range, is appropriate for the PTA rail network;
- 25 per cent, consistent with the Australian average, to be the appropriate benchmark gearing level for the Brookfield Rail network;
- 20 per cent is appropriate for the TPI network, given its higher risk stemming from the broad reliance on a single commodity, iron ore, and the limited number of potential customers.

This gearing will remain fixed until the next rail WACC method review – the annual updates of the rail WACC will adopt this gearing.

### *Return on debt*

The Authority bases its estimates of the cost of debt on a risk premium over and above the risk-free rate, combined with a margin for administrative costs:

$$\text{Return on Debt} = \text{Risk Free Rate} + \text{Debt Risk Premium} + \text{Debt raising costs}$$

The estimate of the return on debt is based on prevailing rates 'on-the-day' just prior to each determination of the annual rail WACC update.

The Authority adopts a 40 business days averaging period for estimating the 'on the day' risk free rate and the debt risk premium for the rail WACC.

### *Risk free rate of return*

The Authority bases its estimation of the nominal risk free rate on the observed yield of 10 year Commonwealth Government Securities (**CGS**) bonds. The 10 year term is consistent with the long term of the WACC estimate.

The risk free rate will be re-estimated for each annual update.

### *Benchmark credit rating*

The Authority considers that the benchmark efficient rail entities would be able to sustain credit ratings of:

- A for the PTA network;
- BBB+ for the Brookfield Rail network; and
- BBB- for the TPI rail network.

The Authority notes that these credit ratings are unchanged from the 2008 review.

These credit ratings will remain fixed until the next rail WACC method review – the annual updates of the rail WACC will adopt these ratings.

### *Debt risk premium*

The debt risk premium is estimated consistent with a 10 year term. The Authority considers that this is the longest feasible term that can be reliably estimated from the observed data.

To this end, the Authority has developed an extended bond yield approach to estimate the 'regulated debt risk premium'. The regulated debt risk premium is derived from the observed yields of relevant corporate bonds – taken from Bloomberg – that qualify for inclusion in the benchmark sample.

To estimate the regulated debt risk premium, the Authority:

- extends the benchmark sample under the bond yield approach to: (i) include Australian corporate bonds denominated in domestic currency (**AUD**) and foreign currencies including USD; Euros; and British pounds; and (ii) exclude bonds issued by financial sectors including banks, duplicates, inflation linked, called and perpetual instruments;
- converts the yields into hedged Australian Dollar equivalent yields inclusive of Australian Swap rates;

- averages AUD equivalent bond yields across the averaging period for each bond (for example, where a 40 trading day averaging period applies, each bond will have a single 40 day average yield calculated for it);
- estimates yield curves on this data – applying the Gaussian Kernel, Nelson-Siegel and Nelson-Siegel-Svensson techniques;
- uses the simple average of these three yield curves' 10 year cost of debt estimate to arrive at the market estimate of the 10 year cost of debt;
- estimates the regulated debt risk premium for the purposes of estimating the regulated cost of debt.

For each of the rail networks, a separate benchmark bond sample is developed, based on the corresponding benchmark efficient credit rating. The Authority uses the Bloomberg data service exclusively in order to construct each benchmark sample. Under the bond yield approach, the following criteria apply in order to select bonds to be included in each of the benchmark samples:

- the credit rating of each bond, as rated by Standard & Poor's, must match that determined for the benchmark efficient entity;
- the remaining time to maturity must be two years or longer;
- the bonds must be issued by Australian (non-financial) entities and denominated in AUD, USD, Euros or GBP;
- fixed bonds and floating bonds are eligible for inclusion;
- both bullet bonds and bonds with callable/putable redemptions are eligible for inclusion; and
- there must be at least 20 yield observations over the required 40 day averaging period.

The debt risk premium for each benchmark entity will be re-estimated at each future annual update.

## *Return on equity*

### **Models of the return on equity**

The model used by Australian regulators for quantifying the return on equity and associated risk to date has been the Sharpe Lintner Capital Asset Pricing Model (**CAPM**).

The Authority reviewed asset pricing approaches as part of its development of the gas Rate of Return Guidelines. The Authority's conclusion from that assessment was that only the Sharpe Lintner CAPM model is relevant for informing the Authority's estimation of the prevailing return on equity for the regulated firm, at the current time.

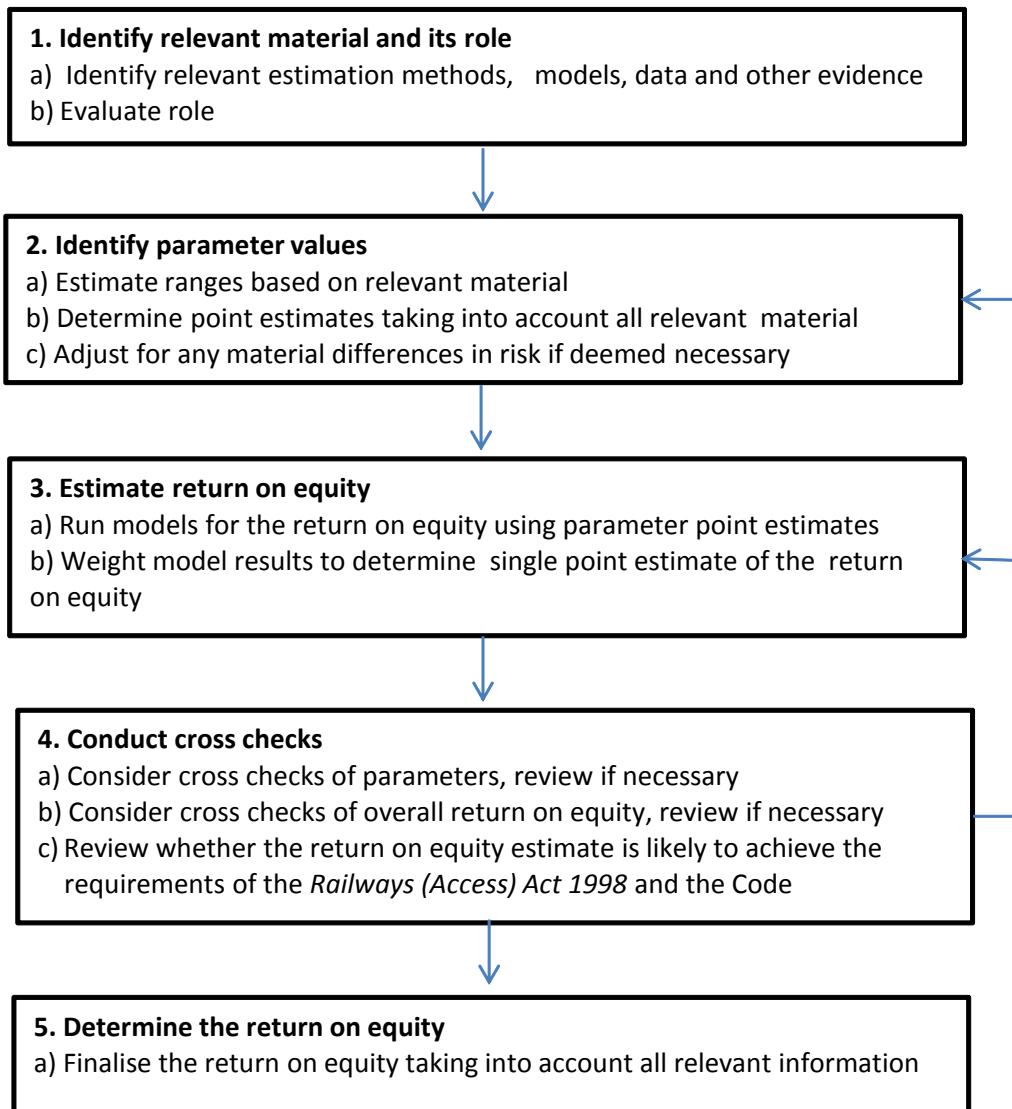
However, the Authority in its recent GDS gas decision has accepted that the Dividend Growth Model (**DGM**) and the Black CAPM are relevant models for the purposes of determining the return on equity. In particular, the Authority utilised the estimates of the market return on equity and implied market risk premium (**MRP**) from the DGM to inform its forward looking MRP for use in the CAPM. In addition, the Black CAPM is considered when the point estimate of equity beta from a range is selected. Those conclusions are adopted for this rail WACC Final Decision. The Authority therefore retains the Sharpe-Lintner CAPM model for estimating the return on equity for the rail WACC for this Final Decision, but also utilises the other two models to inform its decision in relation to the return on equity.

Other models and approaches are considered to be not relevant for determining the return on equity within the Australian context at the current time, at least without some new developments in terms of the theoretical foundations or in the empirical evidence.

### A five step approach to estimating the return on equity

The Authority adopts a five step approach for estimating the return on equity. The five steps are summarised in Figure 1 below.

**Figure 1 Proposed approach to estimating the return on equity**



Source: *The Economic Regulation Authority's analysis*

This approach allows the Authority to have regard to a wide range of material, taking account of relevant models for the return on equity, as well as a range of other relevant information. The Authority gives weight to each piece of information according to its merits at the time of each determination. This enables it to provide a transparent and clear decision that meets the objectives and requirements of the *Railways (Access) Act 1998* and the Code.



With regard to Step 1, the following conclusions have been reached in relation to the approach for estimating the return on equity in this Final Decision:

- The Sharpe Lintner CAPM will be utilised to estimate the return on equity.
- The Black CAPM is relevant for the purpose of estimating the return on equity. However, given it is not reliable and practical to estimate a robust return on equity using this model, the model will not be used directly, but only to inform the point estimate of the equity beta from within its range for input to the Sharpe Lintner CAPM.
- The DGM is a relevant model for informing the market return on equity and also the forward looking MRP.
- The Fama French three factor model is not relevant and as such, this model is not used for the purpose of estimating a return on equity.

The three relevant models will be retained for the purpose of estimating the return on equity for each annual rail WACC update. At each rail WACC update, the following parameters will be re-estimated for the purpose of developing the updated estimate of the return on equity for input to the Sharpe Lintner CAPM:

- the 10 year risk free rate;
- the prevailing MRP.

The following parameters will not be re-estimated prior to the next rail WACC method update and therefore the values determined in this Final Decision (and utilised for the 2015 rail WACC update set out at Appendix 5) will contribute to each subsequent annual rail WACC update:

- equity beta;
- gamma.

### *Market risk premium*

In order to derive the final point estimate for the forward looking MRP, the Authority will utilise relevant information from historical excess risk premia, as well as the DGM.

The Authority notes that the estimate of the MRP informed by historical excess equity risk premia falls within the range of 5.3 per cent (based on the Ibbotson approach) and 8.5 per cent (based on the Wright approach).

The Authority also notes the forward looking MRP derived from various DGM studies is likely to fall within the wide range of 5.6 per cent and 9.7 per cent.

The Authority considers that the Wright estimate provides a strong indicator for the likely return on equity for the next 50 years, given the statistical evidence for the mean reversion of the return on equity. This is consistent with the position set out in the Revised Draft Decision. The implication is that the (implied) forward looking MRP for the rail WACC should be close to 8.5 per cent as at 30 June 2015.

However, the Authority also notes that the potential for interest rates to achieve the historic long term average over the next 50 year period (which also is implied by the Wright method) is uncertain. Given this uncertainty, consideration is also given to the estimate for the MRP of 5.3 per cent derived from the Ibbotson approach.

Therefore, within the range of 5.3 per cent and 8.5 per cent derived from historical excess equity risk premia, the Authority is inclined somewhat more toward the Wright view of the world, given the long term nature of the estimate – which would place the estimate of the MRP in the upper half of the historic range.

With regard to the DGM, the Authority notes that the DGM approach tends to provide upwardly biased estimates. Therefore, the Authority is inclined to give more weight to those estimates which are in the lower half of the recent range.

On balance, taking all of the relevant information into account, the Authority is of the view that a forward looking MRP of 7.3 per cent represents a reasonable balance of the estimates provided by the historical excess premia and DGM approaches – at the current time – consistent with the long term forward view required for the rail WACC method.

### Equity beta

The Authority considers that empirical evidence must be used to inform its judgment for equity beta, as no *a-priori* expectation exists for the equity beta of regulated railway networks, or the corresponding benchmark efficient rail entity. Therefore, the Authority believes that any estimate of equity beta must be informed by empirical evidence. As a consequence, estimates of equity beta using historical data are required in order to inform an appropriate range for the equity beta of the benchmark entity. The Authority considers that issues of imprecision are best addressed via the use of multiple models and statistical techniques to inform a possible range for any equity beta estimate. Therefore the primary evidence used to inform the value for the equity beta of a regulated rail entity should be based on quantitative evidence.

The Authority is of the view that estimates of asset beta based on benchmark samples should ideally be relevant to the regulated rail businesses in Western Australia. In this context, the Authority considers that two aspects of “relevance to a benchmark entity” should be considered. *First*, estimates of asset beta from the benchmark samples should provide some relevance to the economy in which the efficient benchmark entity is operating (in this case, the Australian economy). *Second*, these estimates should also provide some relevance to the industry/sector in which the efficient benchmark entity is operating (in this case, the rail industry).

The Authority considers that a benchmark sample including only Australian businesses that are comparable with rail is preferred for the purpose of its empirical studies. However, the Authority’s analysis indicates that there are insufficient rail businesses comparators operating in Australia. Given empirical estimates are the only viable option for estimating the asset beta for rail businesses, the Authority is of the view that a benchmark sample including both Australian and developed countries in Europe and America is appropriate.

The studies conducted by the Authority have used various econometric techniques including a standard Ordinary Least Squares (**OLS**) approach and other robustness approaches such as the Least Absolute Deviations (**LAD**); maximum likelihood robust methodology (**MM**); and Theil Sen approaches.

Based on the estimates of the asset beta from three different benchmark samples for three regulated rail businesses, the following conclusions have reached.

#### PTA

Given the low level of systematic risk for the PTA rail network return, the Authority considers that an asset beta of 0.3 is appropriate.

Utilising the estimated gearing of 50 per cent, this corresponds to an equity beta of the PTA network of 0.6.

### **Brookfield Rail**

The Authority estimates the asset beta for the Brookfield Rail network as being 0.7. Utilising the estimated gearing of 25 per cent, this corresponds to an equity beta of the Brookfield Rail network of 0.9.

### **TPI**

The Authority considers that an asset beta of 1.05 reflects the higher risks associated with the returns of the TPI network. When combined with the estimated gearing of 0.2, this results in an equity beta of 1.3.

### *Debt raising costs*

The Authority is of the view that debt raising costs should be incorporated as a component in the rate of return on debt. However, these debt raising costs should only include the direct cost components of debt raising, not the indirect costs. The direct costs will be recompensed in proportion to the average annual issuance, and will cover: (i) gross underwriting fees; (ii) legal and roadshow fees; (iii) company credit rating fees; (iv) issue credit rating fees; (v) registry fees; and (vi) paying fees.

The Authority considers that its 2013 estimate of 12.5 basis points per annum provides for a current estimate of debt raising costs for the benchmark efficient entity.

### *Gamma*

The Authority bases its estimate of gamma on the following, with estimates given most weight ranked first:

- the equity share ownership approach gives an estimate of gamma of 0.4;
- the taxation statistics approach gives an estimate of gamma of 0.3; and
- the dividend drop off approach gives a range for the estimate of gamma of 0.3 to 0.5.

The resulting range for the Authority's estimate of gamma is 0.3 to 0.5.

Consistent with its approach set out in the Revised Draft Decision, the Authority places most reliance on the equity share ownership approach. Overall, taking all relevant information into account, a point estimate for gamma of 0.4 is adopted.

### *Inflation*

Given the long term of asset classes to which the rail WACC estimates apply, the Authority will adopt a forward looking estimate of inflation of 2.5 per cent. This is consistent with the mid-point of the Reserve Bank of Australia's inflation target, which is 2 to 3 per cent.

# 1 Introduction

1. The Authority is required to determine, as at 30 June each year, the weighted average cost of capital (**WACC**) for the regulated railway networks.

## 1.1 The Code requirement

2. Clause 3 of Schedule 4 of the *Railways (Access) Code 2000* (**Code**) requires the Economic Regulation Authority (**Authority**) to make an annual determination of a WACC to be applied in the determination of capital costs for each of:
  - the railway infrastructure described in items 49, 50 and 51 in Schedule 1 (hereafter referred to as the **PTA network**)
  - the railway infrastructure associated with that part of the railways network described in item 52 in Schedule 1 (hereafter referred to as the **TPI network**)
  - the railway infrastructure associated with the railways network described in other items in Schedule 1 (hereafter referred to as the **Brookfield Rail network**)
3. The PTA network is the urban passenger network operated by the Public Transport Authority (**PTA**), which is an agency of the Western Australian Government.
4. The TPI network is operated by The Pilbara Infrastructure Pty Ltd (**TPI**) as the owner of the railway network that links Fortescue Metals Group's mines in the Pilbara to TPI's port facilities in Port Hedland.<sup>1</sup>
5. The Brookfield Rail network is the freight network in the south-west of Western Australia operated by Brookfield Rail (formerly known as WestNet Rail), a wholly-owned subsidiary of Brookfield Infrastructure Partners L.P.
6. Clause 3 of Schedule 4 of the Code further requires that in every fifth year subsequent to 2003, the Authority undertake a public consultation program prior to determining the WACC values for that year.

## 1.2 The rail WACC method review

7. The Authority undertook a public consultation program prior to making its annual WACC determination for the regulatory year commencing 1 July 2013, with a view to also undertaking a review of the rail WACC method at that time. The Issues Paper, and submissions from stakeholders, can be found on the Authority's website.
8. However, the Authority chose to defer finalisation of the rail WACC review because at the time the Authority was undertaking a comprehensive review of its approach to determining the WACC under the National Gas Rules, which involved common issues. The Authority subsequently released the gas Rate of Return Guidelines for gas transmission and distribution networks pursuant to the National Gas Rules in December 2013 (the gas Rate of Return Guidelines).

---

<sup>1</sup> The TPI railway was built under the *Railway and Port (The Pilbara Infrastructure Pty Ltd) Agreement Act 2004*, and has been included in the Western Australian rail access regime since 1 July 2008, when Part 3 of that Agreement Act was proclaimed.

9. The Authority then released a draft decision in relation to the rail WACC method review on 5 June 2014.
10. However, the Authority's rate of return approach underwent further development during the course of the Authority's deliberations for proposed revisions to ATCO's gas distribution system (**GDS**) access arrangement, the Draft Decision for which was released on 14 October 2014. Changes in the Authority's approach for the gas decision raised issues of consistency with the approach that had been set out in the draft decision for the rail WACC method.
11. To address the inconsistencies, clarify key differences, and to allow for due process in terms of consultation with rail stakeholders, the Authority decided on 28 November 2014 to revise and re-issue the rail WACC method review draft decision.<sup>2</sup> Changes between the original Draft Decision and the Revised Draft Decision were as follows:
  - the process for conducting this review – incorporated in section 1.2;
  - the averaging period for estimating components of the return on debt – section 6.2.3;
  - the method for estimating the debt risk premium – chapter 9;
  - the method for estimating the market risk premium – chapter 11;
  - the method for estimating the impact of imputation credits on the rate of return, gamma – chapter 14; and
  - the method for estimating inflation – chapter 15.
12. In the interim, the Authority based the 2014-15 rail WACC values on the 2013 method and parameters. The 2014-15 rail WACC determination was released by the Authority on 24 October 2014, and may be found on the Authority's website.
13. This rail WACC method review Final Decision supersedes the previous method developed in the 2008 review. The resulting updated estimates will apply for the determination of the rail WACC for the Freight and Urban Railway Networks for the 2015-16 regulatory year commencing 1 July 2015, and for subsequent years.
14. The WACC results for the three Western Australian regulated rail networks for the 2015-16 regulatory year – derived through application of the Authority's revised approach – are at Appendix 5.<sup>3</sup>

---

<sup>2</sup> Economic Regulation Authority, *Review of the method for estimating the Weighted Average Cost of Capital for the Regulated Railway Networks: Revised Draft Decision*, 28 November 2014.

<sup>3</sup> All parameters contributing to the WACC estimates in Appendix 5 accord with this Final Decision, and are based on 40 trading days ending 30 June 2015.

## 2 The broad regulatory framework

16. The Western Australian Rail Access Regime (**WARAR**) provides for light handed regulation of access to Western Australia's intrastate rail networks. The WARAR seeks to facilitate commercial negotiation between parties. To this end, information approved by the Authority – including on the reasonable costs of access, expressed as a range between incremental and total costs – is provided to the parties. The WARAR also provides for recourse to arbitration if the parties cannot agree.
17. The WARAR is linked to the National Access Regime, which is set out in Part IIIA of the Commonwealth's *Competition and Consumer Act 2010* (**CCA**) and clause 6 of the Competition Principles Agreement (**CPA**). The WARAR was certified as effective by the Commonwealth Minister responsible for the CCA, following consideration by the National Competition Council (**NCC**). In making that decision, the NCC and the Minister:<sup>4</sup>
  - considered the regime in light of the objects of Part IIIA of the CCA; and
  - assessed the effectiveness of the access regime by applying the principles contained in clause 6 of the CPA.
18. The objects clause of Part IIIA (s. 44AA) of the CCA establishes twin objectives for the National Access Regime:
  - to promote the economically efficient operation of, use of, and investment in the infrastructure by which services are provided, thereby promoting effective competition in upstream and downstream markets; and
  - to provide a framework and guiding principles to encourage a consistent approach to access regulation in each industry.
19. The WARAR is given power through the Western Australian *Railways (Access) Act 1998* and its subsidiary Code.
20. The object of the *Railways (Access) Act 1998* is to:
  - ...establish a rail access regime that encourages the efficient use of, and investment in, railway facilities by facilitating a contestable market for rail operations.<sup>5</sup>

### 2.1 Submissions

21. The Authority did not receive any submissions in relation to the broad regulatory framework. As such, section 2.2 is unchanged from the Revised Draft Decision.

<sup>4</sup> The most recent certification occurred for a period of five years (Bradbury D., *Decision to certify the Western Australian Rail Access Regime*, 11 February 2011).

<sup>5</sup> *Railways (Access) Act 1998*, Part 1, s. 2A.



## 2.2 Considerations of the Authority

22. With regard to the rail WACC, the Authority notes that Clause 2 of Schedule 4 of the Code sets out the key requirements for its determination:<sup>6</sup>

### 2. Railway infrastructure

- (1) In this Schedule —  
capital costs means the costs comprising both the depreciation and risk adjusted return on the relevant railway infrastructure.
- (2) For the purposes of this clause, railway infrastructure includes a cutting or embankment made for any reason after the commencement of this Code.
- (3) Capital costs (other than capital costs under subclause (5)) are to be determined as the equivalent annual cost or annuity for the provision of the railway infrastructure calculated in accordance with subclause (4).
- (4) The calculation is to be made by applying —
- (a) the Gross Replacement Value (**GRV**) of the railway infrastructure as the principal;
  - (b) the Weighted Average Cost of Capital (**WACC**) as the interest rate; and
  - (c) the economic life which is consistent with the basis for the GRV of the railway infrastructure (expressed in years) as the number of periods,

where —

GRV is the gross replacement value of the railway infrastructure, calculated as the lowest current cost to replace existing assets with assets that —

- (i) have the capacity to provide the level of service that meets the actual and reasonably projected demand; and
- (ii) are, if appropriate, modern equivalent assets;

and

WACC is the target long term weighted average cost of capital appropriate to the railway infrastructure.

23. Clause 4 of Schedule 4 of the Code defines the nature of the costs as:

The costs referred to in this Schedule are intended to be those that would be incurred by a body managing the railways network and adopting efficient practices applicable to the provision of railway infrastructure, including the practice of operating a particular route in combination with other routes for the achievement of efficiencies.

### 2.2.1 Regulatory objective

24. Any regulatory decision with regard to the rail WACC necessarily needs to determine the approach that is considered to best deliver the object of the *Railways (Access) Act 1998*. This implies that the prime consideration is to achieve estimates that:

<sup>6</sup> *Railways (Access) Code 2000*, Schedule 4, Division 1, Clause 2.

- are consistent with and deliver efficient use of and investment in railway facilities;<sup>7</sup> and
  - facilitate a contestable market for rail operations.
25. The Code, unlike the National Gas Rules, does not explicitly prescribe a rate of return objective. Nevertheless, in order to account for efficient use and investment in railway facilities, the Authority considers that it needs to estimate the rail WACC commensurate with the efficient financing costs of efficient entities with a similar degree of risk in respect of the provision of the rail services.<sup>8</sup> The current regulatory approach assumes that efficient firms with efficient financing provide a 'benchmark' for each regulatory decision.
26. Such efficient financing will contribute to the efficient use of the railway networks and efficient investment. The resulting efficient input costs and output prices will facilitate contestability in the provision of railway services. The Authority considers that outcomes that are observed in contestable markets are in the long term interests of consumers, as these deliver desired goods and services at least cost over time.

### 2.2.2 Criteria

27. The Authority considers that 'criteria' can help to articulate its reasoning where it is applying regulatory discretion in determining the best approach for estimating the rate of return, thereby increasing clarity for stakeholders.
28. Stakeholders in submissions on the Issues Paper were generally supportive of the Authority establishing criteria for considering alternative WACC methodologies, particularly where such criteria were informed by the WARAR objectives.
29. A number of stakeholders suggested additional criteria. Brockman proposed that it is desirable if the WACC estimates are:
- ...consistent with the application of the existing instruments under the Code or, where this is not the case, identifies what changes are required to ensure a change to the WACC methodology does not have consequences that are incompatible with the objectives of the rail regime.<sup>9</sup>
30. The Authority's rationale for criteria were developed as part of the gas Rate of Return Guidelines.<sup>10</sup> The Authority considers that it is desirable that it adopt the same criteria for the rail WACC decision, particularly given the similarity in the objectives between the two regimes.

<sup>7</sup> The railway 'facilities' in question are the 'railway infrastructure' that is defined in Section 3 of the Code as 'the facilities necessary for the operation of a railway' including railway track, tunnels and bridges, signalling and communication systems, workshops and associated machinery'. Rolling stock and associated 'above-rail' facilities such as depots and terminal yards are not included as railway infrastructure.

<sup>8</sup> This statement is similar to the allowed rate of return objective in the National Gas Rules. Where relevant and appropriate, the Authority considers that the approach to estimating the rail WACC should be consistent with the determination of the rate of return in gas. Accordingly, this review refers extensively to the development of the gas Rate of Return Guidelines, undertaken in 2013. For more detail, see Economic Regulation Authority, *Explanatory Statement for the Rate of Return Guidelines: Meeting the Requirements of the National Gas Rules*, 16 December 2013.

<sup>9</sup> Brockman Mining Australia, *Submission in response to Issue Paper*, 15 March 2013, p. 5.

<sup>10</sup> Economic Regulation Authority, *Explanatory Statement for the Rate of Return Guidelines: Meeting the Requirements of the National Gas Rules*, 16 December 2013, p. 9.



31. The Authority considers that the criteria are consistent with the objectives of the *Railways (Access) Act 1998*.

## 2.3 Final Decision

32. The Authority's primary task in developing the rail WACC estimates is to achieve the object of the *Railways (Access) Act 1998*. This implies that the prime consideration is to achieve rail WACC estimates that:

- are consistent with and deliver efficient use of and investment in railway facilities; and
- facilitate a contestable market for rail operations.

33. The Authority considers it desirable if the WACC estimates are:

- driven by economic principles:
  - based on a strong theoretical foundation, informed by empirical analysis;
- fit for purpose:
  - able to perform well in estimating the return on debt and the return on equity over the regulatory years of the access arrangement period;
  - implemented in accordance with best practice;
- supported by robust, transparent and replicable analysis that is derived from available, credible datasets:
  - based on quantitative modelling that is sufficiently robust as to not be unduly sensitive to small changes in the input data;
  - based on quantitative modelling which avoids arbitrary filtering or adjustment of data, which does not have a sound rationale;
- capable of reflecting changes in market conditions and able to incorporate new information as it becomes available;
- supportive of specific regulatory aims; and thereby:
  - recognise the desirability of consistent approaches to regulation across industries, so as to promote economic efficiency;
  - seek to achieve rates of return that would be consistent with the outcomes of efficient, effectively competitive markets;
  - as far as possible, ensure that the net present value of returns is sufficient to cover a service providers' efficient expenditures (the 'NPV=0' condition);
  - provide incentives to finance efficiently;
  - promote simple approaches to estimating the rate of return over complex approaches, where appropriate;
  - promote reasoned, predictable and transparent decision making; and
  - enhance the credibility and acceptability of a decision.

### 3 The WACC framework

34. Schedule 4 of the Code requires that the component of costs relating to invested capital be calculated as an annuity. The annuity method requires the application of the Weighted Average Cost of Capital (**WACC**) to the Gross Replacement Value (**GRV**) of the asset as the principal, over the economic life of the assets.<sup>11</sup>

#### 3.1 Current approach

35. The current approach for estimating the rail WACC has its origins in the 1999 review of the WACC methodology by Macquarie Bank, which was undertaken for the Western Australian Rail Access Regulator.<sup>12</sup> Macquarie Bank recommended the adoption of:
- separate estimates for WACC for the urban and freight networks, to reflect the different risks in the provision of below-ground rail services;
  - gearing based on a benchmark capital structure;
  - a cost of debt based on the sum of estimates of the risk free rate and a relevant debt risk premium, determined from benchmark entities with similar risk, with a term based on 10 years;
  - a return on equity derived from the Capital Asset Pricing Model;
  - a value for imputation credits (gamma); and
  - a corresponding estimated real pre-tax WACC for use in the annuity calculation.
36. This broad approach has remained in place since that time, essentially unchanged, although:
- a margin for debt raising costs was added to the estimate of the cost of debt in 2008;
  - the Authority's bond yield approach was used to estimate the debt risk premium component of the cost of debt from 2011:
    - the bond yield approach substituted for the previous yield margin approach, which was based on Bloomberg and CBA Spectrum yield curves;
    - the bond yield approach was revised in 2012 to be based on the 'joint weighted' approach,<sup>13</sup> following comments made in the Australian Competition Tribunal's decision in 2012 on an application by WA Gas Networks; and

<sup>11</sup> *Railways (Access) Code 1998*, Schedule 4, Division 1, Clause 2 (see paragraph 22 for the extract of this section).

<sup>12</sup> Macquarie Bank, *Western Australia Rail Access Regime: Independent Assessment of Maximum Rate of Return on Rail Infrastructure*, 23 August 1999.

<sup>13</sup> The 'joint weighted' approach weights the estimate of the observed bond yields by the 'amount issued', in addition to the foregoing single weighting on the 'term to maturity'.

- a value of gamma of 0.25 was adopted in 2013, instead of the value of 0.5 used previously, reflecting the Australian Competition Tribunal's decision in 2011, following application by Energex Ltd.<sup>14</sup>

## 3.2 Revised Draft Decision

37. The following conclusions had been reached in the Revised Draft Decision in relation to the WACC framework:
- the Authority will retain the real pre-tax approach to estimating the rail WACC;
  - the Authority utilised the longest term reliable data to inform the rail WACC. Generally, this is a 10 year term; and
  - the Authority would establish point estimates at the parameter level. These point estimates may be determined from within a range, or derived directly. Such point estimates would then inform a single point estimate for an estimation method or financial model.

## 3.3 Submissions

38. The Authority did not receive any submissions in relation to the WACC framework. Therefore, the following section is unchanged from the Revised Draft Decision.

## 3.4 Considerations of the Authority

### 3.4.1 Form of the WACC

39. Consultants to previous reviews of the rail WACC in 2003 and 2008 recommended, as a matter of preference, use of a nominal post-tax (vanilla) framework for estimating the WACC.
40. An advantage associated with the use of a post-tax nominal vanilla WACC is that it is based directly on the observed data. There is no need to transform observed estimates from nominal to real or from post to pre-tax. Australian regulators have progressively moved to adopt the post-tax approach. This removes a source of bias in the estimates.<sup>15</sup>
41. Nevertheless, the consultants to previous reviews of the rail WACC in 2003 and 2008 also recognised that the application of the nominal post-tax approach to the rail WACC may not be justified in terms of the additional complexity and regulatory cost involved with separately estimating tax cash flows.
42. The Australian Rail Track Corporation (**ARTC**) submitted to this review a preference for the use of a pre-tax, real framework as the estimation of future tax liabilities may not be consistent with the light-handed nature of the Code and the determination of the asset base on a GRV basis. ARTC submitted that the determination of future tax liabilities for a company represents a substantial regulatory burden without providing,

<sup>14</sup> Australian Competition Tribunal, *Application by Energex Limited (Gamma) (No. 5)*, 12 May 2011, A Comp T 9.

<sup>15</sup> To convert from a nominal post-tax WACC to a real pre-tax WACC, the most commonly used approach by Australian regulators has been the 'market transformation approach'.

in ARTC's view, significant benefits. ARTC noted that, despite the ACCC's preference for a post-tax nominal framework, ARTC continues to use a pre-tax real framework for its regulatory compliance assessments in the Hunter Valley.

43. On the other hand, both Brockman and Flinders Mining noted the trend of Australian regulators to adopt post-tax estimates. Brockman stated that if this occurred for the rail WACC, then the tax allowances made should reflect the actual tax position of the business and not apply an assumed corporate tax rate. Flinders considered that there would be a regulatory cost in obtaining accurate data on tax liabilities and the imputation of franking credits, but that the benefit would be a more accurate estimate of tax liability applying to a specific railway.
44. The Authority considers that, if it were to apply a post-tax approach, the tax cash flows in the post-tax approach would be based on a tax asset base calculated for the standalone entity.<sup>16</sup> The implication is that the post-tax approach would add considerable complexity to the estimation process. Further, the additional complexity may not be warranted as the Code requires the estimation of total costs through an annuity that provides for the return on and of the cost of building a new railway, rather than through a building block approach that is based on a written down asset.
45. For these reasons, the Authority considers that it is reasonable to retain the real pre-tax approach in order to estimate the rail WACC. On the basis that the market transformation approach has had near uniform acceptance by Australian regulators and stakeholders where the pre-tax approach has been adopted, the Authority will continue to use the market transformation approach in converting the nominal post-tax WACC to the real pre-tax WACC.

### 3.4.2 Components of the rate of return

46. The nominal pre-tax WACC can be expressed, following the Officer/Monkhouse WACC framework, as:

$$WACC = E(R_e) \times \frac{E}{V} \times \frac{1}{(1 - T_c(1 - \gamma))} + E(R_d) \times \frac{D}{V} \quad (1)$$

where:

$E(R_e)$  is the nominal post-tax expected rate of return on equity – the cost of equity (grossed up for the value of imputation credits);

$E(R_d)$  is the nominal pre-tax expected rate of return on debt – the cost of debt;

$\frac{E}{V}$  is the proportion of equity in the total financing (which comprises equity and debt);

$\frac{D}{V}$  is the proportion of debt in the total financing;

<sup>16</sup> That tax position could account for carry forward of losses, and also accelerated depreciation.

$T_c$  is the tax rate; and

$\gamma$  (gamma) is the value of franking credits created (as a proportion of their face value).

47. This approach to estimating the overall rate of return is a ‘bottom up’ approach, which combines separate estimates for the cost of equity and the cost of debt.
48. With the market transformation method, the real pre-tax WACC is obtained by removing expected inflation  $\pi_e$  from the nominal pre-tax WACC as follows:

$$WACC_{\text{real pre-tax}} = \frac{(1 + WACC_{\text{nominal pre-tax}})}{1 + \pi_e} - 1 \quad (2)$$

49. The resulting WACC for a benchmark efficient entity represents the competitive rate of return that an entity must earn on its existing asset base in order to satisfy its creditors, shareholders and other providers of capital.
50. The approach to estimating the gearing (or proportion of debt in total financing), the return on equity and the return on debt are discussed in more detail in the following chapters.

### 3.4.3 The term of the WACC

51. *The Railways (Access) Code 1998* states that the:
- ...WACC is the target long term weighted average cost of capital appropriate to the railway infrastructure.<sup>17</sup>
52. The WACC must remunerate the efficient financing costs of the rail service provider over the *economic life* of the assets.<sup>18</sup> In the context of the rate of return, the Authority considers that the economic life of the rail assets approaches 50 years in many instances, based on the life of typical component rail network assets.<sup>19</sup> The Authority therefore considers that the ‘appropriate’ ‘target long term’ WACC required by the Code will be consistent with a term approaching 50 years. This term will have a WACC that is closer to ‘perpetuity’ – in a financial context – than to a term, say, of 10 years.<sup>20</sup> The Authority therefore has regard to such long term WACC metrics, where they are available (for example, the 128 year average real return on equity used to inform the Wright estimate of the market risk premium).<sup>21</sup> Where relevant long term data are not available, the Authority substitutes the longest term data which

<sup>17</sup> *Railways (Access) Code 1998*, Schedule 4, Division 1, Clause 2.

<sup>18</sup> *Railways (Access) Code 1998*, Schedule 4, Division 1, Clause 2(4)(c).

<sup>19</sup> See for example, Economic Regulation Authority, *Ceiling costs to apply to seven terminal end sections of the South West Main Line*, 5 July 2004, p. 4.

<sup>20</sup> The Authority notes in this context that the impact of cash flows in the first 50 years accounts for the major proportion of the total present value of an investment with an *infinite* asset life, given a typical WACC (an infinite life exceeds that of a typical rail network but is used for illustration). For example, with a real pre-tax WACC of 7.5 per cent, and assuming constant real cash flows, the first 50 years of cash flows account for close to 97 per cent of the present value of an investment yielding an infinite stream of cash flows. The first ten years of cash flows, on the other hand, account for around half of the present value.

<sup>21</sup> See section 11.4.2.1.

are robust (for example, a 10 year risk free rate is adopted, as this provides the longest term robust observations for this parameter).<sup>22</sup>

53. Remunerating the investment over its economic life of the asset is important for maintaining the financial value of an investment in present value terms over its life. With such ‘financial capital maintenance’, investors can expect to recover the opportunity cost of employing their capital, given the associated risks, as well as the real value of their initial investment, over time.
54. This accords with the ‘NPV=0’, or present value principle. The present value principle requires that the present value of a service provider’s revenue stream match the present value of the expenditure stream.
55. The Authority therefore considers that it is required to determine a *long term* rail WACC, consistent with clause 2 of Schedule 4 of the Code, and its requirement to estimate costs derived from an annuity over the economic life of the rail assets.<sup>23</sup> Therefore, the Authority considers that it needs to incorporate a term for the WACC which accounts for the long term return on equity and the long term cost of debt.
56. For the return on equity, a term of 10 years is commonly required as a means to estimate the long term return in Australia. The 10 year term allows components of models of the return on equity to be estimated from reliable data. So for example, in the case of the risk free rate, the component may be estimated from the observed yield on 10 year Commonwealth Government Securities (**CGS**).<sup>24</sup> In addition, the Authority considers that the economic life of rail assets means that the long term average real return on equity may be used to inform the market risk premium (see chapter 11).
57. For the cost of debt, the Authority considers that the long term should also be accounted for. Again, use of the 10 year term provides reliable data consistent with longer term financing by the benchmark entities for both the underlying risk free rate as well as the debt risk premium (**DRP**) components of the cost of debt. The Authority considers that its revised bond yield approach provides the best estimate of the long term return on debt for the Australian finance market.
58. However, the limited sample size of such benchmark bonds in Australia preclude robust estimation of the **DRP** for rail-specific or even infrastructure-specific firms. Instead, the Authority’s benchmark sample includes a large range of firms in different industries, albeit with the target credit rating. As a consequence, the Authority considers that it is appropriate to use the information contained in the broad bond

<sup>22</sup> See section 7.4.1.

<sup>23</sup> This long term annuity time horizon approaching 50 years for the rail WACC differentiates it from the other WACC resets undertaken by the Authority. In the case of the WACC for gas access arrangements, the Authority considers that the correct term is five years, as this accords with the five year time horizon which is the term of the regulatory period (for more detail on why five years is the correct term for five yearly regulatory resets, see Lally M., *The risk free rate and the present value principle*, 2012, [www.aer.gov.au](http://www.aer.gov.au), p. 8). In that case, the NPV=0 principle requires that the term be aligned with the term of the regulatory period, which is five years. See also Lally M., *The Appropriate Term for the Risk Free Rate and the Debt Margin*, Report for the Queensland Competition Authority, April 2010 and Economic Regulation Authority, Final Decision on Proposed Revisions to the Access Arrangement for the Mid-West and South-West Gas Distribution Systems, 30 June 2015, p. 214.

<sup>24</sup> Commonwealth Government Securities with a 10 year term to maturity are commonly used to estimate the long term risk free rate. Estimating over significantly longer terms is potentially less robust, as the market for longer dated CGS is relatively less liquid compared to that for the 10 year CGS (see [aofm.gov.au](http://aofm.gov.au)).



yield benchmark sample – relating to each credit rating – as a means to inform each benchmark DRP.

59. For the foregoing reasons, the Authority has determined that it will adopt a rail WACC, with a term that is consistent with the long economic lives of the assets.<sup>25</sup> Accordingly, the Authority will utilise the longest term reliable data to inform the rail WACC. Generally, this will be a 10 year term. However, where appropriate, longer term data may be used to inform the estimates (for example, the use of the long term averages of the real return on equity).

### 3.4.4 Point estimates or ranges for estimates?

60. The Authority will need to exercise judgment, in order to ensure that the WARAR objective is achieved. This exercise of judgment may extend to the determination of point estimates within potential ranges. The option of using ranges, or judgment to determine point estimates within ranges, can occur at different 'levels' of the estimation process.
61. The key 'levels' are the estimation of the:
- parameter values;
  - return on equity or the return on debt;
  - overall rate of return.
62. The Authority considers each of these levels in what follows. This analysis is similar to that set out in the gas Rate of Return Guidelines.<sup>26</sup>

#### 3.4.4.1 The parameter level

63. The Authority has in the past utilised ranges to inform estimates at the parameter level. For example, the Authority in its Western Power decision, considered ranges for the benchmark credit rating, the market risk premium and the equity beta.
64. In this context, ranges have either been used to combine estimates from a number of different approaches, or to represent uncertainty determined through statistical analysis.
65. For example, in estimating the market risk premium, the Authority in its recent decision on the GDS access arrangement considered two different approaches. These approaches gave overlapping estimates, which together delivered a range, from which the Authority selected a single point estimate for use in estimating the return on equity.<sup>27</sup>

<sup>25</sup> The Authority notes that the longer term estimates developed for the rail WACC are not directly comparable to the 5 year forward looking estimate of the rate of return used for its gas decisions. The term of the gas rate of return is conditioned by the 5 year term of the regulatory period, which requires a 5 year term for the rate of return estimate in order to maintain the present value ("NPV=0") condition. In contrast, the term of the rail WACC is conditioned by the economic lives of the rail assets, which as noted above, are long term.

<sup>26</sup> Economic Regulation Authority, *Explanatory Statement for the Rate of Return Guidelines: Meeting the Requirements of the National Gas Rules*, 16 December 2013, p. 18.

<sup>27</sup> Economic Regulation Authority, *Final Decision on Proposed Revisions to the Access Arrangement for the Mid-West and South-West Gas Distribution Systems*, 30 June 2015, p. 259.

66. Similarly, in estimating the equity beta, the Authority undertook statistical analysis of market data for a sample of benchmark comparators, from which it established a range. The Authority then used its judgment to select a single point estimate.<sup>28</sup>
67. A range is not always required. For example, the gearing ratio has been based on a single point estimate derived from the average of observations from comparator firms.
68. The Authority notes that other Australian regulators adopt similar approaches for determining parameter estimates.
69. The Authority considers that establishing ranges for parameters may be appropriate in some circumstances, while elsewhere a single point estimate may be readily obtained. The Authority considers that it is reasonable to continue with this approach at the parameter level.

#### 3.4.4.2 *The return on equity and the return on debt*

70. The Authority's practice to date has been to establish single point estimates for each parameter, which are then utilised to estimate the return on equity and the return on debt.
71. The alternative could be to utilise ranges for parameters, which then inform a range for the return on equity and the return on debt.
72. The Authority considers that use of single point estimates for parameters is preferred. Point estimates allow stakeholders to readily compare outcomes with other reference points, for example from other sources. In the case of a particular estimation method or financial model, this use of point estimates for parameters would then necessarily lead to a single point estimate for the return on equity and the return on debt. The Authority considers that this gives greater clarity in terms of the means used to estimate the return on equity and the return on debt, which might otherwise be lost if the point estimate was determined at the higher level.
73. However, where multiple estimation methods, financial models, market data or other evidence are used, then this could lead to a range for the return on equity or the return on debt. In this case, the Authority considers that it would determine a point estimate at the level of the return on equity or the return on debt. Again, such point estimates would provide for ready comparison between sources, and for clarity of approach.
74. The Authority therefore establishes point estimates at the parameter level, whether determined from within a range, or derived directly. Such point estimates would then facilitate a single point estimate outcome from each estimation method or financial model.
75. Similarly, the Authority establishes point estimates at the level of the return on equity and the return on debt, whether these are derived from a single point estimate, or from a range informed by multiple estimation methods, financial models, market data or other evidence.

---

<sup>28</sup> Economic Regulation Authority, *Final Decision on Proposed Revisions to the Access Arrangement for the Mid-West and South-West Gas Distribution Systems*, 30 June 2015, p. 277.



76. Where single point estimates are derived from a range, the Authority recognises that it may be appropriate in some circumstances to adopt a formal weighting approach to inform the final estimate. In other cases, the Authority exercises its judgment, articulating any reasons that inform its decisions.

#### 3.4.4.3 The overall rate of return

77. The development of single point estimates for the return on equity and the return on debt leads to a single point estimate for the rate of return for each benchmark efficient entity. The single point estimate is facilitated by the single point estimate of the gearing level.

## 3.5 Final Decision

### 3.5.1 Components of the WACC

78. The Authority retains the real pre-tax approach to estimating the rail WACC.
79. The nominal pre-tax WACC can be expressed, following Officer, as:<sup>29</sup>

$$WACC = E(R_e) \times \frac{E}{V} \times \frac{1}{(1 - T_c(1 - \gamma))} + E(R_d) \times \frac{D}{V} \quad (3)$$

where:

$E(R_e)$  is the nominal post-tax expected rate of return on equity – the cost of equity (grossed up for the value of imputation credits);

$E(R_d)$  is the nominal pre-tax expected rate of return on debt – the cost of debt;

$\frac{E}{V}$  is the proportion of equity in the total financing (which comprises equity and debt);

$\frac{D}{V}$  is the proportion of debt in the total financing;

$T_c$  is the tax rate; and

$\gamma$  (gamma) is the value of franking credits created (as a proportion of their face value).

80. The Authority also retains the market transformation method for converting the nominal post-tax WACC to the real pre-tax WACC.

<sup>29</sup> Officer R.R., The cost of capital of a company under an imputation tax system, *Accounting and Finance*, 1994.

81. With the market transformation method, the real pre-tax WACC is obtained by removing expected inflation  $\pi_e$  from the nominal pre-tax WACC as follows:

$$WACC_{\text{realpre-tax}} = \frac{(1 + WACC_{\text{nominalpre-tax}})}{1 + \pi_e} - 1 \quad (4)$$

### 3.5.2 Term of the WACC

82. The Authority considers that a WACC with a term that is consistent with the long economic lives of the assets will best meet the requirements of the *Railways (Access) Act 1998* and the Code. Accordingly, the Authority utilises the longest term reliable data to inform the rail WACC. Generally, this is a 10 year term. However, where appropriate, longer term data is used to inform the estimates (for example, the use of long term averages of the real return on equity).

### 3.5.3 Point estimates or ranges for estimates?

83. The Authority establishes point estimates at the parameter level. These point estimates are determined from within a range, or derived directly. Such point estimates then inform a single point estimate for an estimation method or financial model.
84. Similarly, the Authority seeks to establish point estimates at the level of the return on equity and the return on debt. These point estimates are derived from a single estimation method, or from a range informed by multiple estimation methods, financial models, market data or other evidence.
85. Where single point estimates are derived from a range, the Authority recognises that it may be appropriate in some circumstances to adopt a formal weighting approach to inform the final estimate. In other cases, the Authority exercises its judgment, articulating any reasons that inform its decisions.
86. The use of a single point estimate for the return on equity and the return on debt leads to a single point estimate for the rate of return. The single point estimate of the rate of return is facilitated by a single point estimate of the gearing level.

## 4 The benchmark efficient entity and risk

87. The object of the *Railways (Access) Act 1998* is to:
- ...establish a rail access regime that encourages the efficient use of, and investment in, railway facilities by facilitating a contestable market for rail operations.<sup>30</sup>
88. Given the object, the Authority considers that it needs to estimate the efficient financing costs of efficient entities with a similar degree of risk in respect of the provision of the below rail services (see 2.2.1). This approach ensures the efficient use of, and investment in, railway facilities.
89. The Authority's regulatory approach assumes that efficient firms with efficient financing, with a similar degree of risk as the railway facilities, provide 'benchmarks' for its regulatory decisions. The composite of such benchmarks are used to derive an estimate of the financing costs of the 'benchmark efficient entity'.

### 4.1 Current approach

90. Previous rail WACC determinations accounted for the risk of the regulated entities by identifying businesses of comparable risk in order to establish gearing, credit rating and equity beta parameters.<sup>31</sup>

### 4.2 Revised Draft Decision

91. In its Revised Draft Decision, the Authority considered that the benchmark efficient entity is defined as:
- A 'pure-play' regulated rail facility operating within Australia without parental ownership, with a similar degree of risk as that which applies to the service provider in respect of the provision of the rail services.
92. The Authority set out that it would base its estimates of efficient financing costs on the observations from a sample of comparator firms, with efficient financing costs, that are judged to be 'similar' to the rail services benchmark efficient entity.
93. There are a range costs and benefits to be evaluated when considering whether to adopt a domestic or international form of any particular model of the rate of return or its components. On balance, the Authority considered that there would likely be significant regulatory costs in moving to a full international approach, with uncertain benefits in terms of potentially more accurate estimates. Therefore, the Authority was of the view that it should continue to base its estimates of the rail WACC on domestic financial markets.
94. However, in recognition of the small data sets for some parameters in the rail WACC – in particular for the gearing, credit rating and equity beta – the Authority would utilise international comparators for the gearing, credit rating and equity beta parameters.

<sup>30</sup> *Railways (Access) Act 1998*, Part 1, s. 2A.

<sup>31</sup> See for example, Economic Regulation Authority, *Final Determination 2008 Weighted Average Cost of Capital for the Freight (WestNet Rail) and Urban (Public Transport Authority) Railway Networks*, 23 June 2008, p. 17.

## 4.3 Submissions

95. In relation to the benchmark efficient entity and risk, issues raised by public submissions can be classified into two key areas: (i) domestic or international financial markets in the estimation of the rate of return; and (ii) a development of criteria for benchmarking purposes.
96. *First*, in relation to the adoption of domestic or international financial markets in the estimation of the rate of return, ARTC supported the view that the rate of return should reflect the rate of return that an investor would require, rather than the theoretical return that an investor would command in either a fully segmented or fully integrated market, neither of which ARTC considers is an appropriate representation of the current market reality. In addition, Brockman submitted that it is appropriate to consider a fully integrated (international) version of the CAPM. However, in its submission, Flinders considered that a domestic version of the CAPM would lack sufficient depth to the extent that it could distort the cost of equity.
97. *Second*, in relation to a development of criteria for benchmarking purposes, Brockman submitted that the nature of the product being freighted is not the most relevant consideration for the benchmarking process. Brockman suggests that instead it is the investment category – that is, rail infrastructure – that should be the focus. Given the challenge of securing a suitable benchmarking sample, Brockman suggests exploring benchmarks from non-rail infrastructure investments.
98. Each of these key issues is discussed in turn below.

## 4.4 Considerations of the Authority

### 4.4.1 Risk and the benchmark efficient entity

99. The need to consider risk is an implied requirement of the *Railways (Access) Code 1998*, which states that the:
- ...WACC is the target long term weighted average cost of capital appropriate to the railway infrastructure.<sup>32</sup>
100. The WACC ‘appropriate’ to the railway infrastructure will be conditioned by the level of risk associated with the particular railway infrastructure in question.
101. Modern portfolio theory (**MPT**) suggests that investors seek to minimise risk for a given level of expected return. In MPT, an asset’s return is modelled as a random variable with a finite mean and variance. The variance of an asset’s return measures the likely divergence from the expected return, and is taken as the measure of risk arising from holding the asset. MPT assumes, among other things, that investors are rational and that markets are efficient.
102. In consequence, the rate of return for an investment based on efficient financing costs may be compared with those for alternative competing investments, once adjusted for risk. Riskier investments have higher costs of funding, both for equity and debt.
103. A corollary is that a necessary, but not sufficient condition, for financing costs to be efficient is that they be consistent with efficient financing costs applying elsewhere in

<sup>32</sup> *Railways (Access) Code 1998*, Schedule 4, Division 1, Clause 2.

the economy, taking account of risk. The regulator, in seeking to achieve the requirements of the object, may look to financial markets and prevailing conditions for evidence as to 'benchmark' financing costs of entities with comparable risks. This has been the Authority's practice to date.

104. In practical terms, as there is no formal definition of the benchmark efficient entity in the *Railways (Access) Act 1998*, there is a need to quantify the key characteristics of such an entity. Generally, this involves establishing a conceptual definition for the benchmark efficient entity, and then gathering evidence from actual 'comparator' entities which resemble the conceptual entity, as a means to inform the benchmark parameters for the cost of equity and the cost of debt.

#### 4.4.2 Defining risk

105. Under MPT, the risk factors influencing the expected returns of a benchmark efficient entity can be separated into systematic risks and non-systematic risks. This is an important risk categorisation, which helps to inform those risks which need to be compensated in the rate of return and those which do not.
106. Systematic risk relates to factors exogenous to firms – often associated with prevailing economic conditions – which will have an impact on all firms, to a greater or lesser degree.<sup>33</sup> Regulators need to be concerned with systematic risk in setting the rate of return for regulated entities, as this risk exposure is non-diversifiable and will influence the risk adjusted returns required by investors seeking to invest in the regulated firm. Systematic risks are key to the determination of the cost of equity.
107. Non-systematic risk, or diversifiable risk, on the other hand, relates to risks that are specific to the firm itself, or to the firm as part of a broader industry segment, and which can be either wholly or partially offset by an investor through an appropriate diversified portfolio.<sup>34</sup> Diversifiable non-systematic risks will not be included in the return on equity required by investors.
108. However, non-systematic risks are included in a firm's cost of debt. Benchmarks for the debt risk premium will capture both the systematic and the non-systematic (idiosyncratic) risk elements required to be recompensed in the cost of debt. The Authority considers that firms in the same notch credit rating would have similar levels of aggregate risk, irrespective of the composition of the contributing risks. With regard to the debt risk premium, the Authority considers therefore that a railway facility is likely to have a similar overall level of systematic and non-systematic risk compared to other firms within the same credit rating band.
109. The key issue then in assessing risk is to identify whether a risk is systematic or non-systematic, and the degree to which it may be offset.<sup>35</sup>

<sup>33</sup> Under portfolio theory, the measure of systematic risk for a particular asset is its co-variance with the overall market portfolio. This reflects the portion of variance in the asset's returns that are explained by the variance of the overall market. For example, this covariance, as a proportion of the overall market variance, informs the beta of the firm in the CAPM.

<sup>34</sup> Some non-diversifiable risks may be managed by the firm itself, for example through purchase of insurance. Such expenditure could be explicitly recognised in operational expenditures, and hence in the cash flow of the regulated firm. Risks managed in this way would *not* need to be compensated through the rate of return.

<sup>35</sup> A consideration by the Authority of the various types of risk, including distinctions between systematic and non-systematic risk – faced by regulated entities – may be found at Economic Regulation Authority, *Explanatory Statement for the Rate of Return Guidelines: Meeting the Requirements of the National Gas Rules*, 16 December 2013, pp. 37 - 43.

### 4.4.3 Conceptual definition of the benchmark efficient entity

110. In the gas Rate of Return Guidelines, the Authority considered that the following definition of the benchmark efficient entity was appropriate to inform its estimation of the WACC:

An efficient 'pure-play' regulated gas network business operating within Australia without parental ownership, with a similar degree of risk as that which applies to the service provider in respect of the provision of reference services.<sup>36</sup>

111. The Authority considers that a definition of the benchmark efficient entity for the rail WACC could align with that for gas. Each subsequent element of the proposed definition is considered in what follows.
112. *First*, the inclusion of the term 'pure-play' works to exclude non-regulated activities (including by the regulated business itself) where it is practical to do so.<sup>37</sup> The Authority considers this is appropriate as non-regulated activities may have a different risk profile.
113. *Second*, the term 'regulated rail facility' is intended to account for the specific type of business activity being dealt with, and that the business activity is regulated.
114. *Third*, 'operating in Australia' is intended to account for country specific factors such as the currency, the level of economic growth and laws affecting business. The Authority considers that this is consistent with its intention to ensure that the rate of return is consistent with the costs of finance in domestic financial markets.<sup>38</sup>
115. *Fourth*, the element 'without parental ownership' is intended to recognise that some risks associated with the provision of the rail services cannot be eliminated, and thus must be compensated. In this event, 'without parental ownership' allows for explicit recognition of those risks, to ensure that these are not simply transferred to the parent, in a way that is not transparent and accountable. However, the Authority notes that this relates only to risks that are systematic, and therefore which are not diversifiable. Risks that are diversifiable may be offset by an investor holding an appropriate portfolio. That investor may be either the parent or an independent investor.
116. *Fifth*, the element 'a similar degree of risk' is intended to recognise that while the composition of contributing risks may differ between entities, the overall systematic risk may be the same. Other entities – for example involved in the provision of other types of infrastructure or even other types of goods or services in the economy more broadly – could have a similar degree of risk.<sup>39</sup>

<sup>36</sup> Energy Networks Association 2013, *Authority Consultation Paper – Rate of Return Guidelines*, [www.erawa.com.au](http://www.erawa.com.au), Attachment, p. 15.

<sup>37</sup> A 'pure play' involves investing in only one line of business, which in this case is deemed to be only the regulated rail asset itself.

<sup>38</sup> The Authority notes that it will need to trade off this consideration in the case of rail in order to ensure there is sufficient benchmark data. See section 4.4.4.3.

<sup>39</sup> For example, there may be particular types of risk – such as credit risk – where a range of firms in the economy might be judged to have the same level of risk as the service provider, even though the scope and scale of activity are entirely different.

Furthermore, comparisons based on similar entities outside of regulated infrastructure can be beneficial in breaking the circularity issues that can result from comparing one regulated entity with another. Circularity arises where observations of the market's valuation for the comparator are strongly influenced by a regulator's decision.



117. Accordingly, the Authority considers that the following definition for the benchmark efficient entity for its rail determinations would be consistent with the requirements of the *Railways (Access) Act 1998* and the Code:
- A 'pure-play' regulated rail facility operating within Australia without parental ownership, with a similar degree of risk as that which applies to the service provider in respect of the provision of the rail services.
118. In its submission to the Issues Paper, Brockman recognised the complexities of establishing the cost of equity for an unquoted business that is part of a wider group that may be engaged in a range of activities and may have a variety of divisions. Brockman considered that finance theory clearly suggests that the cost of capital should reflect the risk of the project or business in question, and not the risk of the firm that holds the rights to those projects. Brockman therefore submit that the Authority should seek to establish a cost of equity in its WACC determination that reflects the risks of a standalone efficient multi-user infrastructure owner.
119. In response, while the Authority agrees with Brockman that the benchmark WACC relates to the standalone project, the Authority considers that its definition of the benchmark efficient entity is clear that there needs to be a similar degree of risk. The potential number of users of an infrastructure facility will have an influence on the risk of a railway facility. Therefore, the Authority considers that the potential number of users should not be assumed, but rather determined on a basis that relates to the particular facility under consideration.

#### 4.4.4 Implementation issues

120. The efficient finance practices of the benchmark efficient entity should reflect the actual practices of comparator firms operating in the market with efficient financing costs.<sup>40</sup>
121. In its most recent decisions, for example, the Authority has based its estimates of efficient financing costs on benchmark results from the average of a sample of comparator firms, for:
- gearing;
  - the equity beta;
  - the credit rating – and the associated debt risk premium.
122. It is desirable that the benchmark not be hypothetical. This means that the benchmark must, as far as possible, reflect achievable financing practices, which reflect the practices of efficient firms exposed to a similar degree of risk as the regulated firm. Importantly, by reflecting achievable efficient financing practices, the benchmark will allow the service provider 'reasonable opportunity' to achieve the efficient parameters determined for the benchmark entity.

##### 4.4.4.1 Public or private ownership

123. The Authority does not consider that a distinction should be made between public or private ownership. It is important to recognise that the requirement for economic efficiency leads to the interpretation of efficient financing costs as defining the

<sup>40</sup> This approach draws on the regulatory literature relating to yardstick competition, whereby the prices of the regulated firm are based on the costs of an average of other similar firms.

opportunity cost of capital. Efficiency requires that this be the same for all firms in the economy, once adjusted for risk.

124. Competitive neutrality principles that apply to state owned utilities reflect this view. State Treasuries are required to adjust the cost of debt to ensure that debt neutrality or government guarantee fees are incorporated in the yield.
125. Such adjustments recognise that without the passing of risk to the government parent, the state owned regulated firm would face the same cost of debt as a private sector regulated firm. This highlights that introducing a distinction between public and private ownership would violate the term 'without parental ownership'.

#### 4.4.4.2 A single benchmark or multiple benchmarks

126. The Authority recognises that rail services are clearly differentiated on the basis of their operations and network infrastructure. The WACC benchmark needs to account for these differences, in recognition that the associated risks in each case differ. In particular, given the differences in the services provided by the three regulated rail networks, the Authority considers that a single benchmark rail entity is inappropriate to adequately capture the divergent risks faced by each network.
127. The Authority notes that the previous advice of Macquarie Bank and Charles River Associates International (**CRA**) distinguishes each of the rail networks on the basis of its infrastructure and operations.
128. In its 1999 report on the Maximum Rate of Return on Western Australian Rail Infrastructure, Macquarie Bank distinguished urban and freight infrastructure on the following basis:<sup>41</sup>
  - there is no foreseeable change in the operational risks of Western Australian urban passenger rail services because it is expected that they will continue to be borne by the State Government;
  - the location of the urban passenger service ameliorates ownership risk due to a low likelihood of asset stranding, obsolescence, regulatory changes, declining demand or volatility in demand forecasting;
  - freight services do not receive community service obligation payments; and
  - freight services are not directly regulated and are open to competition from road transport.
129. CRA differentiated TPI from the general infrastructure business related to the movement of freight in light of the following:
  - the 'class II/III type railroad' industry is a better approximation to TPI than large trans-national railroad networks; and
  - the expectation that there would be some increased risk for independent ore-carrying railways given their reliance on a small number of mining customers creates an expectation that the asset beta would be higher than that of general freight.

<sup>41</sup> Macquarie Bank, *Western Australia Rail Access Regime: Independent Assessment of Maximum Rate of Return on Rail Infrastructure*, 23 August 1999, p. 6.



130. In addition, there are distinct classification frameworks for railway systems on the basis of their operations and infrastructure. In the United States, the Surface Transportation Board classifies rail networks by their operating revenues and whether or not they perform switching services and/or terminal operations.<sup>42</sup>
131. As a consequence, the Authority considers it appropriate to develop multiple benchmarks that are specific to each of the rail networks' infrastructure and operations. Utilising the same benchmark for all three rail networks would not adequately capture their divergent risks, and therefore the efficient financing costs of each of the rail entities. Therefore, the Authority considers it appropriate to estimate gearing, equity beta and credit rating separately for each of the rail networks.

#### 4.4.4.3 *Domestic or international financial markets*

132. In seeking to observe the efficient financing costs of rail service providers operating in Australia, the question arises as to the degree to which international capital markets influence the cost of capital in Australia. Relevant considerations include the degree to which:
- foreign investors seek to invest equity in Australian firms, augmenting domestically-sourced investment;
  - Australian firms seek to raise capital for their Australian investments on overseas capital markets, to supplement capital raisings in Australia; and
  - there is arbitrage between Australia's financial markets and those overseas.
133. These different strands reflect the extent to which foreign investors participate within the Australian domestic capital market.
134. The Authority considers that, ideally, where a particular finance market boundary is adopted, then it is desirable that the same boundary be applied across the full rate of return calculation, so as to ensure internal consistency. So for example, the gas Rate of Return Guidelines concluded that efficient finance costs should be based on the Australian domestic capital market.
135. ARTC in its submission supported this view, stating that the rate of return should reflect the rate of return that an investor would require, rather than the theoretical return that an investor would command in either a fully segmented or fully integrated market, neither of which ARTC considers is an appropriate representation of the current market reality. Therefore, ARTC considers that the domestic CAPM should

<sup>42</sup> Class I carriers are those with operating revenues of 250 million dollars or more, Class II those with revenues in excess of 20 million (1991 US) dollars and Class III, those with revenues of up to (1991 US) 20 million dollars. Class II and III lines are known as short lines and regional railroads (Association of American Railroads, 'Class II and Class III' <http://freightrailworks.org/network/class-ii-and-class-iii/>, 2014, (accessed 23 May 2014)).

All switching and terminal companies are classified as Class III regardless of their operating revenues (US Government Printing Office, 'Electronic Code of Federal Regulations, Title 49: Transportation, Part 1201-Railroad Companies, Instruction 1-1(b)(1)' <http://www.ecfr.gov/cgi-bin/textidx?SID=27113a9126de08a7a3eae834b3efcd5e&node=49:9.1.1.1.3&rgn=div5>, 2014, (accessed 20 May 2014)). Switching operations involve activities such as the making and breaking up of trains, while terminal operations involve activities connecting freight from larger rail networks to other modes of transport or rail.

The Class II and III railroads often feed traffic to and receive traffic from Class 1 railroads. Genesee and Wyoming owns and operates a significant number of Class III railroads, whereas Kansas City Southern is an example of a Class 1 railroad.

- be used to determine the cost of equity, estimated through the use of readily observable market data that may be influenced by the presence of foreign investors.
136. On the other hand, Brockman submitted that it is appropriate to consider a fully integrated (international) version of the CAPM. Nevertheless, Brockman acknowledged that most regulators around the world which apply the CAPM assume segmented (local) capital markets.
137. Flinders considered that a domestic version of the CAPM would lack sufficient depth to the extent that it could distort the cost of equity. As rail infrastructure investments are global, as is evidenced by the foreign investor up-take in the Queensland Freight Rail float, Flinders supports a fully integrated (international) version of the CAPM.
138. Under the Authority's recent approaches to estimating the rate of return, observations of finance market outcomes have had a bearing on:
- for the cost of equity:
    - the risk free rate;
    - the expected market risk premium;
    - the equity beta;
  - for the cost of debt:
    - the nominal risk free rate;
    - the expected debt risk premium; and
  - the assumed utilisation of imputation credits (gamma).
139. For the gas Rate of Return Guidelines, the Authority concluded that while an expansion of the boundaries to allow international data could have benefits, there would likely be significant costs, as well as potential for error. On balance, the Authority was of the view that it should continue to constrain the estimation boundaries to domestic financial markets.<sup>43</sup> However, this did allow for the influence of international investors and lenders within the 'domestic' boundary:
- In summary, the Authority's position is that the boundary should account for the full domestic data set, including any direct influences on the cost of capital for Australian domiciled firms. This may include the influence of international investors in Australian markets for equity, or the influence of international lenders supplying debt finance directly to Australian firms.<sup>44</sup>
140. To the extent that the boundary is expanded to encompass international data, then ideally all these estimates would need to be based on the wider data set. However, the Authority agrees with the Australian Competition Tribunal when it stated:
- ...the Tribunal observes that if a regulator like the ERA had to consider a swathe of Australian and overseas markets in order to estimate the cost of debt and the DRP, the regulator's task would be of considerably greater dimensions and the scope for disagreement over allocations would likewise be considerably greater.

<sup>43</sup> Economic Regulation Authority, *Explanatory Statement for the Rate of Return Guidelines: Meeting the Requirements of the National Gas Rules*, 16 December 2013, p. 29.

<sup>44</sup> Economic Regulation Authority, *Explanatory Statement for the Rate of Return Guidelines: Meeting the Requirements of the National Gas Rules*, 16 December 2013, p. 30.

141. Nevertheless, it is clear that in rail there is a shortage of benchmark comparators for determining gearing, credit rating and equity beta. The practice of the Authority in its past rail determinations has been to utilise international comparators for some of the parameters in the rail WACC estimate.<sup>45</sup>
142. A number of stakeholders agreed with this approach:
- Brockman submitted that international benchmarks would assist in taking the ‘Pilbara effect’ – that is sole use infrastructure with limitations in access, creating a barrier to entry for new market entrants – out of the financing cost evaluation. Brockman considered that when selecting appropriate comparator samples, the Authority should strive towards benchmarking an efficient multi-user infrastructure owner, and use the broadest sample possible that is consistent with this objective.
  - Flinders submitted that debt and equity raising costs can vary significantly depending on the capital requirements and overall risk profile of a corporation. Flinders considered that, while it would seem ideal for correlation purposes that these be benchmarked against stand-alone railway infrastructure providers, these are rare in Australia. Therefore, there is a need for inclusion of overseas railways and in particular the USA freight railways.
143. Overall, the Authority considers that not strictly adhering to the internal consistency of the estimation method – by basing some estimates on a mix of domestic and international estimates – is reasonable in the circumstances in order to enhance the robustness of the parameter estimates.
144. In this context, the Authority considers that some parameters are likely to be more independent of jurisdiction than other parameters. For instance, gearing, credit rating and equity beta (notwithstanding differences in, for example, tax treatment) are likely to be more independent of jurisdiction than are the risk free rate and market risk premium, which will be closely related to country conditions.
145. The Authority therefore considers that it is reasonable to utilise international data for estimating the benchmark gearing, credit rating and equity beta of rail facilities in Australia. This is contrary to the Authority’s preference for estimates based solely on domestic financial data, but is considered warranted given the shortage of comparators.<sup>46</sup> The Authority does not consider that this should create a general precedent for other determinations, where adequate domestic data is available.

#### 4.4.4.4 *Developing criteria for benchmarks*

146. The Authority defines each of the benchmark efficient rail entities as follows:
- A ‘pure-play’ regulated rail facility operating within Australia without parental ownership, with a similar degree of risk as that which applies to the service provider in respect of the provision of the rail services.
147. In order to estimate the relevant risks faced by investors in each of the rail networks, benchmark samples of comparable efficient businesses are constructed. These benchmark samples will have similar risk, and will allow estimation of the required equity beta, credit rating and gearing of each of the benchmark efficient rail entities.

<sup>45</sup> Australian Competition Tribunal, *Application by DBNGP (WA) Transmission Pty Ltd (No 3)*, ACompT 14, 2012, p. 59.

<sup>46</sup> The Authority considers that the use of international bonds in the enhanced bond yield approach is consistent with its definition of ‘domestic’ financial data, as these bonds are issued by Australian firms.

148. Brockman submitted that the nature of the product being freighted is not the most relevant consideration for the benchmarking process. Brockman suggests that instead it is the investment category – that is, rail infrastructure – that should be the focus. Given the challenge of securing a suitable benchmarking sample, Brockman suggests exploring benchmarks from non-rail infrastructure investments. In addition, Brockman suggests that when selecting the benchmark sample, regard should be given to efficient multi-user infrastructure businesses. Brockman submits that the key consideration is that the comparators should be long-life asset businesses.<sup>47</sup>
149. The Authority disagrees with Brockman’s submission regarding sample selection. In particular, the Authority considers that the risks faced by each of the rail networks is sufficiently different to warrant defining multiple benchmark efficient entities. Therefore, broadly defining a single investment category such as ‘rail infrastructure’ will not be able to sufficiently capture the divergent risks faced by each of the railway operators.
150. However, the Authority recognises that choosing a relevant benchmark sample for the PTA, Brookfield Rail and TPI is difficult due to the lack of close comparators of rail infrastructure trading on the Australian Stock Exchange. Only one directly comparable company is available in Australia, Aurizon (ASX:AZJ), which was floated on the ASX in July 2010 as QR National. A single comparable firm leaves the Authority with an insufficient sample on which to estimate regulated cost of capital parameters.
151. For its 2008 rail determination for the PTA and Brookfield (then Westnet), the Authority based its decision on advice from the Allen Consulting Group (**ACG**). ACG reviewed the 2003 methodology and constructed benchmark samples of comparable businesses for passenger and freight.<sup>48</sup> The benchmark samples for the Authority’s 2009 TPI determination were developed by CRA.<sup>49</sup>
152. In light of the continuing lack of sufficient Australian listed comparators, the Authority will continue to augment the sample using international comparator companies.
153. As noted above, the Authority will continue to adopt multiple benchmarks in order to capture the differential risk present between PTA, Brookfield Rail and TPI. This requires the construction of multiple benchmark samples, so as to estimate the credit rating, gearing and equity beta of the benchmarks for each of the differing service providers. Furthermore, given the lack of close comparators to each of the rail networks, the Authority considers that significant regulatory judgement based on additional relevant information is necessary in order to properly reflect the risks faced by each benchmark firm.
154. In their advice to the Australian Energy Regulator on equity beta, McKenzie and Partington outline the qualitative theoretical determinants of systematic risk, which include:
- economic conditions;

---

<sup>47</sup> Brockman Mining Australia Pty Ltd, *Submission in response to Issues Paper- Railways (Access) Code 2000: Weighted Average Cost of Capital WACC Determination – Railway Networks*, February 2013.

<sup>48</sup> Economic Regulation Authority, *Weighted Average Cost of Capital for the Freight (WestNet Rail) and Urban (Public Transport Authority) Railway Networks*, 2008.

<sup>49</sup> Economic Regulation Authority, *The Pilbara Infrastructure (TPI) Final Determination on the 2009 Weighted Average Cost of Capital for TPI’s Railway Network*, 2009.

- political and social considerations;
- market structure; and
- a firm's competitive position.<sup>50</sup>

155. The Authority considers that these four broad categories may be used in order to inform the criteria for the construction of benchmark samples for the regulated rail entities. That is, any comparator company should be comparable to the regulated rail entities with respect to these four factors in order to belong to the corresponding benchmark sample. Again, the Authority notes that categorising a firm in terms of these four factors requires significant regulatory judgement.

#### 4.4.4.5 Public Transport Authority benchmark sample

156. The PTA is an urban passenger network owned by the Western Australian Government. The Authority notes that the PTA network's main service is to transport passengers across the Perth metropolitan area. As a consequence, any comparable company must provide a similar service to that of the PTA. The Authority has previously accepted advice that toll road companies are an appropriate comparator firm to the PTA.<sup>51</sup> In addition, the Authority's predecessor, the Office of the Rail Access Regulator, previously accepted the use of British passenger operations in its WACC determination.<sup>52</sup> The Authority considers that toll road companies are an acceptable proxy to a passenger rail network in that their business model of charging a fare for urban transportation is similar, and have large capital bases. Other comparable firms include commercial passenger transport companies operating services similar to rail such as buses or trams. Given the lack of new comparator firms to the PTA available in Australia since the previous determination in 2008, the Authority considers that the previous methodology for selecting the benchmark sample is necessary and appropriate for the purposes of this determination.

157. The Authority draws on the four determinants of risk outlined above (paragraph 154) to inform its choice of firms for the benchmark sample.

158. The Authority notes that a relevant comparator company must be located in a similarly developed country to Australia in order to adequately capture the risks faced by PTA. In addition, any relevant proxy must be located in a reasonably densely populated area to replicate the risks faced by the PTA network. The Authority considers developed OECD countries, such as the United States, United Kingdom, New Zealand or Canada are an acceptable proxy to the risks faced by an Australian passenger rail operator. These countries have similar economic, political and social conditions to that of Australia. In addition, the Authority considers that only companies that are mature with limited growth opportunities should be included in the benchmark sample. Companies with aggressive growth strategies will have a higher level of risk relative to the PTA and are therefore not appropriate comparators.

<sup>50</sup> McKenzie M. and Partington G., *Estimation of the Equity Beta (Conceptual and Econometric Issues) for a gas regulatory process in 2012*, 2012, p. 5.

<sup>51</sup> The Allen Consulting Group, *Railways (Access) Code 2000: Weighted Average Cost of Capital Report to the Economic Regulation Authority*, 2007.

<sup>52</sup> Network Economics Consulting Group, *Review and Determination of Weighted Average Cost of Capital for Rail Infrastructure Operated by WestNet Rail and Western Australian Government Railway Commission: Final Report for the Office of the Rail Access Regulator*, June 2003, p. 67.



159. The Authority considers that a firm must satisfy the following in order to belong to the PTA benchmark sample:
- provide a service similar to passenger rail, for example toll road or commercial passenger transportation companies;
  - be located in Australia or a similar OECD economy;
  - be mature, hence have limited growth opportunities;
  - be of similar size to the PTA.
160. The comparator companies selected using this method are set out in Table 1.
161. The initial screening of companies returned Toll Holdings Limited, which has the transportation of freight as its primary service. The Authority considers that Toll Holdings is not a relevant comparator company to the PTA network due to the higher systematic risk of freight transportation relative to commercial passenger transportation. As a consequence, Toll Holdings has been excluded from the benchmark sample of companies for the PTA rail network.
162. In addition, two British companies were excluded: Stagecoach Group and FirstGroup, based on their high historical growth rates.

**Table 1** Comparator companies for PTA

Company Name	Country	Bloomberg Ticker	Company Description <sup>53</sup>
Transurban Group	Australia	TCL AU Equity	Transurban Group is involved in the operation of the Melbourne City Link and the Hills Motorway M2 toll roads. The Group is also involved in developing and operating electronic toll systems.
Atlantia SPA	Italy	ATL IM Equity	Atlantia S.P.A is a holding company with responsibility for portfolio strategies in the transport and communications infrastructures and network sectors.
Vinci SA	France	DG FP Equity	Vinci SA builds roads, offers electrical, mechanical, and civil engineering and construction services, and operates toll roads. The Company builds and maintains roads and produces road construction materials, builds electricity and communications networks, installs fire protection and power and ventilation systems, and operates toll highways, bridges, parking garages, and a stadium.
Abertis Infraestructuras S.A	Spain	ABE SM Equity	Abertis Infraestructuras S.A. is an international group which manages mobility and telecommunications infrastructures through three business areas: toll roads, telecommunications infrastructures and airports. The group is present in Europe and the Americas.
Macquarie Atlas Roads Group	Australia	MQA AU Equity	Macquarie Atlas Roads Group manages toll roads. The Company operates toll highways in the United Kingdom, France, and the United States.

Source: Bloomberg Terminal, Economic Regulation Authority analysis.

<sup>53</sup> Bloomberg field: CIE\_DES.

163. The remaining companies in the sample are considered the most relevant comparator companies to the PTA rail network as they involve some form of passenger transportation across suburban areas. However, the Authority considers that the risks faced by these companies only approximate the risks faced by the PTA network.
164. The Authority considers that the risk present in the benchmark sample is expected to overestimate the risk present in the PTA rail network. In particular, the Authority considers the risk of a passenger rail network located in a metropolitan area to be lower than that of a toll road company. As a consequence, the Authority will employ its regulatory discretion to select the relevant benchmark equity beta, credit rating and gearing with the expectation that the above sample overstates the risks faced by the benchmark efficient entity representing the PTA network.

#### 4.4.4.6 Brookfield Rail benchmark sample

165. The Brookfield Rail network is a freight rail network located in the south-west of Western Australia. The Brookfield Rail network transports commodities such as iron ore, grain, coal, and alumina, as well as chemicals and interstate freight. The Authority (and the Office of the Rail Access Regulator before it) has utilised overseas rail networks in order to construct a benchmark sample for the Brookfield freight rail network, due to the lack of similar comparator companies in Australia at the time.<sup>54,55</sup>
166. The Authority notes that since the previous rail WACC determination, Aurizon (formally Queensland Rail) has been listed on the ASX. The Authority considers that Aurizon is a comparator company for the Brookfield Rail network as it is located in Australia and transports freight via rail. It is noted by the Authority that the Standard and Poor's credit rating agency considered Brookfield Rail in Western Australia to be a suitable comparator to the Aurizon network in their credit rating report of the latter.<sup>56,57</sup> However, the regulatory regime differs between Brookfield and Aurizon in that Brookfield is subject to a negotiate-arbitrate regulatory regime, while the Aurizon network is subject to a revenue cap system.<sup>58</sup> In addition, the use of only one comparator may not adequately capture the risks faced by the Brookfield Rail network. Therefore, the Authority considers it necessary to continue to utilise overseas comparators in constructing the benchmark sample despite having a close comparator in Australia.
167. The Authority draws on the four determinants of risk outlined above (paragraph 154) to inform its choice of firms for the benchmark sample.

<sup>54</sup> Economic Regulation Authority, *Weighted Average Cost of Capital for the Freight (WestNet Rail) and Urban (Public Transport Authority) Railway Networks*, 2008, p. 25.

<sup>55</sup> Network Economics Consulting Group, *Review and Determination of Weighted Average Cost of Capital for Rail Infrastructure Operated by WestNet Rail and Western Australian Government Railway Commission: Final Report for the Office of the Rail Access Regulator*, June 2003, p. 67.

<sup>56</sup> Incenta Economic Consulting, *Aurizon Network: Review of benchmark credit rating and cost of debt*, 9 December 2013, p. 20.

<sup>57</sup> In addition, S&P considered APT pipelines and DBNGP Trust a suitable peer to Aurizon.

<sup>58</sup> The Authority notes that the differences to a revenue cap regime may not be marked in circumstances where the over-payment rules apply under the Western Australian rail access regime (see *Railways Access Code 2000*, Section 47). That is, where the over-payment rules apply, a railway owner's revenue is effectively capped at a total cost determined by the Regulator.

168. The Authority considers that a firm must satisfy the following conditions in order to belong to the Brookfield Rail benchmark sample. The firm should be:
- primarily involved in the transportation of goods via rail, across comparable distances to Brookfield;
  - located in Australia or a similar developed economy;
  - involved in the transportation of similar products to those transported on the Brookfield Rail network (that is, bulk goods, but also general freight).
169. The Authority has identified the following comparable companies for the Brookfield Rail benchmark entity (Table 2).
170. In addition, the Authority has included comparator companies that were included in its previous WACC determinations for the Brookfield Rail network.<sup>59</sup> The Authority has previously accepted advice that Australian and New Zealand transport companies are relevant to inform the required equity beta, credit rating and gearing for the Brookfield Rail network.<sup>60</sup> The Authority considers non-rail operators to be less relevant proxy companies compared to rail network operators. Nevertheless, they provide some information of value, particularly given the small size of the sample, so are retained.
171. The Authority has also removed Auckland Airports and Infratil from the benchmark sample. In so doing, the Authority has accepted that these firms are predominantly focused on passenger transport services or energy, such that they do not provide good comparators for Brookfield.<sup>61</sup>
172. The Authority considers that Aurizon is the best comparator company to the Brookfield Rail network given that it operates in Australia and transports commodity based freight.
173. Furthermore, the Authority's *a-priori* expectation is that overseas rail operators will possess a higher level of risk, relative to an Australian railway operator, as American and Canadian railway operators, for example, are expected to face higher degrees of competition from alternative forms of transportation, such as roads.
174. The Authority will therefore employ significant regulatory discretion when determining appropriate benchmark parameters for the Brookfield Rail network, with a view that its risks are at the lower end of overseas railway operators, and at the higher end of Australian and New Zealand transport companies.

---

<sup>59</sup> Economic Regulation Authority, *Weighted Average Cost of Capital for the Freight (WestNet Rail) and Urban (Public Transport Authority) Railway Networks*, 2008, p. 25.

<sup>60</sup> The Allen Consulting Group, *Railways (Access) Code 2000: Weighted Average Cost of Capital 2008 WACC determinations*, October 2007.

<sup>61</sup> In so doing, the Authority has accepted Synergies' view that these comparators are not relevant for the Brookfield benchmark sample (Brookfield Rail, *Submission on the Revised Draft Decision relating to the 2014 review of method for estimating the weight average cost of capital for railway networks*, 20 February 2015, p. 9).



**Table 2** Comparator companies for Brookfield Rail

Company Name	Country	Ticker	Company Description <sup>62</sup>
Genesee & Wyoming Inc.	United States	GWR US Equity	Genesee & Wyoming Inc., through its subsidiaries, owns and operates short line and regional freight railroads and provides related rail services. The Company also provides railroad switching and related services to United States industries with extensive railroad facilities within their complexes. Genesee operates in the United States and Australia.
Union Pacific Corporation	United States	UNP US Equity	Union Pacific Corporation is a rail transportation company. The Company's railroad hauls a variety of goods, including agricultural, automotive, and chemical products. Union Pacific offers long-haul routes from all major West Coast and Gulf Coast ports to eastern gateways as well as connects with Canada's rail systems and serves the major gateways to Mexico.
Norfolk Southern Corporation	United States	NSC US Equity	Norfolk Southern Corporation provides rail transportation services. The Company transports raw materials, intermediate products, and finished goods primarily in the Southeast, East, and Midwest and, via interchange with rail carriers, to and from the rest of the United States. Norfolk Southern also transports overseas freight through several Atlantic and Gulf Coast ports
Kansas City Southern	United States	KSU US Equity	Kansas City Southern, through its subsidiary, is the holding company for transportation segment subsidiaries and affiliates. The Company operates a railroad system that provides shippers with rail freight services in commercial and industrial markets of the United States and Mexico.
CSX Corporation	United States	CSX US Equity	CSX Corporation is an international freight transportation company. The Company provides rail, intermodal, domestic container-shipping, barging, and contract logistics services around the world. CSX's rail transportation services are provided principally throughout the eastern United States.
Canadian Pacific Railway	Canada	CP CN Equity	Canadian Pacific Railway Limited is a Class 1 transcontinental railway, providing freight and intermodal services over a network in Canada and the United States. The Company's mainline network serves major Canadian ports and cities from Montreal to Vancouver, and key centers in the United States Midwest and Northeast.
Canadian National Railway	Canada	CNR CN Equity	Canadian National Railway Company operates a network of track in Canada and the United States. The Company transports forest products, grain and grain products, coal, sulfur, and fertilizers, intermodal, and automotive products. Canadian National operates a fleet of locomotives and railcars.
Toll Holdings Limited	Australia	TRH NZ Equity	Toll NZ Ltd. provides freight transport and distribution services. The Company offers transportation, long-haul bulk freight, warehousing, and freight forwarding services. Toll NZ also operates passenger and freight transport vehicles that provides relocation and priority delivery services. Toll NZ conducts its business in New Zealand and internationally.
Aurizon Holdings	Australia	AZJ AU Equity	Aurizon Holdings Ltd is a rail freight company. The Company provides coal, bulk and general freight haulage services, operating on the Central Queensland Coal Network (CQCN) and including specialised track maintenance and workshop support functions.
Asciano Limited	Australia	AIO AU Equity	Asciano Limited is a provider of essential transport services in the rail and ports and stevedoring industries in Australia and New Zealand. The Company operates container terminals, bulk export port facilities and container and bulk rail haulage services.
Port of Tauranga	New Zealand	POT NZ Equity	Port of Tauranga Limited activities include the provision of wharf facilities, back up land for the storage and transit of import and export cargo, berthage, cranes, tug and pilotage services for exporters, importers and shipping companies and the leasing of land and buildings. The Group also operates a container terminal and has bulk cargo marshalling operations.

Source: Bloomberg Terminal, Economic Regulation Authority analysis.

#### 4.4.4.7 The Pilbara Infrastructure sample:

175. The TPI railway transports iron ore from Fortescue Metal Groups (**FMG**) Christmas Creek, Cloud Break and Solomon precincts in the East Pilbara to TPI's port facilities at Anderson Point, Port Hedland.
176. The Authority draws on the four determinants of risk outlined above (paragraph 154) to inform its choice of firms for the benchmark sample.

<sup>62</sup> Bloomberg field: CIE\_DES.

177. The Authority considers that a firm must satisfy the following conditions in order to belong to the TPI benchmark sample. The firm should be:
- primarily involved in the transportation of goods via rail across comparable distances to TPI;
  - located in a similar developed economy to Australia;
  - involved in the transportation of similar products to those transported on the TPI network (that is, bulk goods).
178. The Authority previously considered the construction of a benchmark sample for TPI in its 2009 WACC determination.<sup>63</sup> There, the Authority noted that TPI's reliance on a single commodity, iron ore, transported across one large distance, differentiates it from the Brookfield Rail network. As a consequence, not all of the companies in the Brookfield sample are appropriate as comparators to TPI in the sense that they are not regional class II/III type operators.
179. However, the Authority has come to the view that Aurizon does provide a comparator for TPI. In this context, the Authority has accepted Brockman's contention that the differences in systematic risk faced by Brookfield, Aurizon and TPI are not as pronounced as previously evaluated by the Authority.
180. In particular, the Authority notes that both the Brookfield and TPI networks are significantly exposed to international commodity markets:
- around 85 per cent of Brookfield's freight task relates to the transport of either export commodities or inputs to export commodities, particularly grain and alumina, with the remainder general freight;
  - 100 per cent of TPI's current freight task relates to the transport of iron ore destined for overseas.
181. However, the Authority considers that TPI is more exposed to global economic conditions than Brookfield, given the potential sensitivity of iron ore to economic conditions. While Brookfield also relies on the global commodity cycle, it also is exposed to fluctuations in demand for grains transport on its network. Grains, which as staples have returns and earnings driven to a lesser degree by economic conditions, and more by fluctuating supply, particularly in the local Western Australian wheat belt.
182. The Authority also notes that TPI's railway is relatively new, with a customer base that is significantly less diversified than the Brookfield railway. The Authority also considers that TPI has lower prospects for *potential* customer diversification as compared to Brookfield, given its remote location and the narrower economic base in the Pilbara region.<sup>64</sup>

<sup>63</sup> Economic Regulation Authority, *The Pilbara Infrastructure (TPI) Final Determination on the 2009 Weighted Average Cost of Capital for TPI's Railway Network*, 2009.

<sup>64</sup> The Authority therefore does not agree with Brockman's contention that somehow TPI has a large potential diversification opportunity. The Authority also does not agree that it is considering only the current customer base in this assessment (Brockman Mining Australia, *Submission in response to the Review of the method for estimating the Weighted Average Cost of Capital for the Regulated Railway Networks: Revised Draft Decision*, 20 February 2015, p. 3).

183. Nonetheless, the Authority agrees with Brockman when it states that:<sup>65</sup>

The likelihood that the current sample has overstated TPI's beta is increased by the fact that no Australian rail operators are included in the comparator group used to estimate TPI's beta. This is despite the Authority's acknowledgment that overseas operators likely face more risk than Australian operators (because American and Canadian railway operators for example are expected to face higher degrees of competition from alternative forms of transportation, such as roads).

184. For that reason, the Authority has considered the characteristics of Aurizon, and how they compare to TPI.

185. In the process, the Authority noted that Incenta recently undertook a first principles assessment of Aurizon's beta. Incenta's conclusions on the factors affecting Aurizon's systematic risk include the:<sup>66</sup>

- *nature of regulation* – a significant component of Aurizon's network revenues are regulated by the Queensland Competition Authority, which tends to reduce systematic risk (the 'Peltzman buffering hypothesis') as compared to Class 1 US railroads, which are not subject to such regulation;
- *mix of demand/traffic* – more diversified traffic will assist in revenue buffering;
- *pricing flexibility* – greater pricing flexibility will tend to reduce systematic risk, other things being equal;
- *duration of contracts* – take or pay contracts lead to revenue stability;
  - US and Canadian Class 1 railroad contracts are typically 1 to 3 years, up to 5 years in the case of coal;

... experience shows that in a significant downturn (e.g. the global financial crisis of 2008-09) almost all components of the Class 1 railroads' traffic mix fell in unison. The exception was the Canadian Class 1 railroads' grain traffic, which is determined by weather patterns (rather than economic cycles), and is subject to explicit regulation. By contrast, we show that Aurizon Network's coal traffic has not been related to Australian (or Queensland) economic and stock market cycles.<sup>67</sup>

- *market power* – Aurizon has greater market power than US and Canadian railroads, which implies greater stability of demand, lower stranded asset risk, and lower beta risk as a result;
- *growth options* – will depend, on the riskiness of new investments: Incenta consider that Aurizon can expand with low risk given pre approval of funds by the regulator
- *operating leverage* – Incenta questions whether there is evidence that US Class 1 railways have a high degree of operating leverage, noting that operating leverage relates to earnings volatility, which will be dampened in a regulated setting with take or pay.

<sup>65</sup> Brockman Mining Australia, *Submission in response to the Review of the method for estimating the Weighted Average Cost of Capital for the Regulated Railway Networks: Revised Draft Decision*, 20 February 2015, p. 16.

<sup>66</sup> Incenta Economic Consulting, *Aurizon Network: Review of benchmark credit rating and cost of debt*, 9 December 2013, p. 5-7.

<sup>67</sup> Incenta Economic Consulting, *Aurizon Network: Review of benchmark credit rating and cost of debt*, 9 December 2013, p. 6.

186. Overall, Incenta's first principle analysis determines the following key features for Aurizon, which it considers should influence the determination of Aurizon's asset beta:
- a regulatory framework that aligns revenue with cost at periodic intervals and that minimises revenue risk (by limiting its exposure to cost risk and interest rate risk) during a regulatory period;
  - strong underlying economics for the network, based on the sound position of the Queensland coal industry, which lowers the risk of market-based stranded asset risk for investors;
  - a high percentage of traffic under take or pay contracts;
  - much of the networks capital has already been fully depreciated.
187. The Authority considers that TPI is comparable to Aurizon on some dimensions of the Incenta analysis. TPI has:
- or is likely to have, contractual arrangements which smooth the volatility of revenue;
  - strong underlying economics for the network, given the strong position of the Pilbara iron ore producers in the global cost curve (for example FMG, RIO and BHPB).
188. On the other hand the Authority notes that TPI has key differences to Aurizon:
- a light handed regulatory framework, which provides a somewhat lower assurance of revenue as compared to the periodic revenue cap resets for the Aurizon Network, as well as for less assured growth options;<sup>68</sup>
  - a new network asset which is in the early years of its life.
189. The Authority notes these differences and similarities. Overall, the Authority concludes that the similarities are sufficient as to allow Aurizon to provide an Australian comparator for TPI. That said, the Authority will also account for the potentially greater systematic risks for TPI – as compared to Aurizon – when considering rate of return outcomes from Aurizon. On this basis, the Authority has determined to include Aurizon as a potential comparator for TPI.
190. In addition, the Authority considers that overseas railway operators are able to provide information the impact of the systematic risks faced by the TPI rail network on its rate of return (Table 3).

---

<sup>68</sup> The light handed regulatory regime applying to rail in Western Australia potentially can provide for negotiated contractual outcomes which may diverge from the terms of access under a more prescriptive, periodic reset regime. However, the differences to a revenue cap regime may not be marked in circumstances where the over-payment rules apply under the Western Australian rail access regime (see *Railways Access Code 2000*, Section 47). That is, where the over-payment rules apply, a railway owner's revenue is effectively capped at a total cost determined by the Regulator.

**Table 3** Comparator companies for TPI Network

Company Name	Country	Ticker	Company Description <sup>69</sup>
Aurizon Holdings	Australia	AZJ AU Equity	Aurizon Holdings Ltd is a rail freight company. The Company provides coal, bulk and general freight haulage services, operating on the Central Queensland Coal Network (CQCN) and including specialised track maintenance and workshop support functions.
Genesee & Wyoming Inc.	United States	GWR US Equity	Genesee & Wyoming Inc., through its subsidiaries, owns and operates short line and regional freight railroads and provides related rail services. The Company also provides railroad switching and related services to United States industries with extensive railroad facilities within their complexes. Genesee operates in the United States and Australia.
Union Pacific Corporation	United States	UNP US Equity	Union Pacific Corporation is a rail transportation company. The Company's railroad hauls a variety of goods, including agricultural, automotive, and chemical products. Union Pacific offers long-haul routes from all major West Coast and Gulf Coast ports to eastern gateways as well as connects with Canada's rail systems and serves the major gateways to Mexico.
Norfolk Southern Corporation	United States	NSC US Equity	Norfolk Southern Corporation provides rail transportation services. The Company transports raw materials, intermediate products, and finished goods primarily in the Southeast, East, and Midwest and, via interchange with rail carriers, to and from the rest of the United States. Norfolk Southern also transports overseas freight through several Atlantic and Gulf Coast ports
Kansas City Southern	United States	KSU US Equity	Kansas City Southern, through its subsidiary, is the holding company for transportation segment subsidiaries and affiliates. The Company operates a railroad system that provides shippers with rail freight services in commercial and industrial markets of the United States and Mexico.
CSX Corporation	United States	CSX US Equity	CSX Corporation is an international freight transportation company. The Company provides rail, intermodal, domestic container-shipping, barging, and contract logistics services around the world. CSX's rail transportation services are provided principally throughout the eastern United States.
Canadian Pacific Railway	Canada	CP CN Equity	Canadian Pacific Railway Limited is a Class 1 transcontinental railway, providing freight and intermodal services over a network in Canada and the United States. The Company's mainline network serves major Canadian ports and cities from Montreal to Vancouver, and key centres in the United States Midwest and Northeast.
Canadian National Railway	Canada	CNR CN Equity	Canadian National Railway Company operates a network of track in Canada and the United States. The Company transports forest products, grain and grain products, coal, sulphur, and fertilizers, intermodal, and automotive products. Canadian National operates a fleet of locomotives and railcars.

Source: Bloomberg Terminal, Economic Regulation Authority analysis.

191. Furthermore, the Authority considers that due to TPI's exposure to only a limited number of potential users in the mining industry, TPI's risks are likely to be at the upper end of those faced by the companies contained in the benchmark sample. At the same time, the Authority considers that the US short-line rail operator Genesee & Wyoming Inc. is likely to be the best comparator for TPI.<sup>70</sup> This is primarily due to

<sup>69</sup> Bloomberg field: CIE\_DES.

<sup>70</sup> Ibid, p. 39.

Genesee & Wyoming Inc. operating class II/III short railway lines, including a number of similar lines in Australia.

## 4.5 Final Decision

192. The benchmark efficient entity is defined as:
- A 'pure-play' regulated rail facility operating within Australia without parental ownership, with a similar degree of risk as that which applies to the service provider in respect of the provision of the rail services.
193. The Authority will base its estimates of efficient financing costs on the observations from a sample of comparator firms, with efficient financing costs, that are judged to be 'similar' to the rail services provider.
194. There are a range of costs and benefits to be evaluated when considering whether to adopt a domestic or international form of any particular model of the rate of return or its components. On balance, the Authority considers that there would likely be significant net costs with moving to a full international approach. Therefore, the Authority is of the view that it should continue to base its estimates of the rail WACC on domestic financial markets.
195. However, in recognition of the small data sets for some parameters in the rail WACC – in particular for the gearing, credit rating and equity beta – the Authority will utilise international comparators for the gearing, credit rating and equity beta parameters to augment the benchmark samples.



## 5 Gearing

196. Gearing refers to the proportion of a regulated business' assets assumed to be financed by debt and equity. Gearing is defined as the ratio of the value of debt to total capital (that is, including debt and equity), and is used to weight the costs of debt and equity when the WACC is determined. The relative proportions of debt and equity that a firm has outstanding constitute its capital structure. Capital structures differ across industries, as well as among different companies within the same industry.
197. Different firms have inherently different risk profiles and as a consequence have varying debt capacities.<sup>71</sup> The optimal capital structure is determined by the business risk inherent to firms in an industry and the expected loss if default occurs.<sup>72</sup> Given that the expected loss of default for the regulated entity is likely to differ from that of the comparable sample, the optimal capital structure of the entity is likely to differ as well. As such, it may be appropriate to adjust any estimate of gearing levels to reflect differences in the level of risk between railway networks.
198. In addition to being used to weight the expected returns on debt and equity to determine the regulated rate of return, the level of gearing of a benchmark efficient business may also be used: (i) for the purpose of adjusting the equity betas that are observed from a sample of comparator businesses when their gearing levels differ from the gearing level of the benchmark efficient business; and (ii) as a factor in determining an appropriate credit rating for deriving the debt risk premium (**DRP**).

### 5.1 Current approach

199. In its 2008 decision, the Authority determined that the appropriate gearing level for the Public Transport Authority was 35 per cent.
200. The estimate of the required gearing for PTA was based on the report prepared for the Authority by the Allen Consulting Group (**ACG**).<sup>73</sup> ACG considered market-based observations of capital structures for a set of comparable businesses containing a sample of mature toll road operators in Australia and overseas. The ACG sample, recommendation and determination are shown below in Table 4.

<sup>71</sup> Australian Competition & Consumer Commission, *Access Undertaking – Interstate Rail Network*, July 2008.

<sup>72</sup> Brealey, Myers and Allen, *Corporate Finance*, McGraw Hill, 1996, New York, p. 476.

<sup>73</sup> The Allen Consulting Group, *Railways (Access) Code 2000: Weighted Average Cost of Capital 2008 WACC determinations*, October 2007.

**Table 4 Public Transport Authority gearing: Allen’s Consulting Group’s sample recommendation and decision 2008.**

Company	Country	Gearing (%)
Vinci SA	France	29
Albertis Infraestructuras SA	Spain	35
Atlantia SPA	Italy	48
Brisa Auto-Estradas-Priv SHR	Portugal	36
<b>European Average</b>		<b>37</b>
Macquarie Infrastructure Group	Australia	22
Transurban Group	Australia	39
<b>Australian Average</b>		<b>31</b>
<b>Average</b>		<b>35</b>
<b>ACG Advice</b>		<b>30-50</b>
<b>Authority's Final Decision 2008</b>		<b>35</b>

Source: Bloomberg and ACG Analysis

201. For the Brookfield Rail network (then under the ownership of WestNet), the Authority’s determination also was based on the advice provided by the Allen Consulting Group.<sup>74</sup>
202. Due to the lack of suitable domestic comparators, a sample of international companies from the US, Canada and New Zealand was used by ACG to conduct the analysis. The Allen Consulting Group constructed a set of comparable businesses for the Brookfield Rail network containing the following:
- listed railways in the USA and Canada;
  - listed transport infrastructure and services firms in Australia and New Zealand; and
  - listed global toll-road operators.
203. ACG’s analysis is reproduced below in Table 5. A gearing level of 30 to 40 per cent was recommended. The Authority subsequently determined that a gearing level of 35 per cent was appropriate for the Brookfield Rail network.

<sup>74</sup> The Allen Consulting Group, October 2007, *Railways (Access) Code 2000: Weighted Average Cost of Capital 2008 WACC determinations*.



**Table 5 WestNet Gearing: Allen's Consulting Group Sample Recommendation and Decision 2008**

Company	Country	Gearing (%)
Kansas City Southern	United States	41
Union Pacific Corporation	United States	28
Rail America Inc.	United States	57
CSX Corporation	United States	44
Burlington Northern Santa Fe	United States	30
<b>United States Average</b>		<b>40</b>
Canadian Pacific Railway Ltd	Canada	22
Canadian National Railway Company	Canada	39
<b>Canadian Average</b>		<b>31</b>
Adsteam Marine Limited	Australia	39
Macquarie Infrastructure Group	Australia	36
Patrick Corporation	Australia	7
Toll Holdings Limited	Australia	18
<b>Australian Average</b>		<b>25</b>
Auckland International Airport Ltd	New Zealand	21
Infratil Ltd	New Zealand	39
Port of Tauranga Ltd	New Zealand	24
Toll NZ Ltd	New Zealand	42
<b>New Zealand Average</b>		<b>31</b>
<b>Average</b>		<b>32</b>
<b>ACG Advice</b>		<b>30-40</b>
<b>Authority's Final Decision 2008</b>		<b>35</b>

Source: Bloomberg and ACG Analysis

204. For TPI, the Authority adopted a gearing of 30 per cent in its 2013 rail WACC determination.<sup>75</sup> This was based on the observation that, unlike the PTA and Brookfield Rail networks, TPI lacks diversification and exclusively services a limited number of users in the mining industry. In addition, the Authority considered that a lower gearing for TPI relative to Brookfield was appropriate, consistent with a lower credit rating assumption for TPI relative to Brookfield. The Authority further noted that the US short-line rail operator Genesee & Wyoming Inc. was likely to be the best comparator for TPI.

<sup>75</sup> Economic Regulation Authority, July 2013, *Final Determination; Weighted Average Cost of Capital for the Freight (WestNet Rail) and Urban (Public Transport Authority) Railway Networks*.

205. The Authority also notes that the Australian Competition and Consumer Commission (**ACCC**) in its most recent Railway Access Undertaking – which applies to ARTC’s interstate rail networks – adopted a gearing ratio of 50 per cent.<sup>76</sup> The ACCC considered adopting a gearing of 60 per cent, given the regulatory precedent for other regulated industries in Australia, for example gas transmission and distribution. The ACCC noted that railway owners are likely to experience more volatile operating cash flows than other regulated firms, and as a consequence, railway owners would be expected to have a lower level of debt. The ACCC also considered the leverage of overseas railways and noted the average of gearing was 26.31 per cent. The ACCC noted that, while overseas rail operators are not ideal benchmarks, they are most likely the best proxies available.
206. The ACCC also stated that it considers trucking and shipping companies to be less than ideal proxies for the capital structure of regulated rail entities. Ultimately, the ACCC decided a 50 per cent gearing level was appropriate.
207. The Queensland Competition Authority adopted a gearing of 55 per cent in its 2010 Draft Access Undertaking for the Queensland Rail Network (now Aurizon Network).<sup>77</sup> This adopted gearing was unchanged from its 2006 undertaking. Incenta, in its 2013 review of Aurizon’s proposed 55 per cent gearing for its forthcoming access undertaking, considered that the proposed level was appropriate given Aurizon’s risks.<sup>78</sup>

## 5.2 Revised Draft Decision

### 5.2.1 PTA

208. In its Revised Draft Decision, the Authority considered that the risks faced by the PTA are substantially lower than those faced by the companies contained in the benchmark sample. This view was based on the consideration that the PTA network primarily transports passengers across the Perth metropolitan area, whilst companies in the benchmark sample are privately held toll companies. The Authority has previously noted that toll road companies are only an approximation to the PTA network, and that toll roads face a larger amount of risk relative to passenger transport. As a consequence, the Authority considered the financial distress costs faced by the PTA are likely to be substantially lower than those faced by the companies in the benchmark sample. Therefore, the Authority considered that a benchmark efficient entity representing the PTA network will be able to sustain higher levels of gearing, in order to take advantage of the interest tax shield.
209. Overall, the Authority considered a gearing of 50 per cent, at the higher end of the observed gearing range, is appropriate for the PTA rail network.

### 5.2.2 Brookfield Rail

210. The Authority considered that a more representative gearing range is formed by using the average of overseas railway operators as a lower bound (approximately 20 per cent) and the Australian average as an upper bound (25 per cent).

<sup>76</sup> Australian Competition & Consumer Commission; *Access Undertaking – Interstate Rail Network*, July 2008.

<sup>77</sup> Queensland Competition Authority, *Final Decision, Queensland Rail Network’s 2010 DAU*, September 2010.

<sup>78</sup> Incenta, *Review of Regulatory Capital Structure and Asset / Equity Beta for Aurizon Network*, 9 December 2013, p. 4.

211. Given that the Brookfield Rail network is likely to face less competition relative to overseas rail operators, the Authority considered the financial distress costs faced by Brookfield Rail to be lower than those faced by international comparators in the benchmark sample. As a consequence, it was expected that the benchmark efficient rail entity representing the Brookfield Rail network will be able to take on higher levels of gearing relative to overseas rail operators.
212. The Authority therefore considered a gearing of 25 per cent, consistent with the Australian Average, to be the appropriate benchmark gearing level for the Brookfield Rail network.

### 5.2.3 TPI

213. In its Revised Draft Decision, the Authority considered that Genesee & Wyoming Inc. is likely to be the best comparator to TPI and that a benchmark gearing of 20 per cent is appropriate for the purposes of that Revised Draft Decision

## 5.3 Submissions

### 5.3.1 The Pilbara Infrastructure

214. HoustonKemp on behalf of TPI submitted that it was of the view that the gearing for the TPI network is robust, specifically with respect to TPI's reliance on a single commodity (iron ore) transported large distances. It noted that the determination distinguishes TPI's risks from either PTA or Brookfield Rail and results in TPI's risks being classified at the upper end of those faced by comparators in the benchmark sample.<sup>79</sup>

### 5.3.2 Brockman Mining Australia

215. Brockman submits that new infrastructure typically commences life with higher gearing levels and that since the WACC is being determined in the context of gross replacement value (**GRV**) the WACC should be calculated on the assumption that the asset base is 'new' infrastructure.
216. Brockman submits that there are inconsistencies between the Authority's credit rating and gearing level determination for TPI as well as inconsistencies between the GRV concept and the gearing level. In particular, Brockman highlights that FMG has attained a credit rating of BBB-, the same as that determined for TPI, yet has substantially higher gearing than the benchmark gearing determined for TPI. It also considered the TPI railway as more creditworthy than the average component of FMG and therefore should be able to support a higher gearing level than FMG as a whole. By this reasoning it considered the Authority's gearing level and credit rating determination as inconsistent. Brockman requests that the Authority consider the link between the credit rating and gearing level and the link between the credit rating and GRV concept and address the matter in the Final Determination.<sup>80</sup>

<sup>79</sup> HoustonKemp Economists, 2015, *Weighted Average Cost of Capital (WACC) for the TPI network*, a report prepared for The Pilbara Infrastructure Pty Ltd, 20 February 2015, p. 4.

<sup>79</sup> This relates to the quality of the pricing data retrieved from Bloomberg.

<sup>80</sup> Brockman Mining Australia Pty Ltd, *Submission in response to Issues Paper- Railways (Access) Code 2000: Weighted Average Cost of Capital WACC Determination – Railway Networks*, February 2013, pp. 6-12.

### 5.3.3 Cooperative Bulk Handling

217. Frontier Economics on behalf of CBH submitted that Queensland Competition Authority's most recent decision for Aurizon was 55 per cent. It also highlighted that the Australian Competition and Consumer Commission (**ACCC**), in its December 2010 position paper on Australian Rail Track Corporation Hunter Valley Rail Networks expressed a view that 52.5 per cent gearing is appropriate.

## 5.4 Considerations of the Authority

218. The Authority considers that, due to the lack of close comparators to regulated rail networks, significant regulatory discretion is needed in order to estimate the relevant benchmark efficient gearing for each rail network. In particular, this regulatory discretion should be informed by theoretical considerations regarding the capital structure of firms relative to the risks they are expected to face.

### 5.4.1 Theoretical Considerations

219. The Authority considers that the modified Modigliani Miller (**MM**) proposition, which includes financial distress costs (further discussed below), is the most appropriate theoretical underpinning to inform the gearing of the benchmark efficient entity. Additional detailed discussion on other theoretical arguments regarding benchmark gearing can be found in the gas Rate of Return Guidelines for gas distribution and transmission networks.<sup>81</sup>
220. The modified MM proposition (to include financial distress costs) suggests that a trade-off occurs in the value of a firm's capital structure: higher gearing can increase the value generated by the interest tax shield (which arises due to reduction in taxes paid as a consequence of the tax deductibility of interest payments); however, if the gearing level becomes too high, the firm will have difficulty meeting its interest payments and, as a consequence, will face significant financial distress costs.
221. The theory relating to this trade-off asserts that the value of a geared firm is equal to its value without leverage, plus the present value of the interest tax shield minus the present value of financial distress costs which can be expressed as follows:<sup>82</sup>

$$V^L = V^U + PV(\text{InterestTaxShield}) - PV(\text{FinancialDistressCosts}) \quad (5)$$

where:

$V^L$  is the total levered value of the firm;

$V^U$  is the total unlevered value of the firm; and

$PV$  is the 'present value'.

222. In particular, the present value of the interest tax shield is strictly increasing in the level of gearing, whilst the financial distress costs are nonlinear; increasing at a

<sup>81</sup> Economic Regulation Authority, *Explanatory Statement for the Rate of Return Guidelines*, 2013, p. 44.

<sup>82</sup> Berk J., DeMarzo P., and Harford J., *Fundamentals of Corporate Finance*, Pearson International, 2008, p. 499.

growing rate as the level of gearing rises. This ensures that a firm cannot maximise their value by arbitrarily increasing their gearing, being constrained by the increasing present value of its financial distress costs. As a consequence, an optimal value of gearing exists that allows a firm to maximise  $V^L$ , the total levered value of the firm by choosing an appropriate level of gearing that maximises equation (5).

223. Gearing and credit rating are therefore related. In this context, the Authority notes Brockman's comments with regard to credit rating of FMG and its gearing, and its view that this raises an inconsistency with regard to the determination of the gearing and credit rating for TPI. In response, the Authority considers:
- first, that the gearing and credit rating of the benchmark firm may not align with that of the parent, given the definition of the benchmark firm;
  - second, that the recent evidence is that FMG has had difficulties issuing investment grade debt, despite ongoing efforts to reduce its gearing.<sup>83</sup> There are many factors contributing to the respective credit ratings of the benchmark firm and FMG.
224. Overall, the Authority considers that the BBB- credit rating and related gearing are consistent with the risks of the benchmark entity. The Authority therefore does not accept that there is an inconsistency.<sup>84</sup>
225. The Authority considers that each of the benchmark efficient rail entities will maximise the trade-off that occurs between the interest tax shield and the present value of financial distress costs. Using regulatory discretion as to the risks faced by the regulated rail networks and its corresponding benchmark sample, a benchmark efficient gearing level can be inferred by observing the gearing of companies in the benchmark sample.

#### 5.4.2 Regulatory Practice

226. The Authority considers it appropriate to determine different benchmark gearing levels for each of the rail networks, given their differing risk profiles. The Authority notes that, unlike for gas and electricity network determinations, there are few or no firms with readily available financial data or information in Australia that are comparable to each of the regulated networks.
227. With the exception of Aurizon, a comparator for Brookfield Rail and TPI, no new domestic rail comparators are available for this determination. Therefore, the Authority considers that the use of overseas data continues to be necessary to inform the required benchmark gearing level of the three regulated rail networks.
228. Various estimation methods are available for determining benchmark gearing. These estimation methods were previously examined by the Australian Energy Regulator in its 2009 WACC review of regulated gas and electricity networks.<sup>85</sup> The Authority has also examined the alternative methods in its recent gas Rate of Return Guidelines

<sup>83</sup> See for example Australian Financial Review, 'Fortescue gets its debt – at a price', 23 April 2015.

<sup>84</sup> The Authority also does not accept Brockman's assertion that new infrastructure commences life with higher gearing levels. Brockman presents no evidence to support this claim.

<sup>85</sup> Australian Energy Regulator, *Final Decision: Electricity transmission and distribution network service providers*, Review of the weighted average cost of capital (WACC) parameters, May 2009.

for gas transmission and distribution networks.<sup>86</sup> Each of these methods is discussed in turn below.

229. First, in its report to the AER in 2009 on the estimated value of equity beta, Associate Professor Henry from the University of Melbourne adopted the book value of net debt,<sup>87</sup> instead of using gross debt.
230. On this basis, gearing is determined as:

$$\overline{\text{Gearing}} = \frac{\overline{\text{Net Debt}}}{\overline{\text{Net Debt} + \text{MV Equity}}} \quad (6)$$

where

MV represents the market values; and

BV represents book values.

231. Second, Standard and Poor's (**S&P**) has reported gearing levels using the book value of debt and the book value of equity. The book value of equity has been reported by Bloomberg as the balance sheet value. S&P's gearing is determined as below.

$$\overline{\text{Gearing}} = \frac{\overline{\text{BV Total Debt}}}{\overline{\text{BV Total Debt} + \text{BV Equity}}} \quad (7)$$

232. Third, the market values of debt and equity could be used in determining benchmark gearing. However, as debt is traded infrequently, it is difficult to obtain the market value. As such, the book value of debt is used as a proxy for its market values. This method is also known as the hybrid approach adopted by Bloomberg. The benchmark gearing level for a benchmark efficient entity is defined as follows.

$$\overline{\text{Gearing}} = \frac{\overline{\text{BV Total Debt}}}{\overline{\text{BV Total Debt} + \text{MV Equity}}} \quad (8)$$

233. In determining benchmark gearing for the regulated rail networks, the Authority considers that it is appropriate to rely on empirical evidence regarding the appropriate benchmark gearing level. For consistency between the Authority's estimates of equity beta and gearing, the Authority considers that the first gearing definition (equation (6)), proposed by Henry, is appropriate for this draft determination.
234. The Authority considers that the use of equation (6) is the most appropriate for rail given the use of overseas comparator companies, and considers a market measure of a firm's capital structure to be more appropriate to inform the capital structure of an Australian company. The Authority considers that the most relevant estimate of

<sup>86</sup> Economic Regulation Authority, *Explanatory Statement for the Rate of Return Guidelines*, 2013, p. 44.

<sup>87</sup> Net Debt is calculated as: Short-term borrowings plus long-term borrowings less Cash & Near Cash items less Marketable Securities less Collaterals. It is noted that in the banking, financial services, and insurance formats, marketable securities are not subtracted to arrive at Net Debt.



the benchmark gearing level for each rail network is to utilise the benchmark samples derived in chapter 4.

235. Brockman submitted that the appropriate time period to estimate the gearing level should be consistent with the period over which other WACC parameters are estimated. For example, Brockman suggests that beta is normally estimated over a 2 to 5 year horizon, and the gearing level should be consistent with this.<sup>88</sup> Flinders submitted that the appropriate time periods should be at the review time frame (five years).<sup>89</sup> The Authority agrees that the time period of samples for related parameters should be consistent, which would be in line with previous regulatory practice and Professor Henry's advice.<sup>90</sup>
236. The Authority has utilised the comparator companies described in chapter 4 to estimate the gearing level for each company in the corresponding sample. The Authority has used observations for each firm encompassing a five year period from 1 July 2010 to 30 June 2015, observing both the Net Debt and Market Value of Equity for the comparator firms. The observed gearing is then determined by application of equation (6). The Authority has also previously noted the need for regulatory discretion, given each of the benchmark samples only approximates the risks faced by each of the rail networks.

### 5.4.3 Empirical evidence regarding gearing

#### 5.4.4 PTA

237. The gearing for European comparators has increased slightly from around 51 per cent on average in 2014 to 56 per cent in 2015 (Table 6).
238. At the same time, the average of the two Australian comparators has decreased from 47 per cent in the 2014 revised Draft Determination to 39 per cent in 2015.

<sup>88</sup> Brockman Mining Australia Pty Ltd, *Submission in response to Issues Paper- Railways (Access) Code 2000: Weighted Average Cost of Capital WACC Determination – Railway Networks*, February 2013.

<sup>89</sup> Flinders Mines, *Submission to the Economic Regulation Authority In response to Issues Paper under Railways (Access) Code 2000: Weighted Average Cost of Capital*, February 2013.

<sup>90</sup> The term of the WACC is the long term, consistent with the need to estimate a long term rail WACC (see section 3.4.30). However, data availability and relevance may imply shorter spans of time for the estimates of the benchmarks.



**Table 6 Public Transport Authority: Benchmark Sample of Toll Road Firm Gearing 2015**

Company	Country	Gearing 2014	Gearing 2015	Change From 2014
Vinci SA	France	0.40	0.63	0.23
Albertis Infraestructuras SA	Spain	0.58	0.55	-0.03
Atlantia SPA	Italy	0.55	0.51	-0.04
<b>European Average</b>		<b>0.51</b>	<b>0.56</b>	<b>0.05</b>
Macquarie Atlas Roads	Australia	0.60	0.46	-0.14
Transurban Group	Australia	0.34	0.32	-0.02
<b>Australian Average</b>		<b>0.47</b>	<b>0.39</b>	<b>-0.08</b>
<b>Average</b>		<b>0.50</b>	<b>0.49</b>	<b>0.00</b>

Source: ERA Analysis, Bloomberg

239. The evidence above establishes a gearing range for the PTA benchmark comparator companies of 34 per cent to 63 per cent.
240. The lower end of the range is provided by Transurban, a mature toll road operator with assets largely in Australia.
241. The Authority considers that the European average provides a robust estimate of the upper bound of the gearing for PTA. This is consistent with the position adopted in the Revised Draft Decision. The Authority considers therefore that a range of 35 per cent to 56 per cent is an appropriate range for the PTA rail network gearing.

#### 5.4.5 Brookfield

242. The sample of benchmark firms for Brookfield in Table 7 overall exhibit a slight decrease in gearing from the 2014 Revised Draft Decision by around 2 percentage points. The Australian sample alone, however, reports a 1 percentage point increase. On balance there appears to be little in this analysis to dissuade the Authority from applying the benchmark gearing level of 25 per cent as determined in the Revised Draft Decision.

**Table 7 Brookfield: Benchmark Sample Gearing 2015**

Company	Country	Gearing 2014	Gearing 2015	Change From 2014
Genesee & Wyoming Inc.	Rail Freight	22	23	1
Union Pacific Corporation	Rail Freight	14	11	-3
Norfolk Southern Corp.	Rail Freight	24	22	-2
Kansas City Southern	Rail Freight	20	15	-4
CSX Corporation	Freight	26	24	-2
<b>United States Average</b>		<b>21</b>	<b>19</b>	<b>-2</b>
Canadian Pacific Railway	Rail Freight	24	18	-6
Canadian National Railway	Rail Freight	16	14	-2
<b>Canadian Average</b>		<b>20</b>	<b>16</b>	<b>-4</b>
Toll Holdings Limited	Freight	20	23	3
Aurizon	Freight	17	18	1
Asciano	Rail Freight	38	36	-3
<b>Australian Average</b>		<b>25</b>	<b>26</b>	<b>1</b>
<b>Port of Tauranga</b>	Ports and Cargo	13	11	-2
<b>New Zealand Average</b>		<b>13</b>	<b>11</b>	<b>-2</b>
<b>Average</b>		<b>22</b>	<b>20</b>	<b>-2</b>

Source: ERA Analysis, Bloomberg

243. The Authority notes that benchmark gearing levels of 55 and 52.5 per cent for Aurizon are mentioned in Frontier Economics submission, based on an Incenta report to the Queensland Competition Authority and a view expressed by the ACCC five years ago.<sup>91</sup> These gearing levels are far in excess of those estimated for the rail freight network sample shown in Table 7, including Australian firms. The Authority considers that as the Incenta estimates are based on a broad range of infrastructure firms, including from water, electricity and gas, they are not comparable to the benchmark sample utilised by the Authority in Table 7.
244. The Authority also notes that Incenta's own analysis on the rail road industry indicates that median gearing was in the order of 22 per cent to 23 per cent; however, Incenta appears to justify the 55 per cent gearing stating that:
- ...Aurizon Network is in a strong position to take on more debt than the average firm...<sup>92</sup>
245. In this context, an important issue relates to the indirect nature of the Authority's estimates in Table 7. The Authority notes that all of its estimates are based on stock exchange data, which covers the whole firm in each case, generally a mix of below and above rail operations. These estimates are higher than those assembled by Incenta. At the same time, the comparable gearing is much lower. The Authority has

<sup>91</sup> Incenta Economic Consulting, 2013, *Review of Regulatory Capital Structure and Asset/Equity Beta for Aurizon Network*, a report prepared for the Queensland Competition Authority, December 2013, p. 14.

<sup>92</sup> Ibid.

observed gearing of 18 per cent for Aurizon. This is much lower than the 55 per cent adopted by Incenta, but is internally consistent with the benchmark sample and the emphasis placed on the various firms within the sample for this Final Decision.

246. The Authority considers it extremely important to maintain internal consistency with the rest of the benchmark sample. For that reason, the Authority will utilise its own observations of gearing derived from the sample data, and its own econometric estimates of the asset betas related to that same data (see Table 36 below for the estimated asset betas of the Brookfield Rail sample). Accordingly, Incenta's estimates will not inform the determination of the gearing for Brookfield Rail.

#### 5.4.6 The Pilbara Infrastructure

247. As noted in section 4.4.4.7, the Authority now considers that Aurizon should be included in the TPI benchmark sample of comparable companies. Similar to the Brookfield sample, the foreign comparators show a slight decrease in gearing when updated to 2015 while the single Australian comparator (Aurizon) indicates a slight increase in leverage. Again, there is little in this analysis to dissuade the Authority from applying the benchmark gearing level of 20 per cent as determined in the Revised Draft Decision.

**Table 8 The Pilbara Infrastructure: Benchmark Sample Gearing 2015**

Company	Country	Gearing 2014	Gearing 2015	Change From 2014
Genesee & Wyoming Inc.	United States	22	23	1
Union Pacific Corporation	United States	14	11	-3
Norfolk Southern Corporation	United States	24	22	-2
Kansas City Southern	United States	20	15	-4
CSX Corporation	United States	26	24	-2
<b>United States Average</b>		<b>21</b>	<b>19</b>	<b>-2</b>
Canadian Pacific Railway	Canada	24	18	-3
Canadian National Railway	Canada	16	14	-3
<b>Canadian Average</b>		<b>20</b>	<b>16</b>	<b>-3</b>
Aurizon	Australia	17	18	-2
<b>Australian Average</b>		<b>17</b>	<b>18</b>	<b>-2</b>
<b>Average</b>		<b>20</b>	<b>18</b>	<b>-2</b>

Source: ERA Analysis, Bloomberg

248. With respect to the link between the GRV concept, credit rating and gearing Brockman provided no evidence to indicate that newly established railway providers have access to debt that is priced such that leverage should differ from the industry standard that optimises the risk adjusted returns to shareholders. The Authority maintains its view that the comparable benchmark sample should be used to determine the benchmark credit rating – not the firm's or parent firm's actual gearing. Also, a benchmark efficient target capital structure (as opposed to actual capital structure) should be used to maintain incentives for the firm to converge toward best industry practice. The firm or parent firm's actual capital structure at the outset of a project may not necessarily represent best industry practice.

## 5.5 Final Decision

### 5.5.1 PTA

249. The Authority considers that the risks faced by the PTA are substantially lower than its freight counterparts, being less cyclical on account of being a passenger service. In the Revised Draft Decision, the Authority noted that toll road companies are only an approximation for a passenger rail network, and was of the view that toll roads are likely to have a more elevated risk profile than rail transport. In light of this, toll roads are unlikely able to sustain the same levels of gearing as passenger rail. The Authority therefore considers that a benchmark efficient entity representing the PTA network will be able to sustain higher levels of gearing.
250. Overall, the Authority considers a gearing of 50 per cent, at the higher end of the observed gearing range, is appropriate for the PTA rail network. This is consistent with the position adopted in the Revised Draft Decision. This gearing will remain fixed until the next rail WACC method review – future annual updates of the rail WACC will therefore adopt this gearing for the PTA.

### 5.5.2 Brookfield Rail

251. The gearing in the sample of benchmark firms for Brookfield overall exhibits little change from the Revised Draft Decision in 2014. No other compelling evidence was presented to dissuade the Authority from applying the benchmark gearing as determined in the Revised Draft Decision.
252. The Authority will therefore apply a gearing level of 25 per cent for the purposes of the Brookfield Final Decision. This gearing will remain fixed until the next rail WACC method review – future annual updates of the rail WACC will therefore adopt this gearing for Brookfield Rail.

### 5.5.3 TPI

253. The gearing in the sample of benchmark firms for TPI also exhibits little change from the Revised Draft Decision in 2014. The Authority remains of the view that the TPI benchmark gearing sample is most appropriate for determining the efficient benchmark level of gearing.
254. The Authority will therefore apply a gearing level of 20 per cent for the purposes of the TPI Final Decision. This gearing will remain fixed until the next rail WACC method review – future annual updates of the rail WACC will therefore adopt this gearing for TPI.

## 6 Return on debt

255. The Authority seeks to estimate the return on debt in a way that contributes to the achievement of the object of the *Railways (Access) Act 1998*.

### 6.1 Current approach

256. In its 2008 review of the method for determining the WACC, the Authority based its estimates of the cost of debt on a debt risk premium over and above the risk-free rate, combined with a margin for administrative costs:

$$\text{Cost of Debt} = \text{Risk Free Rate} + \text{Debt Risk Premium} + \text{Debt raising costs}$$

257. In subsequent annual determinations, the risk free rate was based on the return on the prevailing 10 year Commonwealth Government Security, based on a 20 trading day average just prior to the determination.

258. The Debt Risk Premium (**DRP**) has, since 2011, been estimated using the Authority's bond yield approach, using observations over the same 20 trading day average as for the risk free rate. The resulting sample of bonds has an average term to maturity which varies depending on the time of the sample, but which has in recent years averaged between five and six years.

259. Debt raising costs of 0.125 per cent were adopted, following the advice of the Authority's consultant for the 2008 review, the Allen Consulting Group.

### 6.2 Revised Draft Decision

260. The Authority based its estimates of the cost of debt on a risk premium over and above the risk-free rate, combined with a margin for administrative costs:

$$\text{Cost of Debt} = \text{Risk Free Rate} + \text{Debt Risk Premium} + \text{Debt raising costs}$$

261. The estimate of the return on debt is based on prevailing rates 'on-the-day' just prior to each determination of the annual rail WACC update.

262. The Authority adopted a 40 business days averaging period for estimating the 'on the day' risk free rate and the debt risk premium for the rail WACC.

### 6.3 Submissions

263. The Authority did not receive any submissions in relation to the overall framework to estimate the return on debt. As such, the following section 6.4 is unchanged from the Revised Draft Decision.

### 6.4 Considerations of the Authority

264. Issues in estimating the cost of debt include:

- the broad approach to be adopted for estimating the cost of debt;
- the associated components contributing to the estimate; and

- the averaging period.

#### 6.4.1 Approach to estimating the cost of debt

265. There are three broad alternative approaches to estimating the cost of debt as part of the development of the gas Rate of Return Guidelines.<sup>93</sup> These are:
- observing the cost of debt of companies with comparable risk to the benchmark efficient entity in totality, reflecting either embedded debt costs or the yield on recent bond issuances;
  - using analysts' forecasts of the cost of debt relating to the regulated firm; and
  - estimating the cost of debt for the benchmark efficient entity through a model of the contributing components to their overall cost of debt.
266. The Authority considers that an estimate based on a model of the cost of debt remains the best means to estimate efficient financing costs.
267. In addition, the Authority has considered the relative merits of using an 'on-the-day' estimate of the return on debt, as opposed to a 'portfolio' approach:
- An 'on-the-day' approach estimates each of the components in the cost of debt around a single point in time, such as the period just prior to the WACC determination.
  - A 'portfolio' approach, on the other hand, takes a longer term average of the cost of debt by weighting a sequence of observations of the cost of debt from years prior to the determination.
268. Flinders submitted that the use of a 10 year (historic portfolio) average for the cost of debt, the cost of equity and inflation, would bring the averaging assumptions in line with each other and would be more consistent with actual funding practices. The Authority's concern with this approach, however, is that it does not reflect the efficient cost of debt at the time of the decision and may not reflect the cost of debt for a new replacement railway, as is implicit in the method under the Code.
269. For the rail WACC methodology, the Authority considers that the 'on-the-day' approach is preferable as:
- it has better prediction properties for the cost of debt over the long run as compared to the portfolio approach; and
  - prediction matters because the efficient firm will apply the WACC to its operating and investment decisions, as the WACC will be its opportunity cost of debt.<sup>94</sup>
270. Efficiency requires that the financing cost be the prevailing forward looking cost of debt. The corollary is that total and incremental costs be based on the same prevailing forward looking cost of debt. Otherwise, negotiated rates for access may result in returns to the service provider that are either too low or too high, potentially

<sup>93</sup> These approaches were considered as part of the development of the gas Rate of Return Guidelines (Economic Regulation Authority, *Explanatory Statement for the Rate of Return Guidelines: Meeting the Requirements of the National Gas Rules*, 16 December 2013, Chapter 6: Return on debt).

<sup>94</sup> Further detail on the Authority's consideration of this issue may be found at Economic Regulation Authority, *Explanatory Statement for the Rate of Return Guidelines: Meeting the Requirements of the National Gas Rules*, 16 December 2013, p. 61.

leading to inefficient decisions by parties on either side of the rail services negotiation, and associated economic inefficiency:

- service providers may either over or under-invest in rail service infrastructure; and
- users may either consume too few or too many rail services.

271. Further, the Authority considers that such efficient use of, and investment in, railway facilities cannot be considered in terms of a single rail service provider or a single group of consumers. Such a partial approach may be efficient in isolation, but still leave net efficiency gains once the full general equilibrium considerations are considered. Rail service providers and consumers of rail services are engaged with the broader economy. Hence, efficiency considerations necessarily need to take into account that engagement. This requires efficient pricing of rail services, consistent with outcomes that would be observed in effectively competitive markets.<sup>95</sup>

272. From this perspective, economic efficiency can be characterised as follows:

- Productive efficiency is achieved when firms in the economy produce any given level of output at lowest input cost. Such output may include investment in capital goods, as well as production of goods and services from the existing capital stock. The following outcomes will contribute to the achievement of productive efficiency:
  - The regulated firm funds its investments utilising the lowest input cost of debt, which reflects the prevailing interest rates that are consistent with efficient financing costs.
  - As a corollary, the regulated firm delivers its investments in a way that results in the highest net present value, using a hurdle rate that incorporates the prevailing cost of funds at the time the investment decision was made.
  - The prevailing cost of capital will also influence the decisions made by the regulated firm with regard to its use of factors of production. While investments in major capital assets owned by the firm are sunk in the short run, it may be possible to substitute capital for labour – at the margin – over the medium term. Appropriate pricing for the cost of capital will contribute to efficient decision making in this regard.
- Allocative efficiency is achieved when the economy produces only those goods and services that are most valued by society. This occurs at the point where the marginal cost of producing a good or service equals the willingness to pay for that good or service, which will be reflected in marginal revenue.<sup>96</sup>
  - The choice between investment and consumption in the economy needs to be based on the relative value of that investment to society as a whole. This requires that alternative investments throughout the economy, including by the regulated firm, are based on the prevailing

<sup>95</sup> The Authority notes that effectively competitive prices imply a notion of rivalry among incumbents, sufficient to constrain market power pricing (see for example Australian Competition Law 2013, *Competition*, [www.australiancompetitionlaw.org/glossary/competition](http://www.australiancompetitionlaw.org/glossary/competition)). The Authority does not consider that this necessarily implies new entrant pricing.

<sup>96</sup> Users of the regulated firm's services - both upstream and downstream – make production decisions that are based on efficient prices for the regulated service. At any particular point in time, the capital used for producing the regulated firm's output is 'sunk', and therefore does not contribute to (variable) marginal costs. Use of a regulated firm's service therefore should not depend on the cost of debt.



cost of funds. The cost of capital used by regulated firms – when deciding to invest in additional infrastructure – needs to be updated as market conditions change.

- Dynamic efficiency is achieved when firms make those investments that maximise the returns to the firm and society as a whole over time.
  - The firm's investment decision should be based on the cost of capital expected to prevail over the life of the investment. Again, the cost of capital used by regulated firms – when deciding to invest in additional infrastructure – needs to be updated as market conditions change.

273. The Authority considers that all three efficiency elements are important, and are therefore relevant considerations in achieving the object of the *Railways (Access) Act 1998*.

#### 6.4.2 Components of the return on debt estimate

274. The Authority remains of the view that an estimate based on a model of the cost of debt is likely to best achieve the allowed rate of return objective. The Authority therefore will retain this approach for estimating the cost of debt.

275. Under this approach, the Authority will base the cost of debt on:

- the risk free rate; plus
- a risk premium over and above the risk free rate; plus
- an allowance for the administrative costs of issuing debt.

276. To reflect prevailing conditions, the Authority will use an estimate of the risk free rate derived just prior to the regulatory period, the so-called 'on-the-day' approach. In line with the analysis set out at section 3.4.3, the term of the risk free rate will be 10 years. The approach for estimating the risk free rate is considered further in Chapter 7.

277. The debt risk premium will be derived from the estimated 10 year credit spread for an observed sample of comparator firms with similar credit ratings as the benchmark efficient entity, through the Authority's enhanced bond yield approach. The approach for determining the benchmark credit rating is considered in chapter 8 and the method for estimating the debt risk premium is considered further in chapter 9.

278. Debt raising costs will continue to be based on an allowance for the direct costs of the average annual issuance. The approach for estimating debt raising costs is considered further in chapter 13.

#### 6.4.3 The averaging period

279. The Authority has recently moved to a 40 day averaging period for estimating the components of the return on debt.<sup>97</sup>

280. The Authority considers that when setting the averaging period there is a trade-off between efficiency and short term volatility considerations. The Authority conducted analysis during the development of the gas Rate of Return Guidelines, concluding that an averaging period of 40 days would provide a good estimate of the prevailing

<sup>97</sup> Economic Regulation Authority, *Explanatory Statement for the Rate of Return Guidelines: Meeting the Requirements of the National Gas Rules*, 16 December 2013, p. 85.

rate of return on debt, while reducing the daily volume of transactions required to adjust larger debt portfolios, all other things equal.

281. The Authority will therefore move to adopt a 40 business days averaging period for estimating the risk free rate and debt risk premium for the rail WACC.

## 6.5 Final Decision

282. The Authority will base its estimates of the cost of debt on a risk premium over and above the risk free rate, combined with a margin for administrative debt raising costs:

$$\text{Cost of Debt} = \text{Risk Free Rate} + \text{Debt Risk Premium} + \text{Debt raising costs}$$

283. The estimate of the cost of debt is based on prevailing rates 'on-the-day' just prior to each determination of the annual rail WACC update.
284. The Authority adopts a 40 business days averaging period for estimating the 'on the day' risk free rate and the debt risk premium for the rail WACC annual update.
285. At each rail WACC update, the following parameters will be re-estimated for the purpose of developing the updated estimate of the return on equity for input to the Sharpe Lintner CAPM:
- the risk free rate; and
  - the debt risk premium.
286. The following parameters will not be re-estimated prior to the next rail WACC method update and therefore the values set out for the 2015 rail WACC update will contribute to each subsequent annual rail WACC update:
- debt raising costs.

## 7 Risk free rate of return

287. The risk-free rate of return is a key input to the Authority's approach to estimating the return on equity and the return on debt.
288. The risk-free rate is the rate of return an investor receives from holding an asset with a guaranteed payment stream, that is, where there is no risk of default. Since there is no likelihood of default, the return on risk-free assets compensates investors for the time value of money.

### 7.1 Current approach

289. In its previous determinations, the Authority determined a real risk free rate by:
- determining a nominal risk free rate as the average of implied returns on long term nominal Commonwealth Government Securities (**CGS**) with a 10 year term over a 20 day trading period;
  - determining a forecast value of inflation; and
  - calculating the real risk free rate by use of the Fisher equation.

### 7.2 Revised Draft Decision

290. The Authority based its estimation of the nominal risk free rate on the observed yield of 10 year Commonwealth Government Securities (**CGS**) bonds. The Authority also noted that it would adopt a 40 business days averaging period, just prior to the final determination of the rail WACC, for the purpose of estimating the CGS risk free rate.
291. For its Revised Draft Decision, the Authority's indicative estimate of the 10 year risk free rate, as at 5 November 2014, was 3.33 per cent.

## 7.3 Submissions

### 7.3.1 TPI

292. HoustonKemp, on behalf of TPI, considered the value determined for the risk free rate to be generally appropriate.<sup>98</sup>

### 7.3.2 Brookfield Rail

293. Synergies Economic Consulting, on behalf of Brookfield, submitted that they concur with the use of the ten year Commonwealth Government bond yield as a proxy for the risk free rate over a forty day averaging period.<sup>99</sup>

<sup>98</sup> HoustonKemp Economists, 2015, *Weighted Average Cost of Capital (WACC) for the TPI network*, a report prepared for The Pilbara Infrastructure Pty Ltd, 20 February 2015, p. 4.

<sup>99</sup> Synergies Economic Consulting, 2015, *Review of the Method for Estimating the WACC for the Freight and Urban Railway Networks*, a report prepared for Brookfield Rail, February 2015, p. 6.

### 7.3.3 Brockman Mining Australia

294. Brockman submits that the term currently assumed for establishing floor and ceiling prices is unlikely to be relevant to the negotiated term of the access agreements between TPI and access seekers. It highlights that the periodic renegotiation of a rail access agreement is analogous to the reset of the terms of an Access Arrangement for gas citing the ATCO Gas Draft Decision as an example. By this reasoning Brockman states that the WACC term that would be relevant to any commercial negotiations between TPI and access seeker would be the term of the access agreement. Brockman notes that the term of the majority of the debt currently secured by TPI's parent (FMG) is 5 years.
295. In summary, Brockman suggests that there is tension between the Code requirement to produce a long term estimate and the practical reality that the access agreements are likely to have parameters fixed for long terms which can be reconciled by considering a ten year term to represent the long term estimate. Brockman requested that the Authority reconsider the use of a ten year term for the WACC.<sup>100</sup>

## 7.4 Considerations of the Authority

### 7.4.1 Term of the estimates

296. The Authority notes that both HoustonKemp, on behalf of TPI; and Synergies Economic Consulting, on behalf of Brookfield, agreed with the Authority in relation to the use of the ten year Commonwealth Government bond yield as a proxy for the risk free rate, estimated over a forty day averaging period.
297. The Authority notes that Brockman Mining Australia disagreed with the Authority's use of the 10-year risk free rate. Brockman argued that the WACC term that would be relevant to any commercial negotiations between TPI and access seeker would be the term of the access agreement. Brockman notes that the term of the majority of the debt currently secured by TPI's parent (FMG) is 5 years.
298. The Authority disagrees with Brockman's view in relation to the term of the risk free rate. As presented in its Revised Draft Decision, the Authority maintains its decision that the implications of the requirement in the Code to estimate a "long term" rail WACC necessitates the adoption of a 10 year term for the risk free rate. The Authority is of the view that, given the requirement to estimate the annuity over the economic lives of the assets, which are generally more than 25 years, the 10-year term for the risk free rate is appropriate. The Authority considers that the estimate of 10-year risk free rate provides an estimate with the longest term that is consistently robust.

### 7.4.2 Estimate of the risk free rate

299. The estimate of the 10-year risk free rate, for the 40 days ending 30 June 2015, is 2.97 per cent.

<sup>100</sup> Brockman Mining Australia Pty Ltd, *Submission in response to Issues Paper- Railways (Access) Code 2000: Weighted Average Cost of Capital WACC Determination – Railway Networks*, February 2013, p. 5.

## 7.5 Final Decision

300. The Authority adopts a 40 day averaging period for estimating the risk free rate. The estimate of the nominal risk free rate is based on the observed yield of 10 year CGS bonds.
301. For the purpose of this Final Decision, the estimate of the 10-year risk free rate, as at 30 June 2015, is 2.97 per cent.

## 8 Benchmark credit rating

302. The benchmark credit rating is a key input for estimating the debt risk premium (**DRP**). The credit rating is defined as the forward-looking opinion provided by a ratings agency of an entity's credit risk. Credit ratings provide a broad classification of a firm's probability of defaulting on its debt obligations. As a consequence, credit ratings represent the risk present in holding a debt instrument.
303. As a general rule, the **DRP** is higher when the credit rating is lower, and vice versa. This is because lenders require increased compensation before they commit funds to the debt issuer with a lower credit rating. A lower credit rating can be associated with the higher risk of default which leads to the higher **DRP**.
304. The Authority considers that a credit rating based on the benchmark sample of each of the regulated rail networks is appropriate for the purpose of determining each of the benchmark efficient entity's credit rating for the purposes of this determination. In particular, this credit rating must be consistent with the level of gearing and perceived level of risk present in each of the benchmark efficient rail entities.

### 8.1 Current approach

305. In its 2008 WACC determination for the freight and urban railway networks, the Authority concluded that a BBB+ credit rating for the freight network and an A credit rating for the urban network best reflected the risks of the relevant benchmark efficient entities.<sup>101</sup> This conclusion was based on the advice from the Allen Consulting Group, which observed available credit ratings for comparable overseas and domestic comparators.<sup>102</sup>
306. The Authority, in its 2009 WACC determination, decided that a credit rating of BBB- was appropriate for the TPI rail network. The Authority rejected arguments which proposed that the benchmark credit rating of the regulated entity, in this case TPI, should reflect the credit rating of its main customer, Fortescue Metals Group (**FMG**).<sup>103</sup> The Authority has consistently rejected the argument that the systematic risk of an infrastructure owner necessarily reflects that of its customer base.<sup>104</sup>
307. However, the Authority considers that as the TPI rail network demand is less diversified than Brookfield – in terms of product base and number of customers – and has relatively limited potential for diversifying its customer base, the credit rating should be below that of BBB determined for Brookfield. On the other hand, the Authority also notes that iron ore transport contracts are likely to be based on long term commitments, which reduce the credit risk faced by TPI. In light of this, TPI's

<sup>101</sup> Economic Regulation Authority, *2008 Weighted Average Cost of Capital for the Freight (WestNet Rail) and Urban (Public Transport Authority) Rail Networks: Final Decision*, June 2008.

<sup>102</sup> The Allen Consulting Group, *Railways (Access) Code 2000: Weighted Average Cost of Capital*, October 2007.

<sup>103</sup> Economic Regulation Authority, *The Pilbara Infrastructure (TPI): Final Determination on the 2009 Weighted Average Cost of Capital for TPI's Railway Network*, June 2009, p. 24.

<sup>104</sup> The systematic risk of an infrastructure owner does not directly equate to the systematic risk of its customers, given it is also dependent on a number of other factors, including the nature of the contractual arrangements between the infrastructure owner and customers (see for example, Economic Regulation Authority, *Final Decision on GGT's Proposed Revisions to the Access Arrangement for the Goldfields Gas Pipeline*, 13 May 2010, p. 49).

railway is not viewed by the Authority as falling into the speculative grade credit rating band (below BBB-). The Authority determines that a BBB- rating, the lowest rating in the investment grade spectrum, is appropriate.

308. The Authority notes that the Australian Competition and Consumer Commission in a recent decision determined a BBB credit rating for the ARTC in the Hunter Valley, the Queensland Competition Authority determined a BBB+ credit rating for the QR Network (now Aurizon) and the Independent Pricing and Regulatory Tribunal determined a BBB credit rating for the Hunter Valley network.<sup>105,106,107</sup>

## 8.2 Revised Draft Decision

### 8.2.1 PTA

309. The Authority noted that the risks faced by the PTA are likely to be substantially lower than that of the companies contained in the PTA benchmark sample. Based on the evidence which can be observed regarding the credit rating of these companies (albeit limited), a credit rating interval of BBB to A- was inferred. However, the Authority noted that this interval was based on evidence derived exclusively from European toll road operators, which are considered to be a poor proxy for the credit risk faced by the PTA Rail Network.
310. Furthermore, the Authority noted that the observed gearing of these toll road operators is on average close to 50 per cent,<sup>108</sup> equal to the benchmark assumed gearing of the PTA network. As a consequence, the Authority considered that the financial risk can be considered to be *approximately* equal, whilst the business risk for the PTA rail network can be considered lower.
311. The Authority considered that based on this assessment, the benchmark efficient rail entity would be able to sustain a credit rating of A.

### 8.2.2 Brookfield Rail

312. The Authority considered that Aurizon (with a credit rating of BBB+) is likely to be the best comparator for Brookfield Rail, given that it operates in Australia and transports similar freight.
313. The Authority also considered that the risk faced by Brookfield Rail is less than that faced by overseas freight railway operators. The Authority's *a-priori* expectation is that overseas rail operators will possess a higher level of risk, relative to an Australian railway operator. American and Canadian railway operators, for example, are expected to face higher degrees of competition from alternative forms of transportation, such as roads. In particular, the Authority considered that the risks faced by Genesee & Wyoming Inc. exceed that of Brookfield Rail, and therefore that the credit rating of BB- cannot be used to inform the appropriate credit rating range for Brookfield Rail.

<sup>105</sup> Australian Competition & Consumer Commission, *Position Paper in relation to the Australian Rail Track Corporation's proposed Hunter Valley Rail Network Access Undertaking*, 2010.

<sup>106</sup> Queensland Competition Authority, *Final Decision, Queensland Rail Network's 2010 DAU*, 2010.

<sup>107</sup> Independent Pricing and Regulatory Tribunal, *New South Wales Rail Access Undertaking – Review of the rate of return and remaining mine life from 1 July 2009*, 2009.

<sup>108</sup> Refer to section 5.4.4.



314. The Authority considered that the most appropriate interval of credit ratings for Brookfield Rail is BBB- to BBB+, which is based on the range formed by the remaining Brookfield Rail comparator companies.
315. The Authority considered it appropriate to choose a credit rating at the upper end of the BBB- to BBB+ credit rating interval. The Authority noted that a credit rating of BBB+ would be consistent with the credit rating of Aurizon.
316. The Authority also noted that the Brookfield Rail network is rated as BBB by Standard and Poor's (S&P).<sup>109</sup> The Authority further noted that, whilst a BBB+ determination would diverge slightly from the credit rating assigned by S&P, this divergence would be consistent with Brookfield Rail having a lower level of gearing in terms of the benchmark assumed gearing ratio of 25 per cent. The Authority also noted that S&P has classified Brookfield Rail's financial risk profile as being in the "significant" band (see paragraph 337 for Standard & Poor's financial risk classifications).<sup>110</sup>
317. On balance, the Authority considered a credit rating of BBB+, in conjunction with an assumed benchmark gearing ratio of 25 per cent, as appropriate for the Brookfield Rail network. The Authority noted that this credit rating is unchanged from its 2008 determination.<sup>111</sup>

### 8.2.3 TPI

318. In its Revised Draft Decision, while the Authority considered Genesee & Wyoming Inc. to be the best comparator company for the TPI rail network, it also considered that the credit rating of BB- is inappropriate. Given that the benchmark efficient entity is assumed to minimise its cost of capital, the Authority considered that the benchmark efficient entity would organise its capital structure to ensure an investment grade credit rating. Allowing a credit rating below investment grade would expose the benchmark efficient entity to greater financing costs than would be efficient.
319. As a consequence, the Authority judged that Kansas City Southern's credit rating of BBB-, the lowest possible investment grade rating, as being the appropriate benchmark credit rating for the TPI rail network. The BBB- credit rating is also at the lower end of credit ratings for the TPI benchmark sample, consistent with the Authority's prior reasoning that the TPI rail network will face a higher level of risk relative to the comparators in its benchmark sample.

<sup>109</sup> Standard & Poor's, *Ratings Direct – Aurizon Network Pty Ltd*, 15 May 2013.

<sup>110</sup> Standard & Poor's, *Research Update: Rating on Brookfield WA Rail Affirmed At 'BBB/Stable', with an SACP of 'BBB' and Moderately Strategic Group Status*, 31 March 2014.

Economic Regulation Authority, *2008 Weighted Average Cost of Capital for the Freight (WestNet Rail) and Urban (Public Transport Authority) Rail Networks: Final Decision*, June 2008.

## 8.3 Submissions

320. No submissions were received on the Revised Draft Decision with regard to the credit ratings of the PTA or Brookfield Rail.

### 8.3.1 Brookfield Rail

321. Synergies Economic Consulting consider that it is not standard regulatory practice to estimate a different return on debt estimate within each credit rating band. Synergies note however that the Queensland Competition Authority is an exception, based on its own method. Synergies question whether such differentiation comes at the expense of robustness.<sup>112</sup>

### 8.3.2 TPI

322. With respect to the decision for the TPI benchmark credit rating, Brockman is of the view that the BBB- rating is implausible and inappropriate for a regulated business. It assessed TPI and below rail activities as being more credit worthy than the average BBB- rating of Fortescue Metals Group (**FMG**) as a whole. Brockman raised the prospect of future possible risk diversification available to the TPI railway through servicing other producers as a factor that improves its credit worthiness. Brockman suggests that the Authority erred by selectively focussing on the credit rating of a single firm within its sample of comparators based on untested assumptions about TPI's risk profile and effectively ignored a wider sample of evidence. Brockman concluded its assessment of the Authority's decision for the TPI benchmark credit rating by requesting that the Authority re-examine the sample and also include Aurizon which it believes is a better comparator to TPI than international comparators.
323. Brockman is also of the view that the BBB- rating creates perverse incentives for TPI to not maintain a strong credit rating. Brockman stated that:<sup>113</sup>
- If the Authority assumes too weak a credit rating (i.e. a rating that is below what the benchmark efficient entity ought to be able to achieve), the access provider would be awarded too high a return on debt. This would provide perverse incentives for the access provider to allow its creditworthiness to drop below an efficient level and, therefore, for its cost of borrowing to rise above the efficient level.
324. It requested that the Authority specifically consider credit rating and gearing level determinations for the TPI railway against actuals achieved by FMG on the basis that credit rating and gearing levels for a multi user infrastructure provider should be 'superior' to that of a single iron ore miner. It also requested that the Authority ensure that such determinations relate to risks faced by the benchmark efficient entity rather than the risks currently faced by the TPI railway.
325. Brockman submitted that there are inconsistencies between the Authority's credit rating and gearing level determination for TPI as well as inconsistencies between the Gross Replacement Value (**GRV**) concept and the gearing level. It highlights that FMG has attained a credit rating of BBB-, the same as that determined for TPI, yet

<sup>112</sup> Brookfield Rail, *Submission on the Revised Draft Decision relating to the 2014 Review of the Method for Estimating the Weighted Average Cost of Capital*, 20 February 2015, p. 14.

<sup>113</sup> Brockman Mining Australia Pty Ltd, *Submission in response to Economic Regulation Authority Western Australia: Review of the method for estimating the WACC for the regulated railway networks*, 28 November 2014, p. 9.

has substantially higher gearing than the benchmark gearing determined for TPI. It also considered the TPI railway as more creditworthy than the average component of FMG and therefore should be able to support a higher gearing level than FMG as a whole. By this reasoning, it considered the Authority's gearing level and credit rating determination as inconsistent. Additionally, Brockman views new infrastructure as typically commencing life with higher gearing levels. It submits that since the WACC is being determined in the context of GRV there is an implication that the WACC should be calculated on the assumption that the asset base is 'new' infrastructure. Brockman requests that the Authority consider the link between the credit rating and gearing level and the link between the credit rating and GRV concept and address the matter in the Final Determination.<sup>114</sup>

## 8.4 Considerations of the Authority

### 8.4.1 PTA

326. No submissions were received on the Revised Draft Decision with regard to the credit rating of the PTA.
327. The Authority remains of the view, based on its assessment set out in the Revised Draft Decision, that the benchmark efficient rail entity would be able to sustain a credit rating of A.

### 8.4.2 Brookfield Rail

328. No submissions were received on the Revised Draft Decision with regard to the credit rating of the Brookfield Rail.
329. The Authority remains of the view, based on its assessment set out in the Revised Draft Decision, that the benchmark efficient rail entity would be able to sustain a credit rating of BBB+.

### 8.4.3 TPI

330. The Authority agrees with Brockman's view that reference should be made to a wider sample and that Aurizon as an Australian rail freight company, should be included as a comparator, despite its operational differences.
331. However, the Authority does not agree with Brockman's view that a BBB- credit rating for TPI creates a perverse incentive for it to not maintain a strong credit rating. This is because any regulated firm normally would have a financial incentive to maintain access to low cost debt financing regardless of the benchmark credit rating in order to lower its interest costs and increase profitability. At the same time, the regulated entity is not compensated for a cost of debt that is higher than that determined for the benchmark entity.
332. The Authority maintains its view that the comparable benchmark sample should be used to determine the benchmark credit rating – not the firm's or parent firm's actual credit rating. As mentioned above, a benchmark efficient target capital structure (as

<sup>114</sup> Brockman Mining Australia Pty Ltd, *Submission in response to Issues Paper- Railways (Access) Code 2000: Weighted Average Cost of Capital WACC Determination – Railway Networks*, February 2013, pp. 6-12.

opposed to actual capital structure) should be used to maintain an incentive for the firm to converge toward it.

333. With respect to the link between the GRV concept and credit rating, Brockman provided no evidence to indicate that newly established railway providers have access to debt that is priced such that leverage should differ from the industry standard that optimises the risk adjusted returns to shareholders. The Authority is therefore of the view that the regulated cost of debt should reflect that of the benchmark efficient firm and any analytical reference to TPI's parent FMG, or newly established projects, is therefore irrelevant.
334. The Authority notes Brockman's submission with respect to TPI's prospects for diversification. The Authority noted above that it considered that TPI's potential diversification prospects are somewhat less than Brookfield's (see section 4.4.4.7).
335. In addition, as discussed in section 4.4.4.7, GWR is considered to be the only operationally comparable firm to TPI, on the basis of it being the only class III regional and short-line operator. Therefore, it is the primary comparator in terms of risk profile, with Aurizon a secondary comparator.
336. Although BBB- is at the bottom of the investment grade spectrum, Standard and Poor's classify an issuer with such a rating as having a capacity and willingness to meet financial obligations, such that these obligations can be treated as an investment, rather than a speculative position. If operating and financing aspects of a firm are different enough to the industry in which it operates, 'notching' its rating (for example moving up or down an increment or notch) within a credit band would be appropriate in order to signal that its risk profile is commensurate with a lower or higher risk premium. A firm's creditor is likely to analyse the operating and financial aspects of a firm in pricing debt to differentiate the firm based on these aspects. To respond to Brockman's concerns in relation to the credit rating for TPI, the Standard and Poor's risk profile matrix is used to illustrate the differentiation of firms' credit ratings, on the basis of their risk profiles.
337. The matrix shown in Table 9 characterizes Standard and Poor's credit ratings as a function of the intersection of the business and financial risk profile.

**Table 9 Standard and Poor's Risk Profile Matrix**

Business Risk Profile	Financial Risk Profile					
	Minimal	Modest	Intermediate	Significant	Aggressive	Highly Leveraged
Excellent	AAA/AA+	AA	A	A-	<b>BBB</b>	-
Strong	AA	A	A-	<b>BBB</b>	BB	<b>BB-</b>
Satisfactory	A-	BBB+	<b>BBB</b>	BB+	<b>BB-</b>	B+
Fair	-	<b>BBB-</b>	BB+	<b>BB</b>	BB-	B
Weak	-	-	<b>BB</b>	BB-	B+	B-
Vulnerable	-	-	-	B+	B	B- or below

Source: Standard & Poor's, *RatingsDirect*, 18 September 2012.

338. Business risk stems from the variability in prices, quantities produced and sold and operating earnings, while financial risk stems from the financial structure of the business.
339. Indicative measures of financial risk considered by Standard and Poor's are outlined in Table 10.

**Table 10 Standard and Poor's Example Financial Risk Indicative Ratios Table**

Financial Risk Indicative Ratios (Corporates)			
	<i>FFO/Debt (%)</i>	<i>Debt/EBITDA (x)</i>	<i>Debt/Capital (%)</i>
Minimal	greater than 60	less than 1.5	less than 25
Modest	45-60	1.5-2	25-35
Intermediate	30-45	2-3	35-45
Significant	20-30	3-4	45-50
Aggressive	12-20	4-5	50-60
Highly Leverage	less than 12	greater than 5	greater than 60

Source: Standard & Poor's, *RatingsDirect*, 18 September 2012.

340. Standard and Poor's 2013 Corporate Methodology defines funds from operations (FFO) as shown in (9).

$$FFO = EBITDA - Net\ Interest\ Expense - Current\ Tax\ Expense \quad (9)$$

where

*EBITDA* is revenue less operating expenses plus depreciation and amortization expenses;

*Net Interest Expense* is interest paid less interest earned, capitalised during the financial year; and

*Current Tax Expense* is the tax expense currently payable for the financial year.

341. Indicative measures of business risk considered by Standard and Poor's include:<sup>115</sup>
- Country Risk;
  - Industry Characteristics;
  - Company/Competitive Position;
  - Profitability/Peer Group Comparison; and
  - Management & Strategy.
342. Country risk premiums, profitability measures and peer group comparisons are outlined for TPI's comparators Aurizon and GWR in Table 11. The ratios are based on three complete financial year averages from 2012 to 2014.<sup>116</sup> The industry

<sup>115</sup> See [http://www.standardandpoors.com/aboutcreditratings/RatingsManual\\_PrintGuide.html](http://www.standardandpoors.com/aboutcreditratings/RatingsManual_PrintGuide.html).

<sup>116</sup> GWR is a US based company and so uses three US financial years (which end in December).

average ratios are based on the sample of benchmark comparators shown in Table 37 using the latest data reported by 'Bloomberg Data Point'.

343. Aurizon has a credit rating of BBB+ with financial risk profile that is not inconsistent with the intermediate to significant range in the rating matrix in Table 9 given that two of its financial ratios outlined Table 11 are significant and one is intermediate. A 'strong' business risk profile is consistent with the significant to intermediate financial risk profile and Aurizon's BBB+ credit rating.

**Table 11 Indicative Corporate Measures and Ratios**

	Industry Average	Aurizon		Genesee Wyoming Rail	
<b>Long Term Issuer Rating</b>	BBB	BBB+		BB	
<b>Financial Risk</b>					
<b>FFO/Debt (%)</b>	44%	23%	Significant	2%	Highly Leveraged
<b>Debt/EBITDA (x)</b>	1.54	3.21	Significant	14.56	Highly Leveraged
<b>Debt/Capital (%)</b>	20%	18%	Minimal	23%	Minimal
<b>Business Risk</b>					
<b>Country Risk Premium</b>		7.45%		7.52%	
<b>EBIT Margin</b>	32.26%	21.00 %	Below Industry Average	23.39 %	Below Industry Average
<b>EBITDA Margin</b>	23.87%	36.24 %	Above Industry Average	32.60 %	Above Industry Average
<b>Return on Capital</b>	10.10%	5.21 %	Below Industry Average	6.51 %	Below Industry Average

Source: ERA Analysis, Bloomberg

344. Based on the key indicators in Table 11, GWR's business risk profile is fairly similar to that of Aurizon with comparable country risk as measured by the country risk premium reported by Bloomberg. GWR, however, is highly leveraged based on two indicators, but has minimal financial risk based on the debt to capital ratio which tempers the degree of risk. It would therefore, appear that GWR's overall financial risk profile is below highly leveraged, but above intermediate on the risk profile matrix in Table 9. In the same table, the intersection of the business risk profile of strong and financial risk profile of significant to aggressive is consistent with a credit rating for GWR of BBB to BB. GWR is in fact rated BB.
345. While TPI is operationally more comparable to GWR on the basis that it is a regional US (Class II/III) operator with similar operations to TPI in Australia (see section 4.4.4), the fact that TPI is solely based in Australia leads the Authority to the view that some weight (albeit small) should be based placed on Aurizon as a comparator. Based on these indicators, the main factor differentiating Aurizon and GWR is the financial leverage. The Authority is of the view that the financial risk profile for the benchmark comparator for TPI therefore lies between that of Aurizon (significant) and that of

GWR (aggressive) while the business risk profile should be comparable given the similarity of business risk between the two comparators shown in Table 11. The Standard and Poor's risk matrix in Table 9 indicates that such a risk profile is consistent with a rating of BBB- (that is, between BBB and BB). In light of the high levels of debt relative to cash flows for the short-line regional rail operator GWR, the Authority remains of the view that the investment grade rating of BBB- is appropriate as the benchmark comparator rating for TPI and that this is also consistent with its gearing level.

## 8.5 Final Decision

346. The Authority adopts the following credit ratings for the purpose of determining the rail networks' return on debt:
- A for the PTA network;
  - BBB+ for Brookfield Rail; and
  - BBB- for TPI.
347. These credit ratings will remain fixed until the next rail WACC method review – the annual updates of the rail WACC will adopt these ratings.



## 9 Debt risk premium

348. The debt risk premium (**DRP**) is the margin above the risk free rate of return, required to compensate holders of debt securities for the risk in providing debt finance. The debt risk premium compensates holders of debt securities for the possibility of default by the issuer.
349. The DRP provides compensation to lenders for the additional risk associated with providing debt capital, over and above the risk-free rate. As such, the extent of the compensation, or 'credit spread', is closely related to the risk of the business. When issuing debt in the form of bonds, a credit rating can be assigned that reflects the probability of default of the issuer, and hence the risk present in the bond. Chapter 8 – Benchmark credit rating discusses the credit rating of each of the benchmark efficient rail entities.

### 9.1 Current Approach

350. In the 2008 WACC review for the Freight and Urban Rail Networks, the Authority estimated the debt margins for both the PTA and Brookfield Rail network (then WestNet) utilising the CBA Spectrum fair value yields.<sup>117</sup> This approach was based on the advice of the Allen Consulting Group.<sup>118</sup> In the 2009 WACC determination for the TPI network, the Authority used debt risk premiums derived from the use of Bloomberg fair value curves.<sup>119</sup>
351. The Authority notes that it has ceased utilising the CBA Spectrum and Bloomberg fair value curves in estimating the debt risk premium for regulated utilities since the previous WACC determinations in rail.<sup>120</sup> This was primarily as a consequence of the large divergence between the observed yields of Australian corporate bonds and the estimates produced by CBA Spectrum and Bloomberg fair value curves. The Authority's view is that this divergence is primarily due to the lack of liquidity in the Australian corporate bond market, in addition to the extrapolation of the yield curves to a longer maturity. More recently, CBA Spectrum has ceased publication. The Authority developed the bond yield approach in response to the view that the above methods did not adequately reflect the prevailing market conditions for funds in the Australian corporate debt market. The history of estimating the debt risk premium calculation, and derivation of the bond yield approach can be found in the gas Rate of Return Guidelines.<sup>121</sup>

<sup>117</sup> Economic Regulation Authority, *2008 Weighted Average Cost of Capital for the Freight (WestNet Rail) and Urban (Public Transport Authority) Rail Networks: Final Decision*, June 2008, p. 20.

<sup>118</sup> The Allen Consulting Group, *Railways (Access) Code 2000: Weighted Average Cost of Capital*, October 2007.

<sup>119</sup> Economic Regulation Authority, *The Pilbara Infrastructure (TPI): Final Determination on the 2009 Weighted Average Cost of Capital for TPI's Railway Network*, June 2009, p. 31.

<sup>120</sup> Economic Regulation Authority, *Final Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline*, 31 October 2011.

Economic Regulation Authority, *Final Decision on Proposed Revisions to the Access Arrangement for the Mid-West and South-West Gas Distribution System*, February 2011.

Economic Regulation Authority, *Final decision on proposed revisions to the access arrangement for Western Power*, 5 September 2012.

<sup>121</sup> Economic Regulation Authority, *Explanatory Statement for the Rate of Return Guidelines*, p. 109.

## 9.2 Revised Draft Decision

352. The Authority used the extended bond yield approach to estimate the 'regulated debt risk premium'. The regulated debt risk premium is derived from the observed yields of relevant corporate bonds, taken from Bloomberg, that qualify for inclusion in the benchmark sample.
353. To estimate the regulated debt risk premium, the Authority indicated that it would:
- extend the benchmark sample under the bond yield approach to: (i) include Australian corporate bonds denominated in domestic currency (AUD) and foreign currencies including USD; Euros; and British pounds; and (ii) exclude bonds issued by financial sectors including banks;
  - estimate the credit 'spread to swap' for each bond, in terms of the denominated currency, as a first step;
  - convert the resulting spread to swap for each bond to AUD terms, by accounting for hedging costs;
  - estimate a credit spread to swap yield curve in AUD equivalents – applying the Gaussian Kernel, the Nelson-Siegel and the Nelson-Siegel-Svensson techniques;
  - use the simple average of these three yield curves' 10 year spread to swap estimate to arrive at the final estimate of the 10 year spread to swap;
  - add the 10 year Australian swap rate to the resulting 10 year spread to swap, to determine the 10 year cost of debt; and
  - estimate the regulated debt risk premium as the 10 year cost of debt spread to the 10 year risk free rate.
354. For each of the rail networks, a separate bond sample would be developed, based on the corresponding benchmark efficient credit rating. The Authority used the Bloomberg data service exclusively in order to construct each benchmark sample. Under the bond yield approach, the following criteria would apply in order to select bonds to be included in each of the benchmark samples:
- Credit rating of each bond must match that of the corresponding benchmark efficient entity, as rated by Standard & Poor's.
  - The remaining time to maturity must be two years or longer.
  - The bonds must be issued by Australian (non-financial) entities and denominated in AUD, USD, Euros or GBP.
  - Fixed bonds and floating bonds are eligible for inclusion.
  - Both bullet bonds and bonds with callable/puttable redemptions are eligible for inclusion.
  - There are at least 20 yield observations over the required 40 day averaging period.

## 9.3 Submissions

### 9.3.1 TPI

355. Houston Kemp on behalf of TPI submitted that it was of the view that the debt credit rating for the TPI network is robust, specifically with respect to TPI's reliance on a single commodity (iron ore) transported large distances. It noted that the determination distinguishes TPI's risks from either PTA or Brookfield Rail and results in TPI's risks being classified at the upper end of those faced by comparators in the benchmark sample.<sup>122</sup>

### 9.3.2 Brookfield Rail

356. Synergies Economic Consulting (**SEC**), on behalf of Brookfield, are of the view that the use of the revised bond yield approach is not the most appropriate to apply in light of robust independent alternatives being available. Its overarching concern is that the Authority's revised approach is complex and difficult to replicate, and that the additional benefits of applying the approach are unknown. Specifically, SEC submitted that:

- identifying the bonds is complex because not all of the bonds in the potential universe will meet the Authority's criteria all of the time;
- it requires identification of bonds in a number of different markets;
- it requires swapping into Australian dollars; and
- it requires three different curve fitting techniques.

357. SEC's conclusions on the issue of complexity and replicability are that as long third party provider estimates such as the Reserve Bank of Australia (**RBA**) or Bloomberg are robust and the estimates are not biased the ability to replicate the estimate is considered unnecessary.

358. In relation to the reliability of the estimates, SEC submits that there has been no allowance in the Authority's sample selection process to evaluate the reliability of the data itself. It expressed concern that the Authority may be resolving the trade-off between sample size and relevance by favouring sample size. SEC is of the view that the RBA's method is in contrast to this, outlining that the RBA assigns the Bloomberg BVAL score to Bloomberg data and applies rules to come up with the best estimate given the available data.<sup>123</sup>

359. SEC acknowledges the issue relating the average tenor of the RBA's estimate being less than 10 years, however is of the view that there is likely to be insufficient data of adequate quality available to construct yield curves out to these long maturities. It was of the view that extrapolating short term estimates out to 10 years could be superior to the Authority's approach if the estimates used in extrapolation are more robust.

<sup>122</sup> HoustonKemp Economists, 2015, *Weighted Average Cost of Capital (WACC) for the TPI network*, report prepared for The Pilbara Infrastructure Pty Ltd, 20 February 2015, p.4.

<sup>123</sup> This relates to the quality of the pricing data retrieved from Bloomberg.

360. SEC submits that it is not standard Australian regulatory practice to estimate a different return on debt within each credit rating band. It is of the view that distinguishing between different credit rating notches in each category cannot be at the expense of reliability. It highlighted that the Authority considered that it should not be constrained in its credit rating evaluation by a limited set of DRP estimates (such as those provided by the RBA). It then highlighted that the Authority had acknowledged other situations where it may need to relax its selection criteria, such as that when a limited number of daily yield observations are available for a bond. SEC appears to imply that the Authority should relax its narrow credit rating classification and encompass other credit ratings within each band to improve the reliability of estimates.
361. With respect to the RBA data series, SEC submits that all of the Authority's reasons for rejecting the use of the series in the in the Revised Draft Decision can be addressed through extrapolation and interpolation. It notes that extrapolation can be used to address the issue of the average tenor of the RBA estimates being less than 10 years. With respect to estimating the DRP for separate credit rating estimates within a band (for example A-, BBB+ and BBB-), it proposed that the Authority could interpolate a DRP between estimates for different credit ratings. Similarly, it proposed that the Authority could address the issue of the RBA only publishing month-end estimated by interpolating daily estimates between the month end estimates. SEC also noted that the RBA intends to produce daily estimates at some point in future. SEC concluded by expressing that it considers it to be important that the Authority demonstrate that the additional costs of the Authority's process (including for stakeholders) is outweighed by the additional benefits compared to approaches using data from independent data sources.<sup>124</sup>

### 9.3.3 Brockman Mining Australia

362. Brockman submits that it does not accept that there is sufficient evidence to support the material difference in debt risk premium outcomes between TPI and Brookfield. It highlights that under the revised bond yield approach the premium for Brookfield has fallen 8 per cent from 2013 while the premium for TPI has increased 48 per cent over the same period. Brockman was also concerned by the material increase in the premiums for all three railways that result from using the revised bond yield approach. It noted that the Authority's decision to use BBB- for the TPI benchmark credit rating is a key determinant in explaining the differences between the DRP for TPI and Brookfield.

---

<sup>124</sup> Synergies Economic Consulting, 2015, *Review of the Method for Estimating the WACC for the Freight and Urban Railway Networks*, a report prepared for Brookfield Rail, February 2015, pp. 11-15.

## 9.4 Considerations of the Authority

363. The Authority's response to the issues raised in submissions on its Revised Draft Decision is provided as follows.

### 9.4.1 The use of RBA Estimates

364. The RBA estimates are determined by the Gaussian Kernel method.<sup>125</sup> This approach assigns a weight to every observation in the bond sample – informed by the distance of the observation's residual maturity from the target tenor – according to a Gaussian (normal) distribution centred at the target tenor. The RBA notes that this method recognises that the observed spreads on bonds with residual maturities close to the target tenor contain more information about the underlying spread at that tenor than spreads on bonds with residual maturities that are further away.

365. Formally, the Gaussian Kernel average credit spread estimator  $S(T)$  at target tenor  $T$  (say, 5 years) for a given broad rating (say, BBB-rated bonds) and date is given by (10):

$$S(T) = \sum_{i=1}^N w_i(T; \sigma) \times S_i \quad (10)$$

Where

$w_i(T; \sigma)$  is the weight for the target tenor  $T$  of the  $i^{\text{th}}$  bond in the sub-sample of bonds with the given broad rating; and

$S_i$  is the observed spread on the  $i^{\text{th}}$  bond in the sub-sample of  $N$  bonds with the given broad rating.

$\sigma$  (sigma), which is measured in years, controls the weight assigned to the spread of each observation based on the distance between that bond's residual maturity and the target tenor. Sigma is the standard deviation of the normal distribution used to assign the weights. It determines the effective

<sup>125</sup> Reserve Bank of Australia, 'New Measures of Australian Corporate Credit Spreads', *Bulletin*, December quarter 2013.

width of the window of residual maturities used in the estimator, with a larger effective window producing smoother estimates.

366. The weighting function is as follows in (11).

$$w_i(T; \sigma) = \frac{K(T_i - T; \sigma) \times F_i}{\sum_{j=1}^N K(T_j - T; \sigma) \times F_j} \quad (11)$$

Where

$K(T; \sigma)$  is the Gaussian Kernel function giving weight to the  $i^{th}$  bond based on the distance of its residual maturity from the target tenor ( $|T_i - T|$ ).

$F_i$  is the face value of the  $i^{th}$  bond.

367. The Gaussian Kernel may then be defined as below in (12).

$$K(T_i - T; \sigma) = \frac{1}{\sqrt{2\pi} \sigma} \exp\left[-\frac{(T_i - T)^2}{2\sigma^2}\right] \quad (12)$$

368. The Gaussian Kernel method provides for a degree of flexibility in weighting the observations around the target tenor through the choice of the value of the smoothing parameter,  $\sigma$ .

369. The RBA then selects a smoothing parameter of 1.5 years for both A-rated bonds and BBB-rated bonds.

370. The RBA concluded that the Gaussian Kernel method produces effective weighted average tenors that are very close to each of the target tenors. The exception is the 10 year tenor, where the effective tenor is currently 8.6 years. The RBA argues that this difference reflects the dearth of issuance of bonds with tenors of 10 years or more.

371. However, the Authority is of the view that the RBA did not develop their corporate bond yield and credit spread data for the express purpose of making regulatory determinations. The RBA explicitly states that the series were constructed by the RBA for addressing specific research topics. Additionally, the RBA explicitly state that they do not provide comments or recommendations on the appropriateness of its use for any particular purpose.

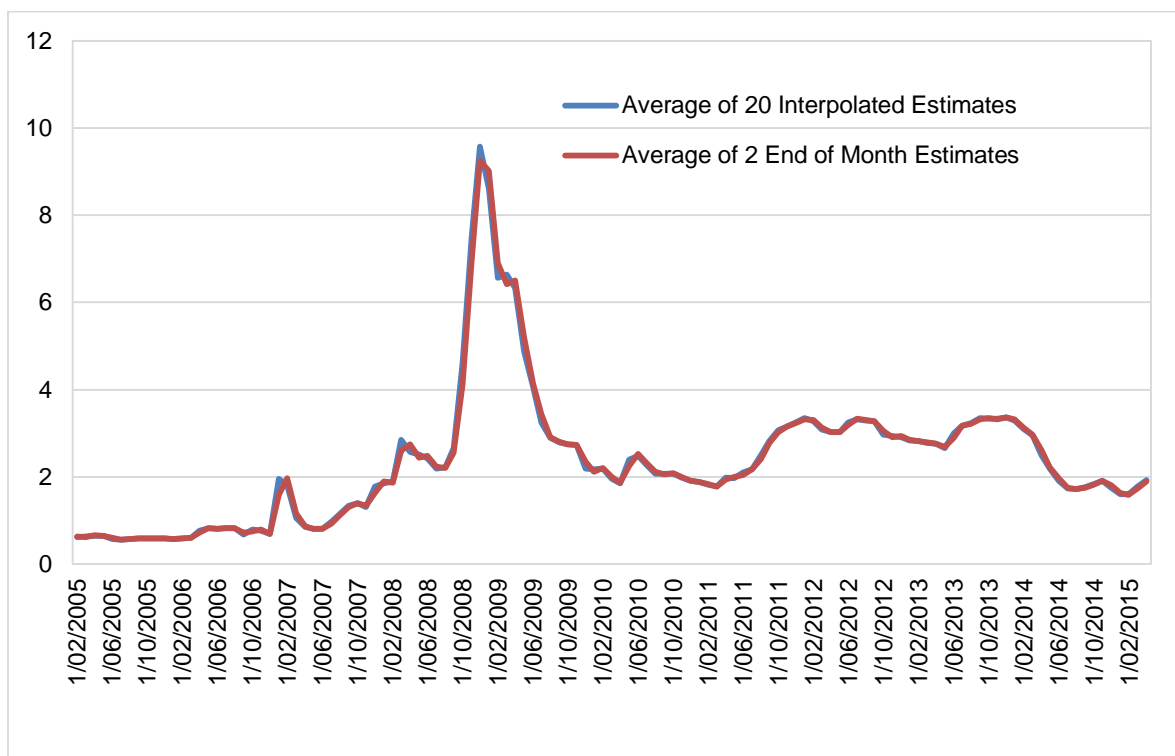
372. For use in the regulatory context, the RBA data requires a series of manipulations in order to approximate cost of debt and debt risk premium estimates other than end of month observations, and those for A or BBB band. The RBA also estimates spreads and yields at a *target* tenor using the Gaussian Kernel approach. In the current context of regulation, cost of debt and debt risk premium estimates at an *effective* tenor of 10 years are required. Again extrapolation is typically required in order estimate the cost of debt or debt risk premium at an effective tenor of 10 years when

using the RBA data. Each of these manipulations are approximations applied to what already are estimates. Each of the approximations proposed by SEC are examined below.

#### 9.4.1.1 Linear interpolation of trading day estimates between RBA end of month estimates

373. Linearly interpolating between end-of-month estimates is not significantly different from taking a simple average of two end of month estimates as shown in Figure 2. This effectively only uses two data points to inform an estimate. The Authority adopts an averaging period of 40 trading days for the risk free rate – trading off efficiency of the estimate for smoothing of short term volatility.<sup>126</sup> The same averaging period is applied to the debt risk premium for similar reasons, as well as consistency with the risk free rate.

**Figure 2 Time Series - Linear Interpolation versus Simple Average of RBA End of Month Estimates**



Source ERA Analysis, Reserve Bank of Australia data.

374. A more rigorous analysis confirms that there is no significant difference between taking the simple average between two end of month estimates and 20 days of linearly interpolated estimates between months. The simple averages are regressed on the averages of the interpolated estimates. If the two are not statistically different from each other the slope coefficient should equal 1 and the intercept (difference) equal to 0 – that is,  $\alpha$  and  $\beta_i$  in equation (13) will ‘disappear’ making the left side equal to the right.

<sup>126</sup> Economic Regulation Authority, *Explanatory Statement for the Rate of Return Guidelines: Meeting the Requirements of the National Gas Rules*, 16 December 2013, pp. 85-86.



$$\text{Simple Average}_i = \alpha + \beta_i (\text{Interpolated Estimates}_i) \quad (13)$$

where

*Interpolated Estimates<sub>i</sub>* is the average of 20 interpolated estimates

$\alpha$  is the intercept or constant difference

$\beta_i$  is the slope coefficient; and

*Simple Average<sub>i</sub>* is the simple average of two end of month estimates.

**Table 12** Regression of Average of 20 interpolated estimates vs End of Month Estimates

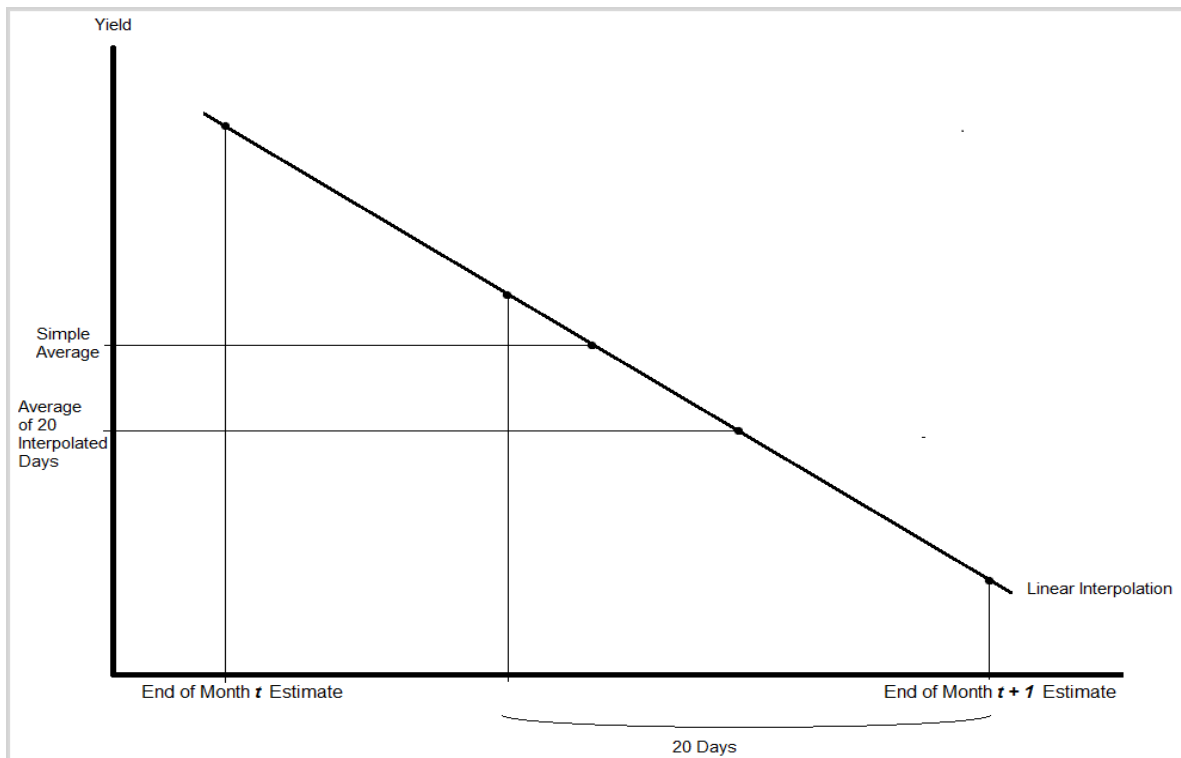
	Coefficients	p-value
Difference ( $\alpha$ )	0.00	0.87
Slope ( $\beta_i$ )	1.00	0.00
Observations	123	

Source: ERA Analysis

375. The p-value on the intercept in the regression is reported in Table 12. The intercept can be interpreted as the 'constant' difference between the two series in Figure 2 and the value of 0.87 strongly suggests that the difference is not different to zero as it is far greater than 0.05 (5 per cent level of statistical significance). The slope coefficient also appears to be equal to one and is highly significant as the low p-value indicates.<sup>127</sup> This result indicates that the average of the 20 day interpolations is not much different to using a simple average of two end of month estimates. This is unsurprising given that the average of the interpolations and simple average are two points just a few days apart on the same linearly interpolated curve. This concept is shown in Figure 3 assuming the latter month has a lower yield than the earlier month, but holds for all other scenarios.

<sup>127</sup> To add additional robustness a 'joint test' of the hypothesis that the intercept is equal to 0 and the slope coefficient is equal to 1 could be carried out. Given the statistical significance of the parameters here it is unlikely that the hypothesis would be rejected.

**Figure 3 Conceptual distance between Linear Interpolation and Simple Average of RBA End of Month Estimates**



Source: ERA Analysis

376. The Authority considers that two end of month observations in the simple average, is less likely to be representative of the actual daily average DRP or cost of debt in a given month than the actual average itself. An equal result is likely only to occur by chance. The Authority, however, notes SEC's submission that the RBA intends to produce daily estimates at some point in future which may resolve this issue of lack of representativeness.

#### 9.4.1.2 Interpolating between credit ratings

377. The Authority is of the view that a linear approximation of the debt risk premium or cost of debt submitted by SEC for credit ratings between A and BBB is subject to a high degree of error. There is no reason to assume that the spread between credit ratings is equal. Assigning equidistant values to credit ratings is therefore problematic. The Australian Energy Regulator acknowledged this issue in its review of the WACC parameters for electricity transmission and distribution network service providers in 2008.<sup>128</sup> The Authority therefore favours the direct estimation of the debt risk premium or cost of debt for a given credit rating.

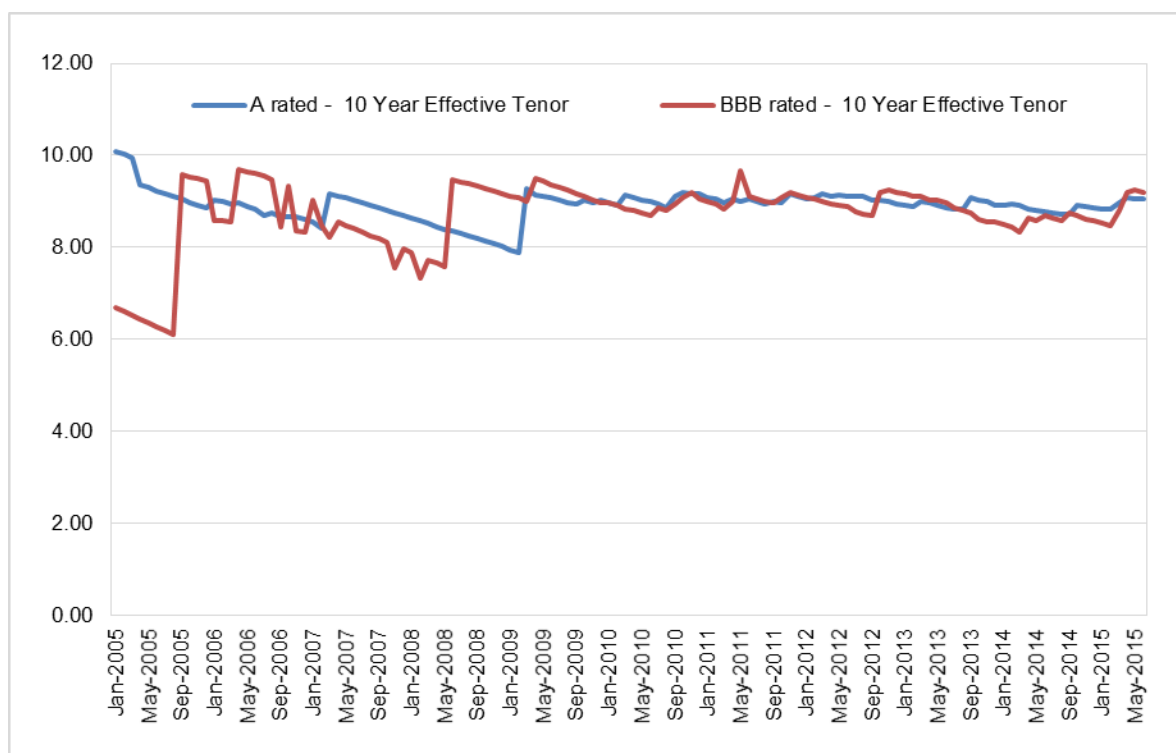
378. Linear approximation of the debt risk premium or cost of debt submitted between A and BBB credit ratings also leaves the issue of the absence of third party estimates for the BBB- credit rating unresolved.

<sup>128</sup> Australian Energy Regulator, *Explanatory Statement - Electricity transmission and distribution network service providers: Review of the weighted average cost of capital (WACC) parameter*, December 2008 p. 259.

### 9.4.1.3 Extrapolating the yield estimate for the 10 year tenor

379. The effective tenor for the RBA corporate bond yield and spread estimates is generally less than the 10 year tenor currently required by Australian regulators as shown in Figure 4. The implication is, assuming an upward sloping yield curve, that the RBA yields and spreads will systematically underestimate those for a 10 year effective tenor. To adjust for this the AER, on the advice of Lally, linearly extrapolates between the effective tenors and yields of the 7 and 10 year series.<sup>129</sup> This implicitly assumes that a linear approximation past the effective tenor on the 10 year RBA estimates is not significantly different from an estimate that accounts for any curvature in the term structure of a yield curve. If the term structure in a yield curve for a given credit band has a tendency to be concave (increasing at a decreasing rate) linear extrapolation will introduce upward bias.

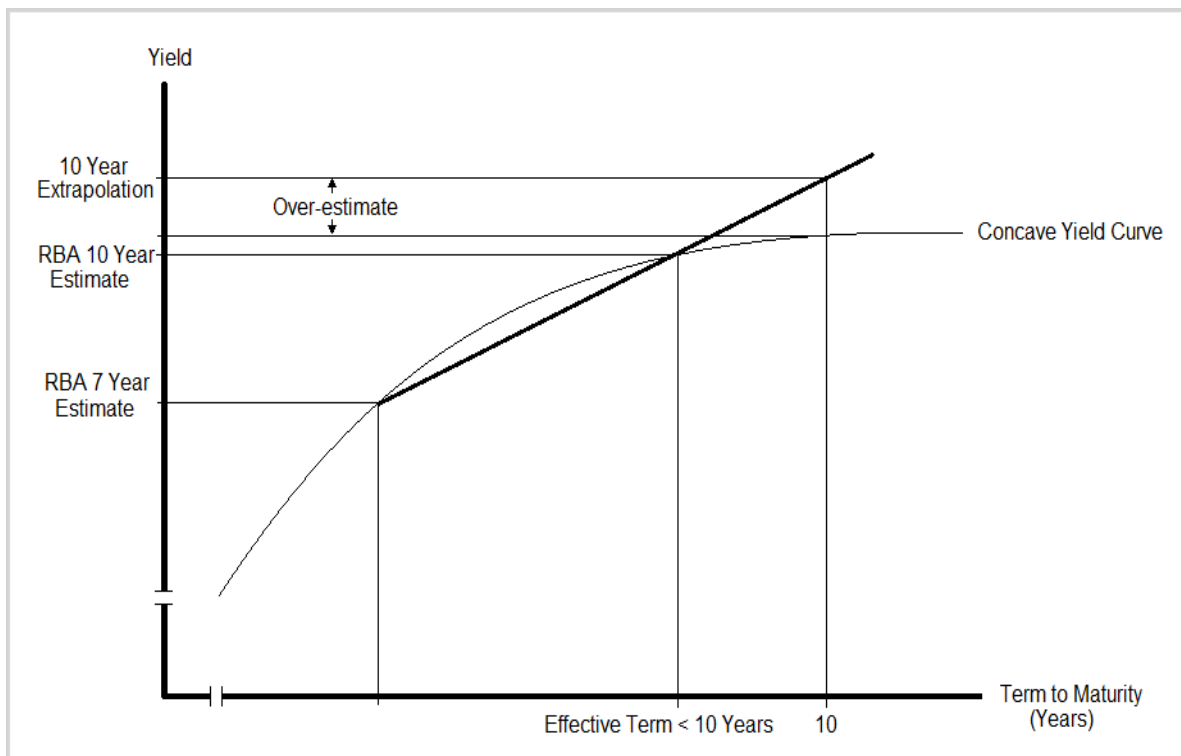
**Figure 4 Reserve Bank of Australia Corporate Bond Yield and Spread 10 Year Estimates - Effective Tenor**



Source: ERA Analysis, Reserve Bank of Australia data

380. The Authority notes that there may be occasions when the curvature in the term structure of the yield curves are quite pronounced and the effective tenor of the 10 year RBA estimates is significantly lower than 10 years (see Figure 4). In these circumstances a linear extrapolation maybe subject to a material degree of error. The Authority is of the view that curve fitting techniques – which interpolate estimates between observations with a remaining term to maturity less than and greater than 10 years provides additional information on curvature – should be taken into account. Interpolation based on actual data is preferable to extrapolation based on an assumption of a linearity in the yield curve, provided there are sufficient estimates at the long end of the curve. The reasoning behind the possibility of overestimates is stylistically illustrated in Figure 5.

<sup>129</sup> Australian Energy Regulator, *Jemena Gas Networks (NSW) Ltd Access Arrangement 2015-20: Attachment 3 – Rate of Return*, June, 2015, p. 210.

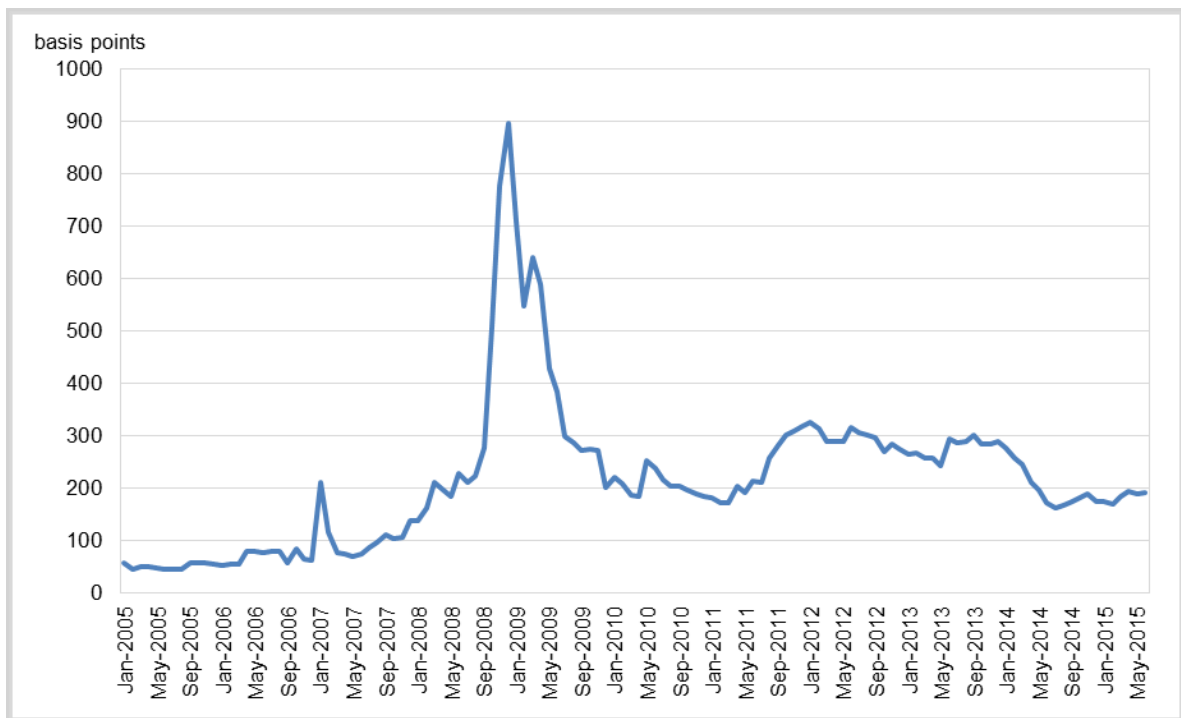
**Figure 5** Extrapolating 10 year Estimates from Reserve Bank of Australia Data

Source: ERA analysis

381. The potential errors in applying the various interpolations and extrapolations outlined above may also be compounded through the application of more than one approximation at a time. For example, interpolating a 20 day DRP or cost of debt estimate based on two end of month estimates may create an unrepresentative starting point. The error may then be compounded by using a linear extrapolation based on an erroneous assumption of linearity.

#### 9.4.1.4 Transparency and Flexibility

382. The RBA corporate bond spreads and yields were published as a convenience for the public and not specifically for use in regulatory decisions. The RBA therefore had no reason to be compelled to publish its list of bond used in its estimations or the specific details of its hedging method. While SEC considers the ability to replicate estimates unnecessary in light of RBA and Bloomberg data being available, the Authority is of the view that there may be instances where stakeholders do not accept the results based on Bloomberg or RBA estimates and that transparency is helpful in addressing stakeholder concerns. Such transparency is desirable in the context of regulation as it enables the regulator and stakeholders to have a greater understanding of, and informed discussion on the main drivers of DRP and/or cost debt estimates. For example, it is difficult to understand and discuss the specific drivers (such as the bonds) in the estimation of the BBB rated yield spread estimates in December 2008 and March 2009 (shown in Figure 6) without being able to observe the specifics of the bonds in the sample and any Australian dollar equivalent conversion methods applied.

**Figure 6 Reserve Bank of Australia BBB Rated Spread to Swap**

Source Reserve Bank of Australia data and ERA Analysis

383. Retaining the revised bond yield approach also allows for flexibility in sample selection during market conditions when limited bonds may be on issue. For example, during 2008 and 2009, the number of bonds on issue significantly declined. Under such circumstances the benefit of relaxing bond selection criteria, as suggested by SEC, may outweigh the cost in terms of lack of relevance. Strictly applying bond selection criteria for the purposes of continuity in a data series may result in cost of debt and DRP estimates that are far more anomalous than those that use a broader sample of bonds that do not strictly adhere to the selection criteria. Examples of relaxing criteria include:

- incorporating bonds that have a credit rating a notch above or below the benchmark; and
- allowing specific types of instruments excluded to be included with appropriate adjustment such as inflation linked notes.

384. As discussed above, SEC submit that it is not standard Australian regulatory practice to estimate a return on debt for credit rating 'notches' within each credit rating band. The Authority reiterates that there is a trade-off between relevance (for example, restricting the sample of bonds to those with the exact credit rating required) and sample size (for example, relaxing the requirement for a specific sample in order to include more bonds). Including bonds with a higher or lower credit rating in the sample is likely to result in a cost of debt estimate that is materially different to the true cost of debt for the benchmark credit rating determined by the Authority.

385. A careful analysis of the costs and benefits associated with relaxing criteria in such circumstances must take place, before estimates are adopted and if necessary, appropriate adjustments to the estimates should be made. The Authority considers that on balance, retention of its bond yield approach is desirable in the interests of transparency, precision, independence and replicability.

## 9.4.2 ERA estimates as at 30 July 2015

386. In the Revised Draft Decision, the Authority estimated the 10 year debt risk premium expressed as a spread to swap which was converted to Australian dollar equivalents and then added to the 10 year Australian Dollar swap rate. Since then, Bloomberg LP have developed the Swaps Toolkit (beta) that allows for the retrospective conversion of foreign currency denominated bond yields into hedged Australian dollar equivalents. An additional benefit of this method is that, in the rail context, it eliminates the need to separately calculate the DRP and risk free rate – the cost of debt is estimated as one number, thus reducing the complexity of the estimation procedure.
387. To estimate the regulated DRP, the Authority:
- extends the benchmark sample under the bond yield approach to: (i) include Australian corporate bonds denominated in domestic currency (**AUD**) and foreign currencies including USD; Euros; and British pounds; and (ii) exclude bonds issued by financial sectors including banks, duplicates, inflation linked, called and perpetual instruments;
  - converts the yields into hedged Australian Dollar equivalent yields inclusive of Australian Swap rates;
  - averages AUD equivalent bond yields across the averaging period for each bond (for example, where a 40 trading day averaging period applies, each bond will have a single 40 day average yield calculated for it);
  - estimates yield curves on this data – applying the Gaussian Kernel, Nelson-Siegel and Nelson-Siegel-Svensson techniques;
  - uses the simple average of these three yield curves' 10 year cost of debt estimate to arrive at the market estimate of the 10 year cost of debt; and<sup>130</sup>
  - estimates the regulated debt risk premium for the purposes of estimating the regulated cost of debt.
388. The approach uses asset swap spread or 'ASW Spread' data from Bloomberg. The specific details of this methodology are outlined in Appendix 4. The approach can be easily implemented by anyone that has access to a Bloomberg terminal even with minimal technical knowledge. It should be noted that the Authority's previous approach and the AER's approach to calculating debt risk premiums also require access to a data provider such as Bloomberg. The Authority considers that this addresses SEC's contention with respect to complexity in swapping into Australian dollars and also reduces complexity by allowing the cost of debt to be estimated directly as one number.
389. The first step in estimating the cost of debt is to conduct a search for bonds that match the criteria set out in Table 13. This should be carried out as soon as practicable after the date that marks the final trading day for the 40 trading day averaging period – in this instance 30 June 2015. Anyone that has access to a Bloomberg terminal can implement this search using the 'SRCH' facility.<sup>131</sup> The Authority is of the view that the availability of such facilities should address SEC's

<sup>130</sup> The Authority intends to adopt the average because there is no strong evidence to suggest that one approach outperforms the others. It is likely that the average will show less variability under a range of prevailing conditions.

<sup>131</sup> Bloomberg's help facility can also provide live assistance.

concerns with respect to identifying bonds that meet the Authority's criteria across a number of different markets.

**Table 13 Revised Bond Yield Approach Selection Criteria**

Criteria	ERA's approach
Remaining term	>= 2 years
Denominated currency	AUD, USD, EUR and GBP
Industry of issuers	Non-financial corporates only
Country of Risk	Australia
Maturity Type	Bullet, Callable and Puttable
Exclude	Perpetual, inflation linked, called instruments
Consolidate	Duplicate issues

Source: ERA analysis

390. Once bonds meeting these criteria are identified for each benchmark credit rating, the hedged yields are downloaded for all bonds simultaneously using Bloomberg's Swaps Toolkit facility to convert yields into Australian dollar equivalents. This is done for each of the 40 trading days. The yields of bonds that have a minimum of 20 trading days' worth of observations are then averaged into a single '40 trading day average' for each bond. The remaining term to maturity for each bond from the determination date and face value of each bond in Australian dollars (using the conversion rate at the time of issue) are also downloaded from Bloomberg. The term to maturity data and Australian dollar equivalent yields are used to fit the Gaussian Kernel, Nelson-Siegel and Nelson-Siegel-Svensson curves.
391. The specification for the Gaussian Kernel curve is outlined at (10) above, however the Authority uses yields for each bond in place of corporate credit spreads.
392. The specification for the Nelson-Siegel and Nelson-Siegel-Svensson curves are outlined in (14) and (15) below. Least squares is used as the fitting method for these curves based on the constraints outlined in Table 14.

### The Nelson-Siegel methodology

393. The Nelson-Siegel methodology assumes that the term structure of the yield curve has the parametric form shown in (14):

$$y_t(\tau) = \beta_{0t} + \beta_{1t} \frac{1 - e^{-\lambda\tau}}{\lambda\tau} + \beta_{2t} \left( \frac{1 - e^{-\lambda\tau}}{\lambda\tau} - e^{-\lambda\tau} \right) \quad (14)$$

Where

$\hat{y}(\tau)$  is the credit spread (debt risk premium) at time t for maturity  $\tau$  ; and

$\beta_{0t}, \beta_{1t}, \beta_{2t}, \lambda$  are the parameters of the model to be estimated from the data.

394. The Nelson-Siegel methodology uses observed data from the bond market to estimate the parameters  $\beta_{0t}, \beta_{1t}, \beta_{2t}, \lambda$  by using the observed yields and maturities



for bonds. With the estimated parameters  $\beta_{0t}, \beta_{1t}, \beta_{2t}, \lambda$ , a yield curve is produced by substituting these estimates into the above equation and plotting the resulting estimated yield  $\hat{y}_t(\tau)$  by varying the maturity  $\tau$ .  $\hat{y}_t(\tau)$  has the interpretation of being the estimated yield for a benchmark bond with a maturity of  $\tau$  for a given credit rating.

### The Nelson-Siegel-Svensson methodology

395. The parametric form of the Nelson-Siegel-Svensson curve used by the Authority is that specified in the Svensson (1994).<sup>132</sup> The notation for this parametric form is shown in equation (15):

$$\hat{y}_t(\tau) = \beta_{0t} + \beta_{1t} \frac{1 - e^{-\tau/\lambda_1}}{\tau/\lambda_1} + \beta_{2t} \left[ \frac{1 - e^{-\tau/\lambda_1}}{\tau/\lambda_1} - e^{-\tau/\lambda_1} \right] + \beta_{3t} \left[ \frac{1 - e^{-\tau/\lambda_2}}{\tau/\lambda_2} - e^{-\tau/\lambda_2} \right] \quad (15)$$

Where

$y_t(\tau)$  is the credit spread (debt risk premium) at time  $t$  for maturity  $\tau$ ; and

$\beta_{0t}, \beta_{1t}, \beta_{2t}, \beta_{3t}, \lambda_1, \lambda_2$  are the parameters of the model to be estimated from the data.

396. The Nelson-Siegel-Svensson methodology is estimated in the same way as the Nelson-Siegel method, except uses a different parametric form.
397. The following constraints are used to estimate the Nelson-Siegel and Nelson-Siegel-Svensson curves (Table 14).

<sup>132</sup> L. Svensson, *Estimating and Interpreting Forward Interest Rates: Sweden 1992-1994*, Institute for International Economic Studies, University of Stockholm, Seminar Paper No 579, p. 6.

**Table 14 Nelson-Siegel-Curve Constraints**

Parameter	Constraints	
<b>Nelson-Siegel</b>		
$\beta_{0t}$	> 0	
$\beta_{1t}$		
$\beta_{2t}$		
$\beta_{1t} + \beta_{2t}$	> 0	
$\lambda_1$	> 0	
<b>Nelson-Siegel-Svensson</b>		
$\beta_{0t}$	0 =<	=< 15
$\beta_{1t}$	-15 =<	=< 30
$\beta_{2t}$	-30 =<	=< 30
$\beta_{3t}$	-30 =<	=< 30
$\lambda_1$	0 =<	=< 2.5
$\lambda_2$	2.5 =<	=< 5.5

Source: ERA Analysis

398. For the Gaussian Kernel estimates, the face value in Australian dollars is required in addition to the term to maturity data and Australian dollar equivalent yield for each bond. It must be noted that for the 10 year Gaussian Kernel estimate the target tenor is set using iterative methods such that the *effective* or weighted tenor, as opposed to the target tenor itself, equals 10 years. It is the average of this and the two curve estimates that are used to arrive the final 10 year cost of debt estimate after all estimates are annualised. Estimates are expressed as an annualised rate using equation (16) and assuming semi-annual payment ( $m = 2$ ):

$$\text{Annualised Yield} = \left(1 + \frac{\text{Coupon}}{m}\right)^m - 1 \quad (16)$$

399. The results are shown in Table 15.

**Table 15 Estimated Cost of Debt for A, BBB+ and BBB- Credit Ratings**

Term	3	5	7	10
<b>A</b>				
ERA Gaussian Kernel	3.401	3.762	4.055	4.420
ERA Gaussian Kernel with 10 Year Weighted Tenor Correction				4.551
Nelson-Siegel	3.058	3.695	4.151	4.574
Nelson-Siegel Svensson	3.062	3.707	4.129	4.630
<b>Average of 3 techniques</b>	<b>3.174</b>	<b>3.721</b>	<b>4.111</b>	<b>4.585</b>
<b>BBB+</b>				
ERA Gaussian Kernel	3.805	4.137	4.484	5.057
ERA Gaussian Kernel with 10 Year Weighted Tenor Correction				5.188
Nelson-Siegel	3.488	3.978	4.455	5.148
Nelson-Siegel Svensson	3.557	3.968	4.421	5.193
<b>Average of 3 techniques</b>	<b>3.616</b>	<b>4.028</b>	<b>4.453</b>	<b>5.176</b>
<b>BBB-</b>				
ERA Gaussian Kernel	4.545	4.917	5.413	5.833
ERA Gaussian Kernel with 10 Year Weighted Tenor Correction				6.308
Nelson-Siegel	4.527	5.065	5.554	6.204
Nelson-Siegel Svensson	4.520	4.961	5.664	6.565
<b>Average of 3 techniques</b>	<b>4.531</b>	<b>4.981</b>	<b>5.544</b>	<b>6.359</b>

Source: ERA Analysis, Bloomberg

400. The Authority notes that the Gaussian Kernel estimates without the correction are materially lower than the other estimates. The use of three estimation methods serves as a 'cross check' between estimates to ensure that the results are not unduly influenced by the idiosyncrasies of one particular estimation method applied to the sample in question. SEC submitted concerns over the complexity of applying three estimation methods. The Authority notes that it is common practice in research to apply different estimation techniques as a test of robustness. The rationale for this is aptly summarised in the following quote from Plümper and Neumayer:

The recognition that model misspecifications are ubiquitous goes back at least to George Box, who alarmed his readers that "all models are wrong, but some are useful" (Kennedy 2008: 71). Similar claims have been made over and over again. Martin Feldstein (1982: 829), former president of the National Bureau of Economic Research and former Chairman of the Council of Economic Advisers warned that "in practice all econometric specifications are necessarily 'false' models", while Luke Keele put it this way: "statistical models are always simplifications, and even the most complicated model will be a pale imitation of reality" (Keele 2008). In the summary verdict of Peter Kennedy (2008: 71): "It is now generally acknowledged that econometric models are false and there is no hope, or pretense, that through them truth will be found." Like us, these authors do not suggest that models *can* be misspecified. Instead, they agree that all models are *necessarily* misspecified.<sup>133</sup>

<sup>133</sup> T. Plümper and E Neumayer, 'Model Uncertainty and Robustness Tests: Towards a New Logic of Statistical Inference', *Rochester: Social Science Research Network*, 2012, p. 3. Available from ProQuest, (accessed 17 July 2015).

401. This illustrates the Authority's view that the benefit of additional rigour from using the three methods outweighs the costs of additional complexity, particularly given the large absolute dollar value and duration of the assets potentially involved in the rail determinations.

### 9.4.3 Robustness

402. SEC surmise that the RBA and Bloomberg do not publish 10 year estimates on account of insufficient data of adequate quality being available. As noted above in the discussion on the RBA estimates, the Authority is of the view that the Bloomberg and RBA estimates were not developed for the express purpose of making regulatory cost of debt determinations.
403. While the RBA appear to have sufficient data to fit yield curves, it appears their research objectives did not necessitate fitting curves.<sup>134</sup>
404. Where the method involving Bloomberg's SRCH function entails an (ad hoc) calculation which is produced as needed, BVAL curves graph a band of continuing, periodic indicators of the price of debt for Australian corporates over time. BVAL applies criteria to create a daily sample of Australian firms within a given credit band, plot a curve and maintain a series of observations corresponding to the yield at various tenors on the curve, such as 5 and 7 years. BVAL criteria does not filter out financial institutions which typically have significantly different financial profiles to that of other firms within the economy, including utilities. There are occasions when there could be as little as one observation greater than 10 years. An example of the BBB BVAL constituents which highlight the prevalence of financial institutions and short tenors in the sample is shown in Table 16.

---

<sup>134</sup> In the parametric estimation sense.

**Table 16** BBB BVAL Curve Constituent Industry Sectors and Tenors

Industry Sector	Remaining Term to Maturity as at 30 June 2015
Utilities	0
Energy	0
Financial	1
Financial	1
Utilities	2
Financial	2
Utilities	2
Utilities	2
Consumer, Cyclical	2
Financial	2
Financial	2
Financial	3
Financial	3
Financial	3
Energy	3
Industrial	3
Basic Materials	4
Consumer, Cyclical	4
Basic Materials	4
Financial	5
Energy	5
Consumer, Non-cyclical	5
Utilities	6
Industrial	7
Industrial	10

Source: Bloomberg – downloaded 17 July 2015

405. In addition, Bloomberg's BVAL curve bond selection criteria has been specified to select bonds issued in the same currency, country of risk, unsecured in rank and bullet vanilla bonds. For the purposes of regulation, more observations around the long end of the curve is desirable and so expanding the sample to include various currency denominations allows regulators access to a greater universe of bonds with a long remaining term to maturity. The Authority therefore considers that the revised bond yield approach to be more appropriate.
406. The Authority notes that estimates under the previous bond yield approach were based on a sample of Australian bonds restricted to being issued in Australian dollars and being domiciled in Australia which tend to have an average tenor of around 5 years. Part of the rationale for moving to the revised bond yield approach which includes foreign currency issues is the ability to estimate the cost of debt or DRP at a 10 year tenor. As the estimated exposure to default under the new approach (10 years) is significantly longer than the original approach (around 5 years) the new estimates are expected to be higher in the order of around 30 basis points, reflecting an upward slope in the spread to swap curve.<sup>135</sup> The material increase in all three

<sup>135</sup> Based on average differences between the RBA 7 and 10 year corporate bond spreads to swap.

premiums when moving from the original bond yield approach to the revised approach highlighted by Brockman is therefore to be expected.

### Sample Size versus Relevance - Sensitivity Analysis

407. The Authority acknowledges SEC's concerns relating to insufficient data of adequate quality being available particularly with respect to constructing yield curves out to longer maturities that distinguish between credit rating notches in each band. The BBB- credit rating tends to suffer from a small number of bonds being available (see Figure 17). This is likely to explain the considerable difference between the indicative DRP estimates for TPI and Brookfield in the revised Draft Determination highlighted by Brockman (paragraph 362). The sensitivity of the cost of debt estimates to a change in sample are analysed by relaxing the credit ratings to expand the sample size and re-estimating the cost using the three methods. The relaxed credit bands are as follows:

- the A rated sample expanded to include A-, A and A+;
- the BBB+ rated sample expanded to include BBB and BBB+; and
- the BBB- rated sample expanded to include BBB- and BBB.

408. The A+/A/A- sample results are shown in Table 17.

**Table 17 A+/A/A- Sample 10 Year Yield Estimates**

Years	10
RBA Gaussian Kernel May-June 2015 Average	4.551
RBA Gaussian Kernel May-June 2015 Extrapolated to 10 years	4.729
ERA Gaussian Kernel	4.645
ERA Gaussian Kernel with 10 Year Weighted Tenor Correction	4.824
ERA Nelson-Siegel	4.877
ERA Nelson-Siegel Svensson	4.958
Average of all 3 ERA Methods	<b>4.886</b>

Source: ERA Analysis, Bloomberg, Reserve Bank of Australia data

409. The number of bonds in the A+/A/A- sample is comparable to that of the RBA, particularly at the long end as shown in Table 18. This indicates that in terms of sample size along the curve, estimates based on this sample should be reasonably robust.

**Table 18 A+/A/A- Sample by Tenor**

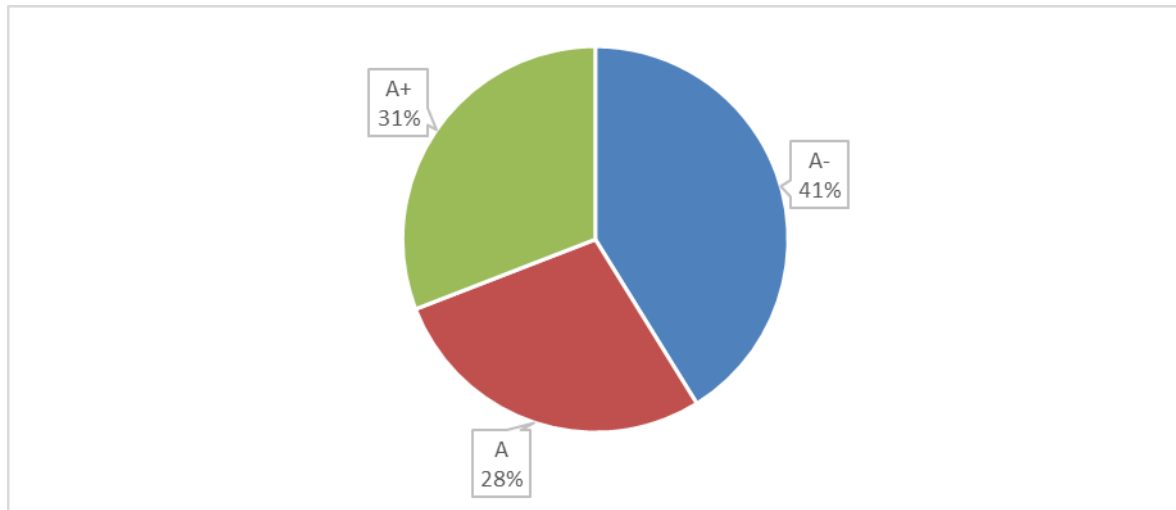
Tenor Range	1<X<=4	4<X<=6	6<X<=8	8<X<=12	12<=X
RBA Number of Bonds	43	18	12	10	8
ERA Number of Bonds <sup>136</sup>	15	18	13	14	8

Source: ERA Analysis, Bloomberg

<sup>136</sup> For purposes of maximising the number of observations for robustness, the Authority relaxed the criteria of excluding bonds with less than 50 per cent of observations which resulted in the inclusion of 2 additional bonds both with maturities of 6.96 years and 14 observations up to 30 June 2015.

410. The estimate using the broader A+/A/A- sample, however, includes a large number of A- rated bonds representing around 41 per cent of the sample as shown in Figure 7. These would presumably require a higher risk premium than the A and A+ bonds and is thus likely to bias the sample upward. This is taken into consideration in the Final Decision.

**Figure 7 Composition of A+/A/A- Sample**



Source: ERA Analysis, Bloomberg

The BBB+/BBB results are shown in Table 19.

**Table 19 BBB+/BBB Sample 10 Year Yield Estimates**

Years	10
RBA Gaussian Kernel ( <b>BBB Band</b> May-June Average 2015)	5.175
RBA Gaussian Kernel ( <b>BBB Band</b> May-June Average 2015) Extrapolated to 10 years	5.290
ERA Gaussian Kernel	5.148
ERA Gaussian Kernel with 10 Year Weighted Tenor Correction	5.262
ERA Nelson-Siegel	5.240
ERA Nelson-Siegel Svensson	5.276
Average of all 3 ERA Methods	<b>5.259</b>

Source: ERA Analysis, Bloomberg, Reserve Bank of Australia data

411. Despite being based on a narrower band than the RBA's BBB-/BBB/BBB+ sample, the BBB+/BBB sample appears to be relatively well represented along the curve, indicating that reasonably robust yield curves can be estimated on the data.

**Table 20 BBB+/BBB Sample by Tenor**

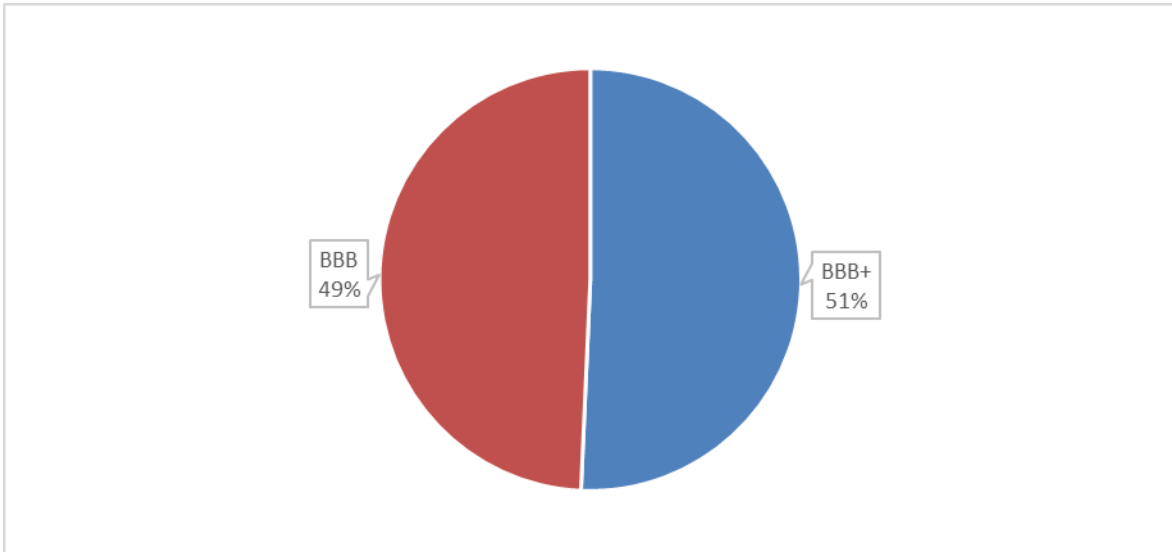
Tenor Range	1<X<=4	4<X<=6	6<X<=8	8<X<=12	12<=X
RBA Number of Bonds	22	29	17	9	3
ERA Number of Bonds	15	23	18	13	2

Source: ERA Analysis, Bloomberg



412. The estimate using the expanded BBB+/BBB sample is marginally higher (8 basis points) than the original pure BBB+ sample based estimate of 5.176. The Sample is more or less equally represented by BBB+ and BBB bonds as shown in Figure 8.

**Figure 8 Composition of BBB+/BBB Sample**



Source: ERA Analysis

413. The equal representation of lower rated (BBB) bonds in the sample would be expected to upwardly bias the BBB+/BBB estimate from the true BBB+ rating due to the lower rated BBB bonds having a higher DRP. This is taken into consideration in the Final Decision.

414. The BBB/BBB- results are shown in Table 21.

**Table 21 BBB/BBB- Sample 10 Year Yield Estimates**

Years	10
RBA Gaussian Kernel ( <b>BBB Band</b> May-June 2015)	5.175
RBA Gaussian Kernel (BBB Band May-June 2015) Extrapolated to 10 years	5.290
ERA Gaussian Kernel	5.264
ERA Gaussian Kernel with 10 Year Weighted Tenor Correction	5.341
ERA Nelson-Siegel	5.537
ERA Nelson-Siegel Svensson	5.539
Average of all 3 ERA Methods	<b>5.472</b>

Source: ERA Analysis, Bloomberg

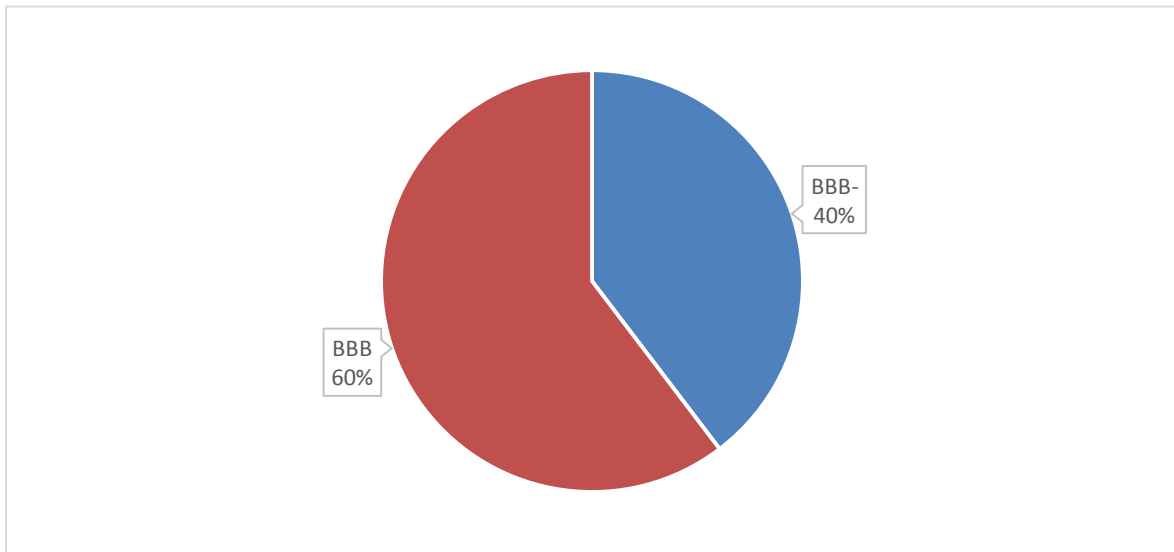
415. Again, despite being based on a narrower credit band than the RBA's BBB+/BBB/BBB- sample, the BBB/BBB- sample is comparable to that of the RBA's sample, particularly along the long end of the curve as shown in Table 22. On this sample yield curves estimated out to 10 years should be reasonably robust.

**Table 22** BBB/BBB- Sample by Tenor

Tenor Range	1<X<=4	4<X<=6	6<X<=8	8<X<=12	12<=X
RBA Number of Bonds	22	29	17	9	3
ERA Number of Bonds <sup>137</sup>	10	19	16	8	5

Source: ERA Analysis, Bloomberg, Reserve Bank of Australia data

416. The BBB/BBB- sample is over represented by BBB bonds, as shown in Figure 9, meaning that the three method estimate of 5.472 per cent is likely to be a significantly downward biased compared to the true, but unknown, BBB- estimate. This is taken into consideration in the Final Decision.

**Figure 9** Composition of BBB/BBB- Sample

Source: ERA Analysis, Bloomberg

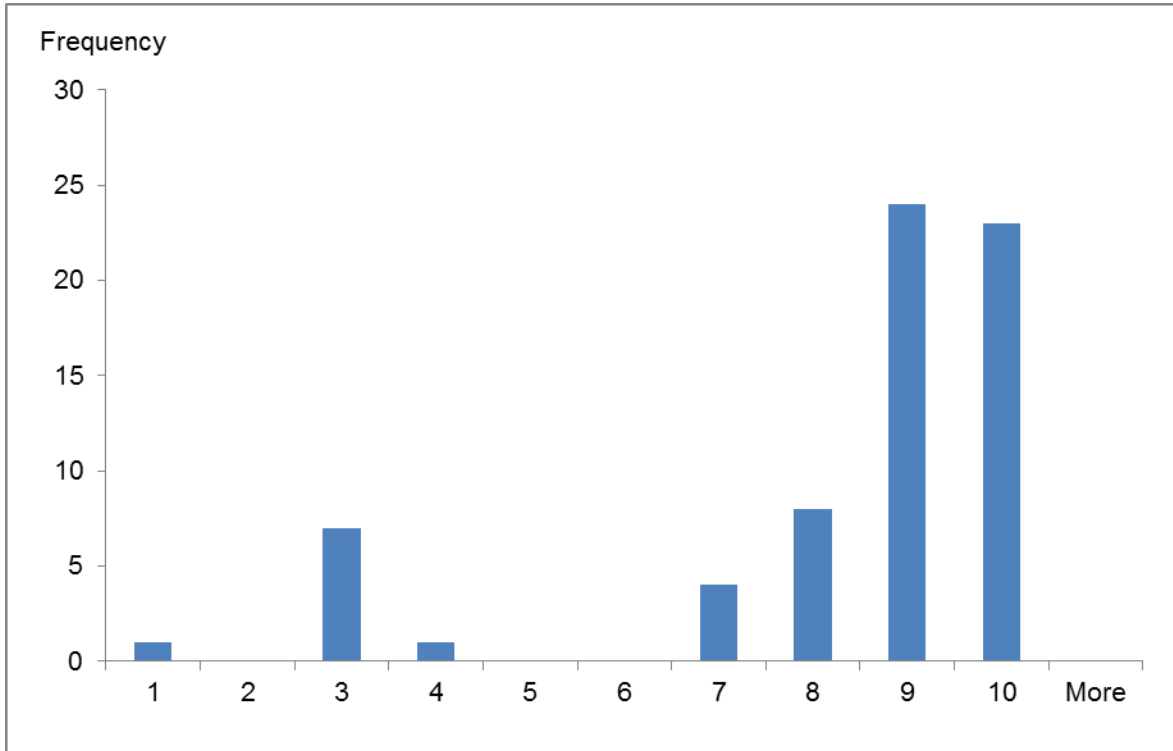
### Data Quality

417. The Authority acknowledges SEC's submission in relation to the quality and relevance of the yield data with reference to the BVAL score. The Authority has no reason to believe that there is a systematic relationship between an observation's BVAL score and reported yield. As long as there is no reason to suspect that prices with low BVAL scores (for example less than 5) are introducing significant bias into the estimation process, there is no reason to exclude them. This assumption for the estimates is tested below.
418. If it were shown that observations with low BVAL scores were consistently distributed above or below the Authority's estimated curves, it may be the case that the lower quality observations are biasing the estimates. In these circumstance the extent of any bias introduced by included BVAL scores would need to be evaluated.
419. An inspection of the proportion and distribution of Bloomberg bond yields with a low BVAL rating (less than five) for each of the three curves estimated is provided below.

<sup>137</sup> For purposes of robustness, the Authority relaxed the criteria of excluding bond with less than 50 per cent of observations which resulted in the inclusion of 2 additional bonds both with maturities of 4.96 years. One had 17 observations and the other 18 observations up to 30 June 2015.

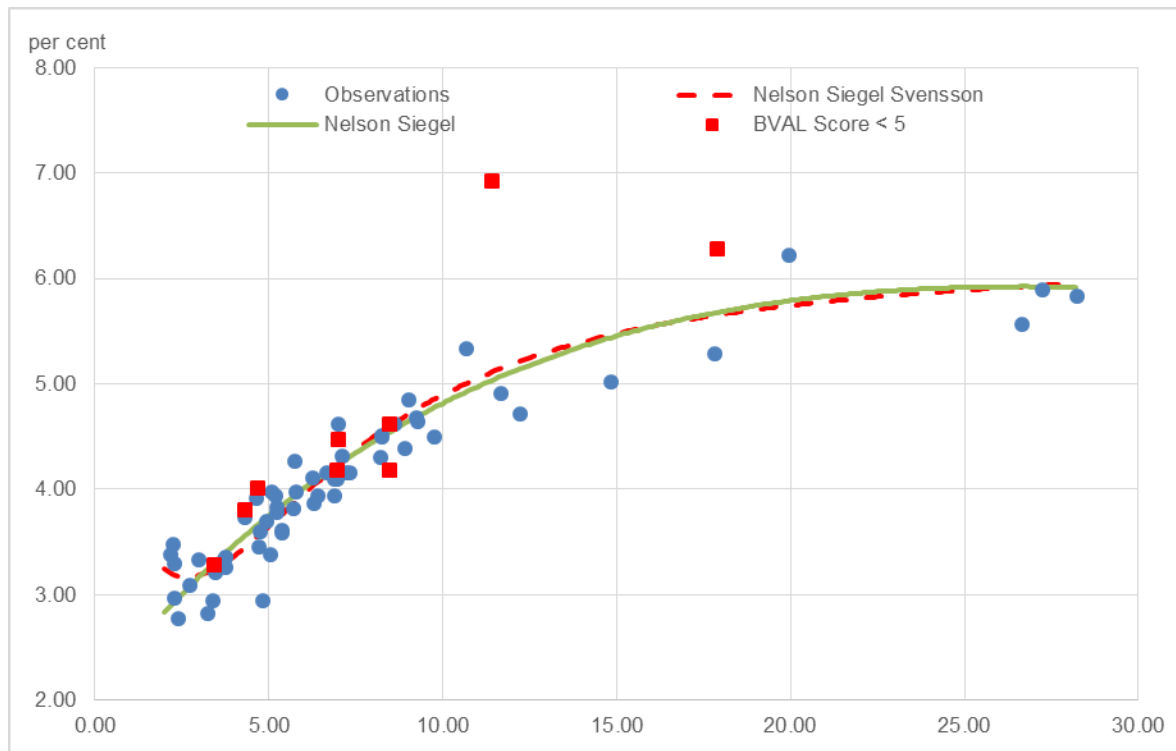
420. In the A+/A/A- band, 59 of the 68 observations have a BVAL score of seven or higher, with nine being the most common score. This indicates that the majority of the yield observations in estimating the A+/A/A- rated curve are considered to be of good quality by Bloomberg.

**Figure 10** Distribution of A+/A/A- Sample BVAL Scores



Source: ERA Analysis, Bloomberg

421. Of the 68 observations in the A+/A/A- sample, nine had a BVAL score less than five. Six of the nine observations are distributed above the fitted curves with some significantly above the curves at the longer end as shown in Figure 11.

**Figure 11 Low BVAL Score Distribution around A+/A/A- Curve**

Source: ERA Analysis, Bloomberg.

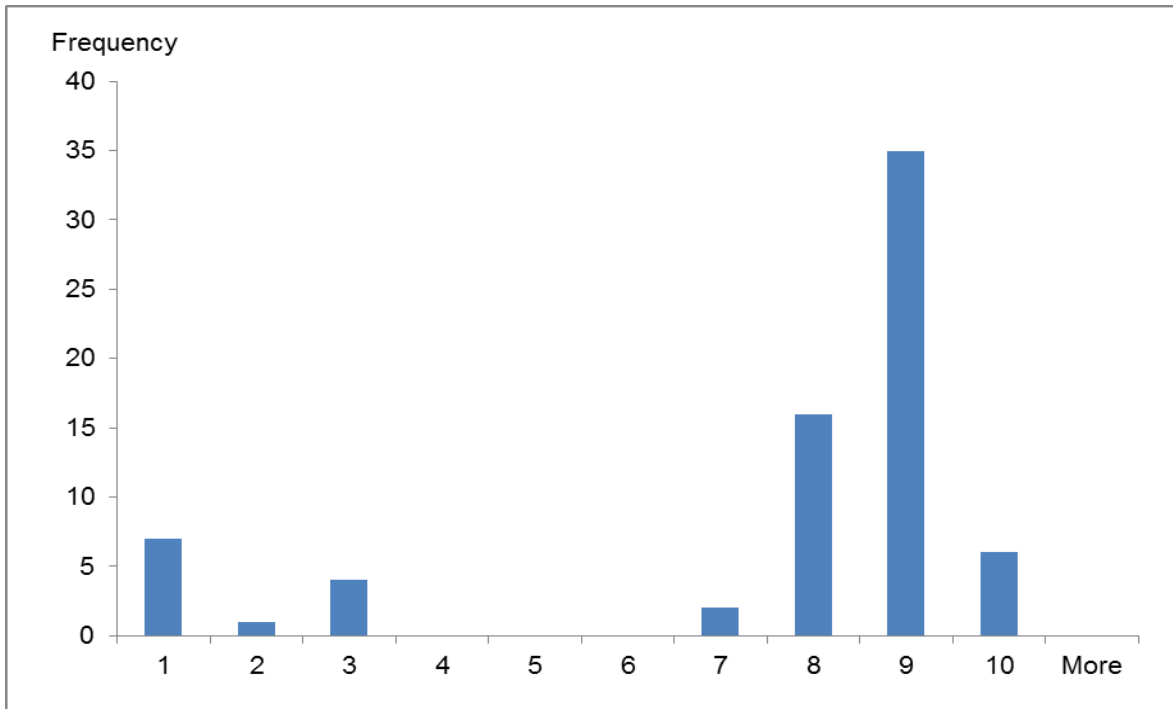
422. The curve was re-estimated, excluding the nine BVAL scores that are below five. The results are shown in Table 23.

**Table 23 A+/A/A- Rating Estimates excluding observations with low BVAL score**

Method	Yield (per cent)
RBA Gaussian Kernel May-June 2015 Average	4.551
RBA Gaussian Kernel May-June 2015 Extrapolated to 10 years	4.729
ERA Gaussian Kernel	4.601
ERA Gaussian Kernel with 10 Year Weighted Tenor Correction	4.733
ERA Nelson-Siegel	4.757
ERA Nelson-Siegel Svensson	4.814
Average of all 3 ERA Methods	<b>4.768</b>

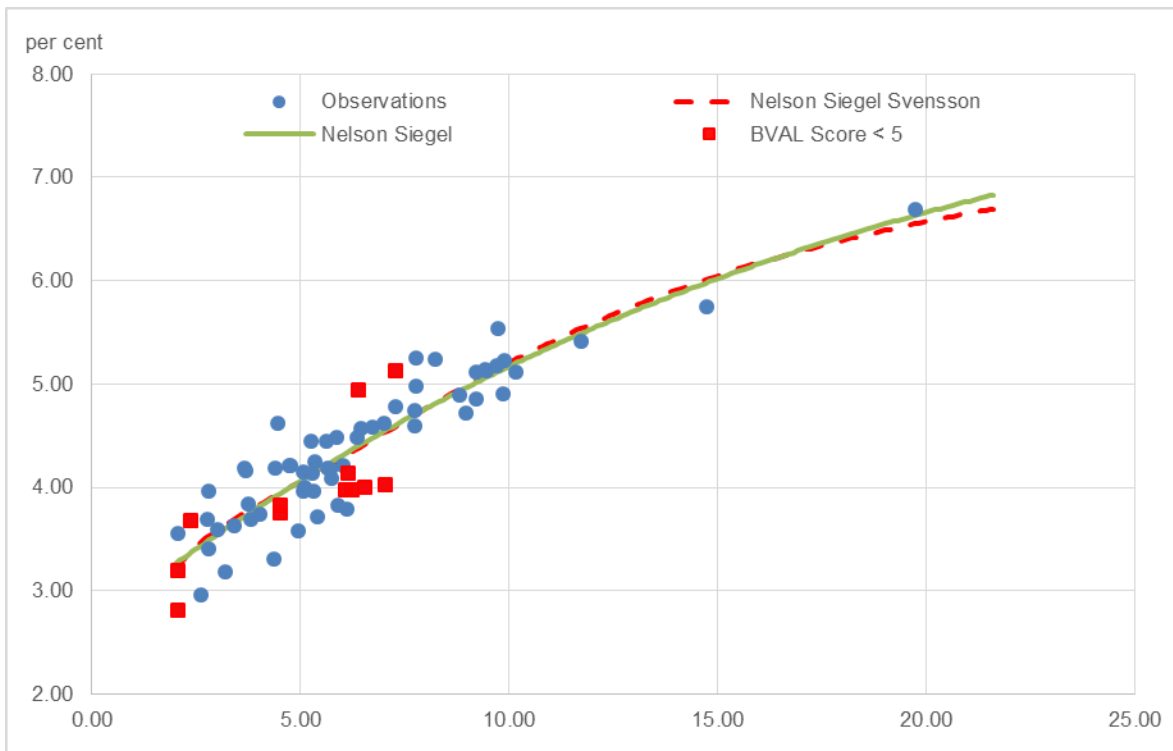
Source: ERA Analysis, Bloomberg

423. Excluding the BVAL estimates with a low score reduces the estimate based on all three methods by 12 basis points. This tends to indicate that the lower quality data (as indicated by Bloomberg's BVAL score) was upwardly biasing the estimate. This estimate is still likely to be too high to reflect a pure A band rating (due to the over-representation of A- bonds discussed in paragraph 410). Despite this, the estimate of 4.768 per cent excluding the low BVAL scores is a robust starting point from which a pure A rated cost of debt estimate can be inferred. This is taken into consideration in the Final Decision.

**Figure 12** Distribution of BBB+/BBB Sample BVAL Scores

Source: ERA Analysis, Bloomberg

424. In the BBB+/BBB rated band 59 of the 71 observations have a BVAL score of seven or higher, with nine being the most common score. This indicates that the majority of the yields observations in estimating the BBB+/BBB rated curve are considered to be of good quality by Bloomberg.

**Figure 13** Low BVAL Score Distribution around BBB+/BBB Curve

Source: ERA Analysis, Bloomberg

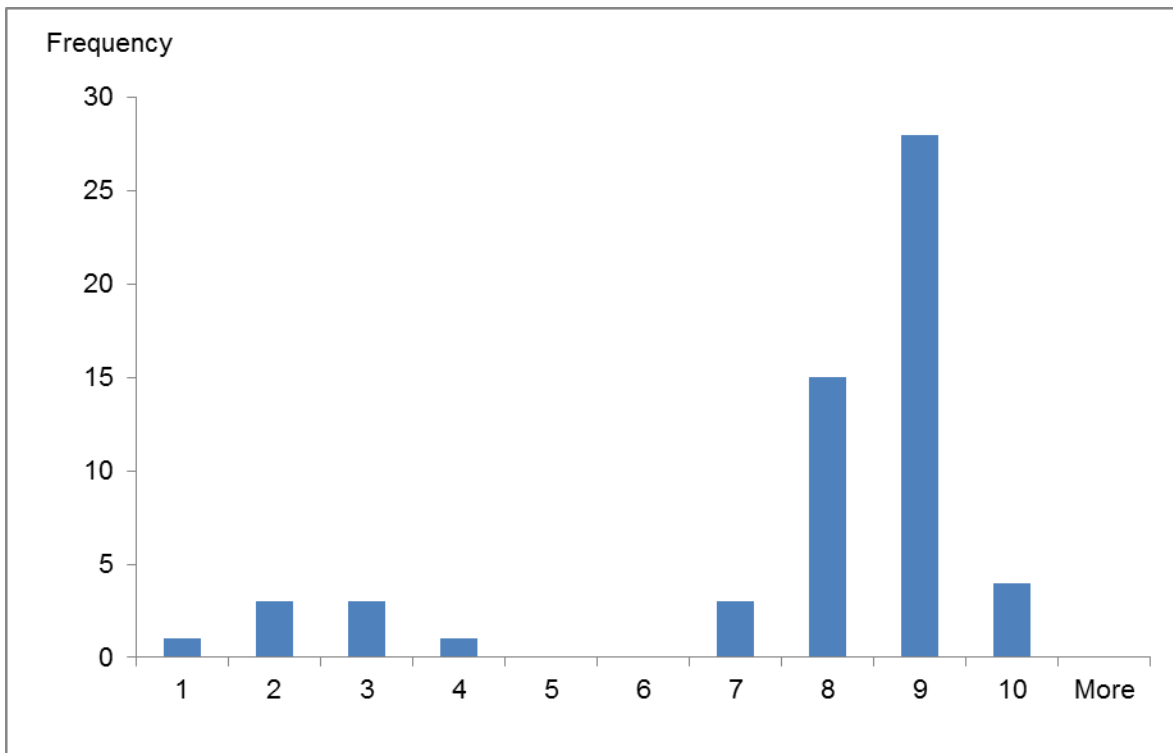
425. Figure 13 indicates that the observations with a low BVAL score are fairly evenly distributed on either side of the curve and so it is unlikely that the inclusion of the observations with BVAL scores less than five are introducing any significant bias. The three method estimate of 5.259 for the BBB+/BBB sample per cent therefore appears to be a robust starting point from which a BBB+ estimate can be inferred. This is taken into consideration in the Final Decision.

**Table 24** BBB+/BBB Rating Estimates excluding observations with low BVAL score

Years	10
RBA Gaussian Kernel (BBB Band May-June Average 2015)	5.175
	5.290
ERA Gaussian Kernel	5.155
ERA Gaussian Kernel with 10 Year Weighted Tenor Correction	5.261
ERA Nelson-Siegel	5.248
ERA Nelson-Siegel Svensson	5.277
Average of all 3 ERA Methods	5.262

Source: ERA Analysis, Bloomberg

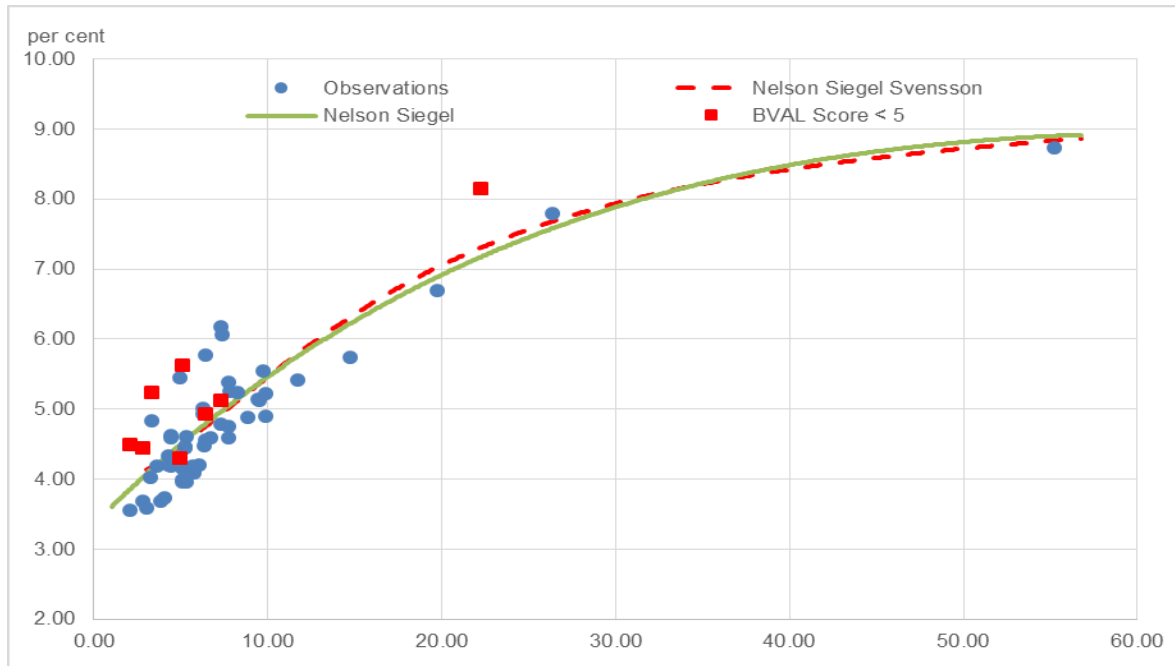
426. To address SEC's concerns relating to the reliability of the data in the Brookfield cost of debt estimate, the 10 year cost of debt on the BBB+/BBB sample has been re-estimated excluding the observations with a BVAL score less than five with the results shown in Table 24. The difference between the original BBB+/BBB estimate (5.259 per cent) and the estimate excluding low BVAL score observations (5.262 per cent) is less than one basis point, indicating that the original estimate was fairly robust to the inclusion of the low scoring data. The estimates including the low BVAL scores (hence having a larger sample) will therefore be used as a robust starting point to infer a BBB+ cost of debt in the Final Decision.

**Figure 14** Distribution of BBB/BBB- Sample BVAL Scores

Source: ERA Analysis, Bloomberg.

427. The BBB/BBB- sample contains 50 observations with a BVAL score of seven or higher, again with nine being the most common score. Eight observations had a score of less than five. This indicates that the majority of the observations in the BBB/BBB- sample are considered to be of good quality by Bloomberg.



**Figure 15 Low BVAL Score Distribution around BBB/BBB- Curve**

Source: ERA Analysis, Bloomberg.

428. Figure 15 indicates that the low observations tend to be distributed on the upper side of the curve and so it is likely that the inclusion of the observations with BVAL scores less than five are introducing an upward bias.

**Table 25 BBB/BBB- Rating Estimates excluding observations with low BVAL score**

Years	10
RBA Gaussian Kernel ( <b>BBB Band</b> May-June 2015)	5.175
RBA Gaussian Kernal (BBB Band May-June 2015) Extrapolated to 10 years	5.290
ERA Gaussian Kernel	5.266
ERA Gaussian Kernel with 10 Year Weighted Tenor Correction	5.341
ERA Nelson-Siegel	5.468
ERA Nelson-Siegel Svensson	5.441
Average of all 3 ERA Methods	<b>5.416</b>

Source: ERA Analysis, Bloomberg.

429. The BBB/BBB- curve was re-estimated without the low BVAL observations with the results shown in Table 25. The three method average estimate is 5.416 per cent which is marginally lower (around six basis points) than the BBB/BBB- estimate (5.472 per cent) that includes the observations with a low BVAL score. This tends to indicate that the original BBB/BBB- estimate was not considerably biased by the inclusion of observations with a BVAL score less than five. The distribution of observations with low BVAL scores, however, indicates that the estimate of 5.416 per cent excluding the observations is a preferable benchmark from which the BBB- cost of debt can be inferred for the Final Decision.

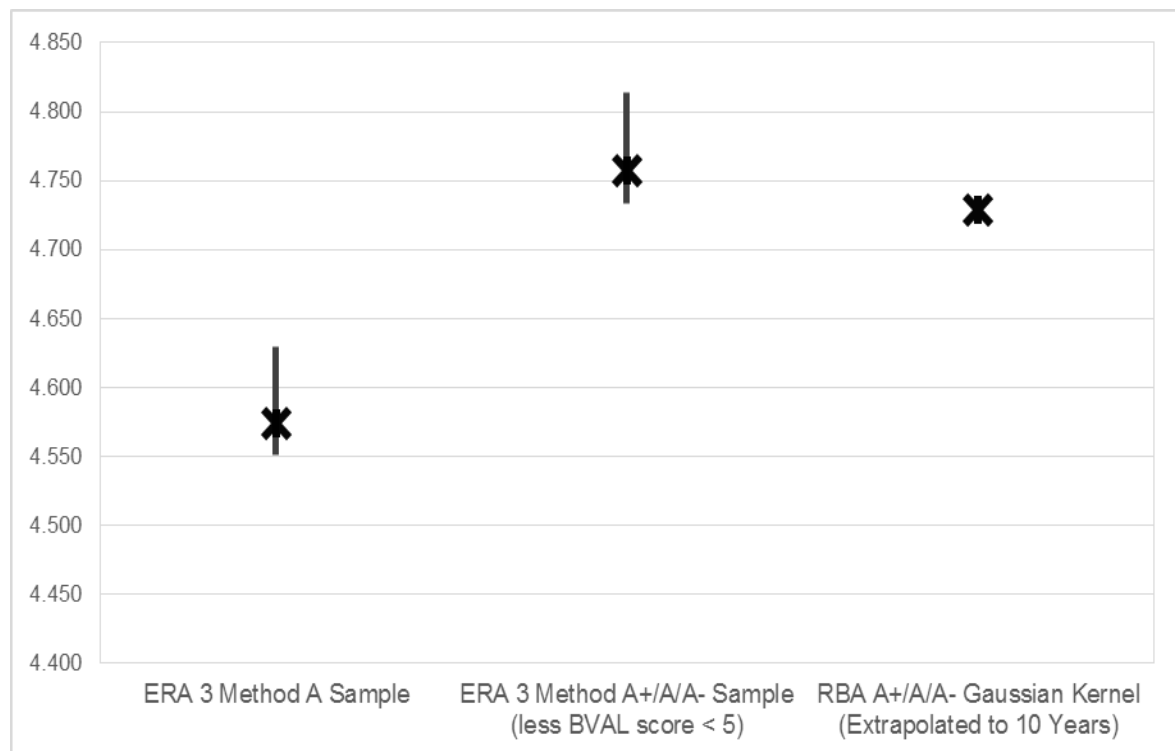
## 9.5 Final Decision

430. As highlighted by SEC, the sample based on the narrowly defined credit notches may restrict the sample size, such that estimates may not be robust. This has led the Authority to expand the sample by including additional credit rating notches within the broader band for each benchmark credit rating. Additionally, concerns were raised in relation to the reliability of the data in the absence of any filtering on the basis of the observations' Bloomberg BVAL scores which evaluate the quality of the pricing. Accordingly, the Authority has accounted for this in each of the expanded sample estimates. A comparison of results and a Final Decision for each determination is outlined below.

### 9.5.1 PTA

431. The results of the three estimation methods based on the (pure) A rated sample are shown in the first line plot in Figure 16. The top of the line plot indicates the highest of the three estimates, the bottom indicates the lowest estimate and the cross indicates the estimate that falls in between that of the two methods.

**Figure 16 A Rated Cost of Debt Estimates – Various Methods and Sources**



Source: ERA Analysis, Bloomberg, Reserve Bank of Australia data

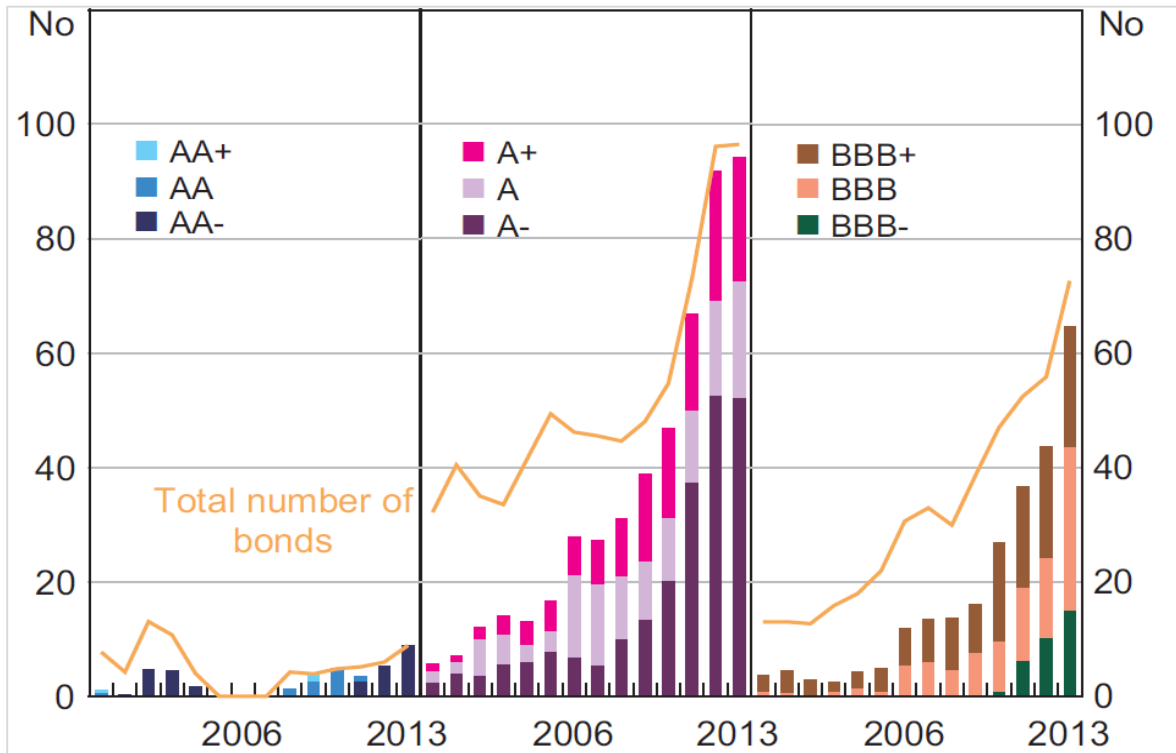
432. The estimates for the A+/A/A- sample excluding the low BVAL scoring observations are considered more robust and are shown in the second line plot line. As discussed in paragraph 410, the Authority notes that A- estimates are overrepresented in the sample and thus the estimates are expected to be upwardly biased from the true (but unknown) pure A rated cost of debt.

433. For a third cross check an extrapolation of the RBA Gaussian kernel estimate is displayed for comparison.<sup>138</sup> The Authority expects this to be an over-estimate for

<sup>138</sup> This uses the average of June and July 2015 data.

the following two reasons. The term structure of the yield curves estimated in Figure 11, Figure 13 and Figure 15 is consistently concave (curved downward) meaning that the linear extrapolation on the RBA data is likely to an overestimate as outlined in paragraph 379 to 381. It is also possible that the RBA A rated (A+/A/A-) estimate is largely represented by A- bonds and is therefore subject to the same upward bias as the Authority's A+/A/A- estimates. A graphical analysis of the RBA's A rated sample in Figure 17 (middle panel) indicates that this is likely to be the case.<sup>139</sup> Still, the RBA estimate extrapolated to 10 years is lower than that of the Authority's A+/A/A- estimates.

**Figure 17 RBA Analysis of Average Number of Valid Securities by Credit Rating**



Source: Reserve Bank of Australia, 'New Measures of Australian Corporate Credit Spreads', Bulletin, December quarter 2013

434. The Authority therefore considers that a cost of debt estimate between the top of the A sample line plot (4.630 per cent) and the RBA Gaussian kernel estimate extrapolated to 10 years (4.729) is appropriate. Given the potential upward bias in the extrapolated estimate discussed, the determination for the cost of debt should be toward the lower of these two estimates. The Authority therefore determines that the (pure) A rated cost of debt that is to be applied in the cost of capital determination for the Public Transport Authority is 4.630 per cent.
435. Given the 10 year risk free rate of 2.97 per cent, the estimate of the DRP for PTA is 1.660 per cent.

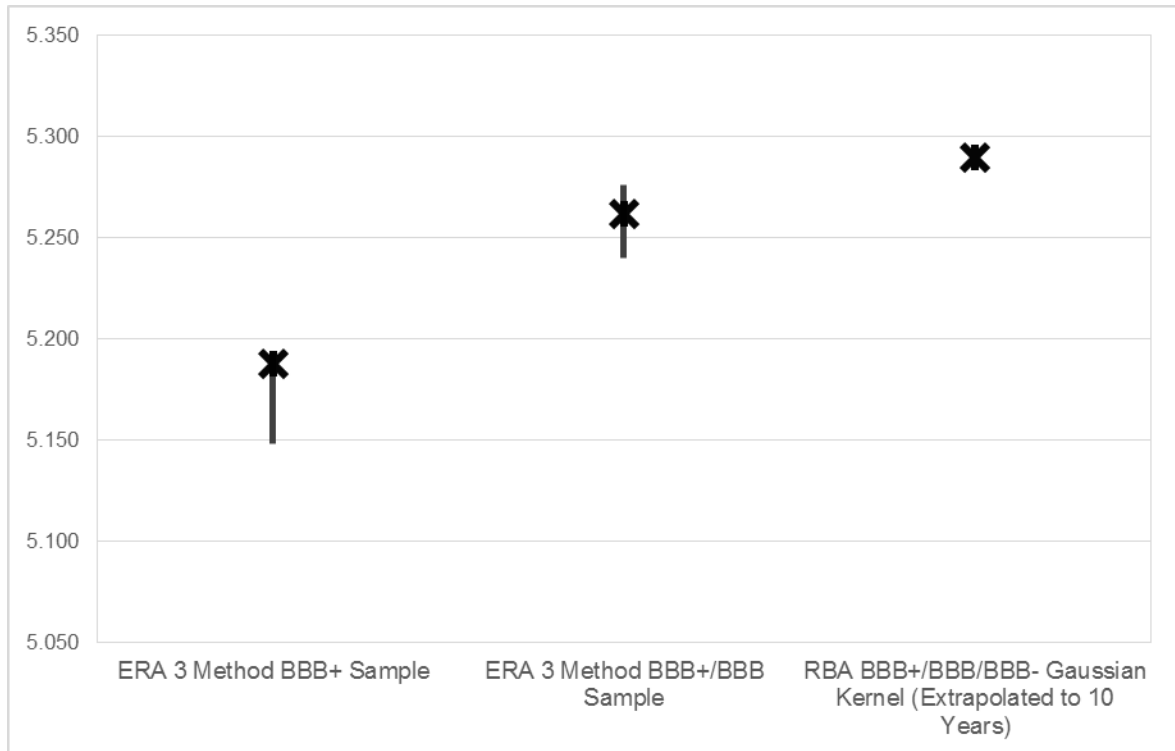
### 9.5.2 Brookfield

436. The results of the three estimation methods based on the (pure) BBB+ rated sample are shown in the first line plot in Figure 18. Again, the top of the line plot indicates

<sup>139</sup> I. Arsov, M. Brooks and M. Kosev, Reserve Bank of Australia, 'New Measures of Australian Corporate Credit Spreads', Reserve Bank of Australia Bulletin December, 2013, p. 18.

the highest of the three method estimates, the bottom indicates the lowest estimate and the cross indicates the estimate that falls in between that of the two methods. The Authority notes that two of the methods produce estimates that are very close together and are toward the top of the line plot, suggesting more weight should be given to the upper end of the range.

**Figure 18** BBB+ Rated Cost of Debt Estimates – Various Methods and Sources



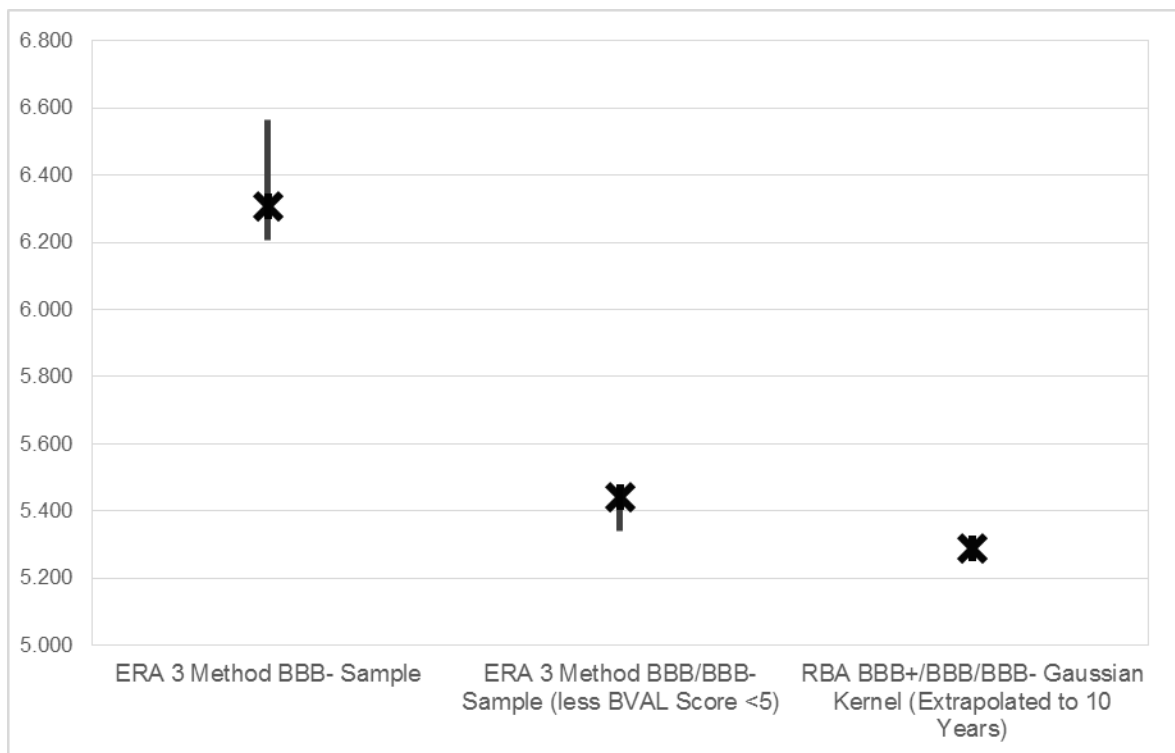
Source: ERA Analysis, Bloomberg, Reserve Bank of Australia data

437. The estimates for the BBB+/BBB sample are considered more robust (due to a higher sample size) and are shown in the second line plot line. As discussed in paragraph 413, the equal weighting of BBB+/BBB estimates in the sample is expected to significantly upwardly bias the estimate above that of true (but unknown) BBB+ cost of debt. As would be expected, the RBA BBB rated (BBB+/BBB/BBB-) estimate extrapolated to 10 years is above all of the Authority's estimates based on the more highly rated instruments and so suggests the Authority's results are sensible.
438. Based on the above reasoning, the Authority expects the most appropriate estimate for the BBB+ cost of debt lies between the top of the BBB+ line plot (5.193 per cent) and bottom of the BBB+/BBB line plot (5.240 per cent). The coincidence of the two estimates toward the top of the BBB+ line plot and the upward bias from the inclusion of the lower rated BBB plus instruments in the BBB+/BBB line plot lead the Authority to conclude that the BBB+ cost of debt determination should lie only marginally above or even be 5.193 per cent. The Authority therefore determines that the (pure) BBB+ rated cost of debt to be applied in the cost of capital for determination for Brookfield is 5.193 per cent.
439. Given the 10 year risk free rate of 2.97 per cent, the estimate of the DRP for Brookfield Rail is 2.223 per cent.

### 9.5.3 TPI

440. The results of the three estimation methods based on the (pure) BBB- rated sample are shown in the first line plot in Figure 19. Again, the top of the line plot indicates the highest of the three method estimates, the bottom indicates the lowest estimate and the cross indicates the estimate that falls in between that of the two methods. The Authority notes that there was around 9 to 26 basis points difference between each of the estimates which is a greater variance between estimates than for the other credit ratings. This likely reflects the limited availability and thus smaller samples of BBB- bonds and greater variation typically seen in the yields of less traded lower grade instruments, emphasizing the need for a greater number of observations.

**Figure 19** BBB- Rated Cost of Debt Estimates – Various Methods and Sources



Source: ERA Analysis, Bloomberg, Reserve Bank of Australia data

441. The estimates for the BBB/BBB- sample excluding the observations with a BVAL score below five are considered to be more robust and are shown in the second line plot line. As discussed in paragraph 416, the Authority notes that the substantial overweighting of BBB estimates in the sample are expected to significantly downward bias the estimate below that of the true BBB- cost of debt. Further, as expected, the RBA BBB rated (BBB+/BBB/BBB-) estimate extrapolated to 10 years is below all of the Authority's estimates based on the inclusion of higher (credit) rated instruments and so, as a cross check, confirms the Authority's results are sensible.

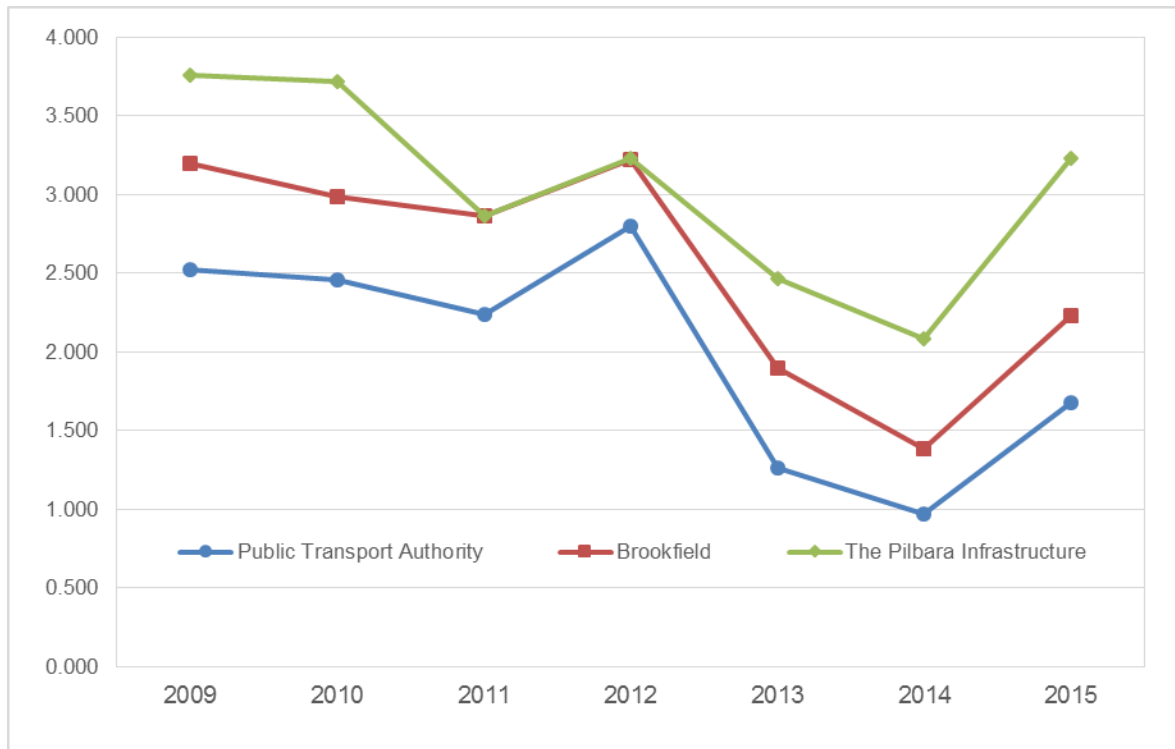
442. The Authority expects that the BBB- cost of debt should be toward the bottom of the BBB- plot line (6.204 per cent). This is because two of the three estimates are closer to the bottom end than the higher end. The determined cost of debt should also be substantially above the BBB/BBB- sample plot line due to the prevalence of higher rate BBB bonds in the BBB/BBB- sample. The Authority therefore determines an estimate of 6.204 per cent to be appropriate for application in the cost of capital determination for The Pilbara Infrastructure.

443. Given the 10 year risk free rate of 2.97 per cent, the estimate of the DRP for TPI is 3.234 per cent.

### 9.5.4 Comparison of determinations across time

444. A comparison of all three determinations, on a DRP basis, is shown in Figure 20.

**Figure 20 Comparison of Rail WACC Determinations: Debt Risk Premium Basis**



Source: ERA Analysis, Bloomberg

445. The first thing to note is the increase in all three premiums since 2014. As discussed in paragraph 406, the revised bond yield approach results in estimates representing an effective tenor of 10 years compared to the previous approach which tended to have estimates with an effective tenor of around 5 years. Given that the yield curve is typically upward sloping, this is expected to account for around 30 basis points of the increase. Another factor driving the increase is the heightened levels of volatility and risk seen in global financial markets stemming from the re-emergence of the Greek debt crisis and Chinese stock market crash over the June-July 2015 period.

446. The second thing to note is what appears to be a disproportionate increase in the TPI debt risk premium relative to Brookfield and PTA. The Authority notes that it is not unusual for lower grade bonds to experience a proportionally greater drop in price (increase in yields) relative to higher grade bonds. Increased volatility and risk in financial markets often result in relatively higher demand for quality debt and conversely lower demand for low quality debt.

447. In light of these considerations the Authority views its cost of debt/debt risk premium estimates for all three service provider to be sensible.

## 10 Return on equity

448. There are no readily observable proxies for the expected return on equity. Estimating a forward-looking return on equity – sufficient to provide regulated firms with reasonable opportunity to recoup their prevailing equity financing costs – requires the use of models. Generally, these models seek to explain the required return on equity through a relationship with some ‘portfolio’ of risk factors, or else in terms of the present value of the expected stream of future cash flows.
449. In this chapter, the Authority sets out the approach which it will use for estimating the return on equity. The chapter also identifies the points at which the Authority considers it may need to draw on its judgment when determining the return on equity. The approach follows that developed for the recent Authority’s gas access decisions.<sup>140</sup>

### 10.1 Current approach

450. The Authority has in previous WACC determinations under the Code applied the Sharpe Lintner Capital Asset Pricing Model (**CAPM**) to estimate the cost of equity. For the 2008 review, the Allen Consulting Group recommended that the Authority continue to apply this method, for reason that it is uniformly applied by Australian economic regulators and was broadly accepted by regulated businesses.
451. For the treatment of taxation, the Authority determined and applied pre-tax rates of return, informed by the insights of the Officer/Monkhouse CAPM model relating to returns to equity in the presence of tax imputation credits.

### 10.2 Revised Draft Decision

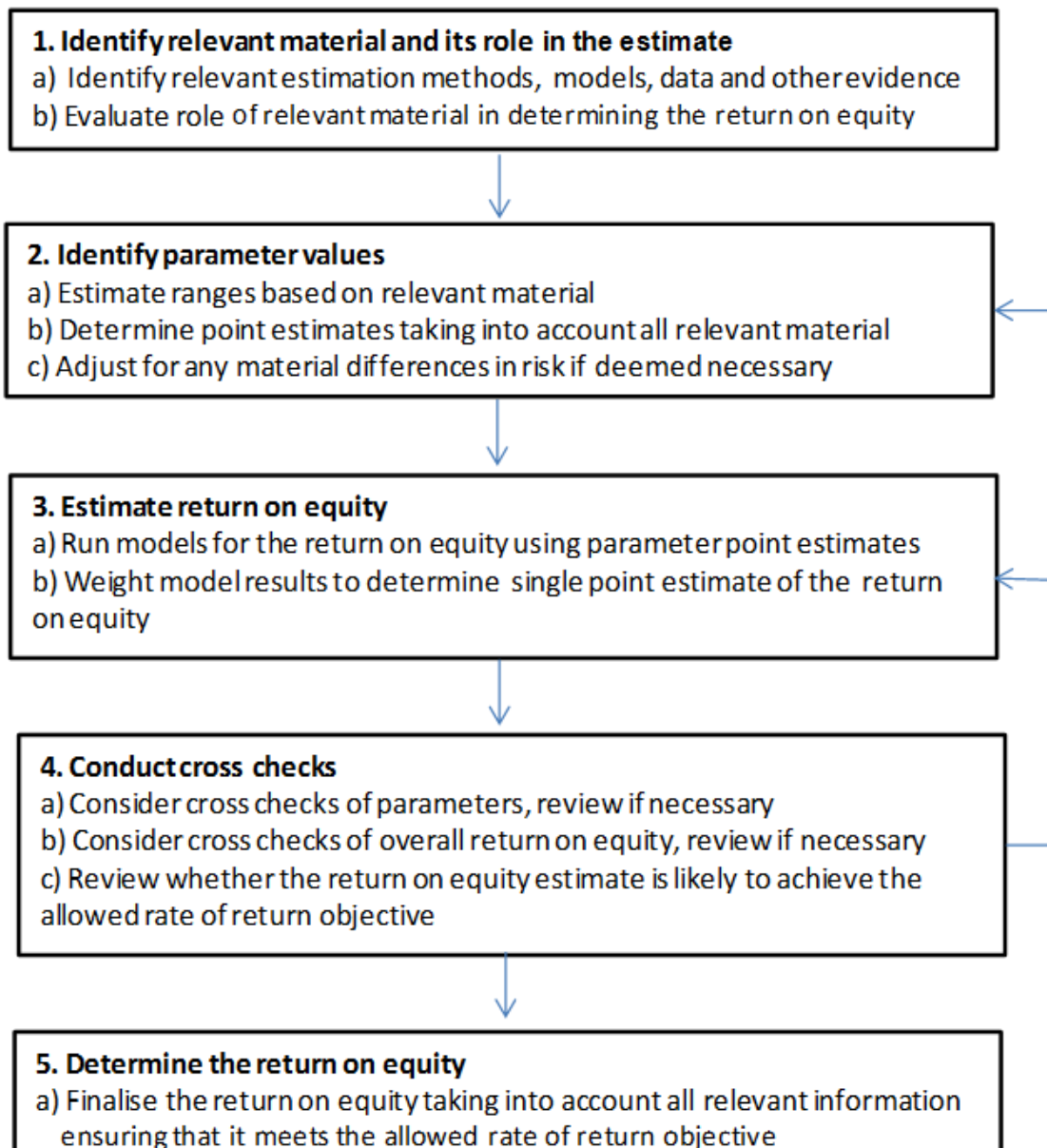
452. The Authority in the Revised Draft Decision determined to adopt a single point estimate for the forward looking return on equity for the benchmark firm.
453. Where there are multiple relevant estimation methods, financial models, market data and other evidence informing the return on equity, then the Authority determined to combine these to form ranges for relevant inputs. The Authority recognised that it may be appropriate in some circumstances to adopt a formal weighting approach for each estimation method or model, for the purpose of determining the range.
454. Where the return on equity is derived as a range, then the Authority determined to utilise other relevant information, and its judgment, to determine a single point estimate for the return on equity.
455. Similarly, parameter estimates contributing to the relevant estimation methods or models may initially be estimated as ranges, or derived directly as a point estimate. Where parameter estimates are derived as ranges, the Authority determined to utilise other relevant information and its judgment to determine a single point estimate for input to relevant estimation methods and models.

<sup>140</sup> See Economic Regulation Authority, *Explanatory Statement for the Rate of Return Guidelines: Meeting the Requirements of the National Gas Rules*, 16 December 2013 and Economic Regulation Authority, *Final Decision on Proposed Revisions to the Access Arrangement for the Mid-West and South-West Gas Distribution Systems*, 30 June 2015.



456. Finally, the Authority determined to adopt a five step approach for estimating the return on equity. The five steps are summarised in Figure 21. This approach will allow the Authority to have regard to a wide range of material, taking account of relevant models for the return on equity, as well as a range of other relevant information. The Authority will give weight to each piece of information according to its merits at the time of each determination. This will enable it to provide a transparent and clear decision that meets the objectives and requirements of the *Railways (Access) Act 1998* and the Code.

**Figure 21 Approach to estimating the return on equity**



## 10.3 Submissions

457. The Authority received four submissions in response to its Draft Decision.

### 10.3.1 The Pilbara Infrastructure

458. Based on advice from HoustonKemp Economists (**HoustonKemp**), TPI submitted that the ERA's Revised Draft Decision on the regulated WACC for TPI is appropriately constructed and methodologically rigorous.<sup>141</sup> In particular, HoustonKemp considered that the Authority:<sup>142</sup>
- adopted an estimate of the real pre-tax WACC that is of a standard form well accepted by Australian jurisdictional economic regulators;
  - applied well-recognised and widely adopted methods for estimating the required return on debt and equity;
  - estimated industry/business specific WACC parameters through a logical and well-reasoned assessment of comparator benchmarks; and
  - estimated WACC parameters that are common to the wider market in a manner consistent with the requirements of the Railways (Access) Code.
459. HoustonKemp submitted that while the CAPM adopted by the Authority is the principal financial model used by all Australian jurisdictional regulators, regard should be given to a wide range of financial models in estimating the cost of equity, such as the Fama-French three-factor model, and the Dividend Growth Models. HoustonKemp argued that having regard to a wider, rather than a narrower, body of relevant information must improve the quality of any estimates of required return on equity.<sup>143</sup>

### 10.3.2 CBH

460. Frontier Economics, CBH's consultant on the WACC issue, responded to the Authority's Revised Draft Decision in relation to the meaning of a 'long term' WACC, consistent with the requirements of the Railways Access Code.
461. Frontier Economics argues that the Authority should determine 'long term' to mean 10 years, and then adopt the approach used by the Australian Energy Regulator (**AER**) to estimate a 10 year WACC. In addition, Frontier argued that the methodology is quite consistent with the methodology employed by the Authority in its gas decision and was of the view that such an approach would have the benefit of harmonising, and making the gas and rail decisions more consistent. Frontier argued that some elements of the Authority's WACC (such as the risk-free rate) already have a 10 year term assumption, this approach would achieve consistency between all elements of the WACC by ensuring that all the elements (including the Market Risk Premium) are defined and estimated on the basis of a 10 year term assumption.<sup>144</sup>

<sup>141</sup> The Pilbara Infrastructure Pty Ltd, 2015, *Submission to Revised Draft Decision of Weighted average cost of capital methodology for regulated railway networks*, 20 February 2015, p. 1.

<sup>142</sup> HoustonKemp Economists, 2015, *Weighted Average Cost of Capital (WACC) for the TPI network*, a report prepared for The Pilbara Infrastructure Pty Ltd, 20 February 2015, p. 1.

<sup>143</sup> HoustonKemp Economists, 2015, *Weighted Average Cost of Capital (WACC) for the TPI network*, a report prepared for The Pilbara Infrastructure Pty Ltd, 20 February 2015, p. 3.

<sup>144</sup> Frontier Economics, 2015, *A submission on the ERA's Revised Draft Decision on the WACC method for Brookfield Rail*, a report prepared for CBH, February 2015, p. v.

### 10.3.3 Brookfield Rail

462. Brookfield Rail engaged Synergies Economic Consulting (**Synergies**) to provide an expert's advice in relation to an estimate of the return on equity in response to the Authority's Draft Decision.
463. Synergies submitted that if sole reliance is to be placed on the SL CAPM model, then greater consideration needs to be given to other models, estimation methods and evidence, including the Black CAPM, the Fama French model, the Dividend Discount Model, the Wright approach and relevant independent expert reports.<sup>145</sup>
464. Synergies also commented on how the estimates from these different models and evidence should be taken into consideration. Synergies argued that if the estimates are widely dispersed (above and below the CAPM), then it may be no better off. However, Synergies argued if the other estimates cluster within a smaller range and/or are consistently above or below the CAPM estimate, this should prompt a review of the CAPM estimate.<sup>146</sup>
465. Synergies submitted that more weight should be placed on the evidence presented by NERA – referenced by the Authority – that the Brailsford, Handley and Maheswaran estimates overstated the Lamberton adjustment, resulting in a downward bias.<sup>147</sup>
466. Synergies also submitted that decisions by overseas regulators on market-based parameters should not be referred to at all. Synergies argued that rates of return cannot be directly compared across different markets, even if they are specified in real terms. Synergies considered that recognising the integration of global capital markets that has occurred, all of the inputs in the CAPM will still be heavily influenced by domestic market conditions.<sup>148</sup>

### 10.3.4 Brockman Mining Australia

467. Brockman Mining Australia (**Brockman**) responded to the Authority's Draft Decision on return on equity in relation to the term of the WACC.
468. Referring to the Authority's reasoning in the ATCO Draft Decision, Brockman argued that the WACC term that would be relevant to any commercial negotiations between TPI and access seekers would be the term of any access agreement. In addition, Brockman submitted that TPI's parent seems to arrange its debt finance using five year cycles, so its debt capital has a five year term.<sup>149</sup>

<sup>145</sup> Synergies Economic Consulting, 2015, *Review of the Method for Estimating the WACC for the Freight and Urban Railway Networks*, a report prepared for Brookfield Rail, February 2015, p. 6.

<sup>146</sup> Synergies Economic Consulting, 2015, *Review of the Method for Estimating the WACC for the Freight and Urban Railway Networks*, a report prepared for Brookfield Rail, February 2015, p. 6.

<sup>147</sup> Synergies Economic Consulting, 2015, *Review of the Method for Estimating the WACC for the Freight and Urban Railway Networks*, a report prepared for Brookfield Rail, February 2015, p. 7.

<sup>148</sup> Synergies Economic Consulting, 2015, *Review of the Method for Estimating the WACC for the Freight and Urban Railway Networks*, a report prepared for Brookfield Rail, February 2015, p. 7.

<sup>149</sup> Brockman Mining Australia, *Submission in response to the Economic Regulation Authority Western Australia Review of the method for estimating the Weighted Average Cost of Capital for the Regulated Railway Networks*, 2015, p. 5.

469. However, Brockman acknowledged that there may be some tension between (a) the Code requirement for the Authority to produce a long-term estimate, and (b) the practical reality that access arrangements are unlikely to have parameters fixed for very long terms. Brockman argued that this tension can be reconciled by considering 10 years to represent the 'long term' and then estimating required returns over the next 10 years.<sup>150</sup>
470. Brockman requested the Authority reconsider its assumption that the appropriate term for the WACC is 10 years.<sup>151</sup>

## 10.4 Considerations of the Authority

471. The Authority considers that, in estimating the return on equity, regard needs to be given to relevant estimation methods, financial models, market data and other evidence. The question then arises as to which of the possible alternative estimation methods meet the broader requirements of the object of the *Railways (Access) Act 1998* and the Code.

### 10.4.1 Theoretical considerations for determining the return on equity

472. The estimate of the rate of return on equity is required to be forward looking; investors make investments based on their expectations of the stream of net cash flows that those investments will generate over the future period. This leads to a number of considerations.
473. First, the equity investor is principally concerned with the risks relating to the expected future stream of net cash flows. If an investor could expect to achieve the same return elsewhere at lower risk, then it would be irrational to invest in the regulated asset, as the expected present value would be lower than for the alternative investment. The efficient rate of return should just compensate the investor for the additional risk of holding the asset, over and above the 'risk free' asset. This is the key insight of the Markowitz portfolio theory, as well as of the CAPM.<sup>152</sup>
474. However, only systematic risks are compensated in the return on equity. Specifically, the exposure of the asset to systematic risks will drive the covariance of the return of the specific asset with respect to the variance of the returns on the overall market for securities.
475. Non-systematic or 'idiosyncratic' risks for the return on equity may be diversified away. Where idiosyncratic risks influence the variance of the expected returns to the asset, then this may be exactly offset through holding other assets in the efficient market portfolio with corresponding offsetting risk and variance.

<sup>150</sup> Brockman Mining Australia, 2015, *Submission in response to the Economic Regulation Authority Western Australia Review of the method for estimating the Weighted Average Cost of Capital for the Regulated Railway Networks*, page 5.

<sup>151</sup> Brockman Mining Australia, 2015, *Submission in response to the Economic Regulation Authority Western Australia Review of the method for estimating the Weighted Average Cost of Capital for the Regulated Railway Networks*, page 6.

<sup>152</sup> Brealey R.A. and Myers S.C., *Principles of Corporate Finance*, McGraw Hill, 1996, p. 173.

476. Second, estimates of the return on equity need to be based on the expected returns of securities with similar risks, as the actual risks of the underlying assets of any firm are rarely observable.<sup>153</sup> Provided that the risks of the underlying asset and the observed securities are similar, then the observed returns on equity from those securities should reflect the opportunity costs of investing in the underlying assets.
477. As discussed in Chapter 4, the Authority considers that the benchmark efficient entity needs to have a similar degree of risk as that which applies to the service provider in respect of the provision of the rail services. The Authority interprets a 'similar' degree of risk as allowing for reasonable differences in the degree of risk among firms informing the benchmark, which recognises the significant uncertainties in the risks and the associated confidence intervals.
478. Third, there is a need to consider prevailing conditions for the return on equity.<sup>154</sup> McKenzie and Partington succinctly capture the rationale for the need to consider prevailing conditions:<sup>155</sup>
- In principle then, what we first need to do is to measure the risk of the investment. We then discount the expected future cash flows from the investment at the *current* equilibrium expected return in the capital market, for securities with the investment's level of risk. The word 'current' is important here. In any required return calculation we should be using current values because if capital markets are efficient current values contain the best information available on future values. In particular historic values for the rate of return on equity, or interest rates, are not relevant *except* to the extent that they help us estimate the *current* rates. Since current interest rates are readily observable, historic interest rates typically have no place in determining the required rate of return. If the current interest rates differ from historic rates then there will have been windfall gains or losses that are already reflected in the current value of equity.
479. The prevailing return on equity will fluctuate. As noted in the recent paper outlining the reasons for the 2013 Nobel Prize award for economics, a range of evidence suggests that 'the volatility and predictability of stock, bond and foreign exchange returns can only be consistent with arbitrage-free [that is, efficient] markets if the expected return, i.e., the discount factor, is highly variable over time'.<sup>156</sup> The implication is that the expected return on equity is not constant through time.
480. However, the Authority's analysis for the gas Rate of Return Guidelines suggests that the return on equity is mean reverting, over the longer term.<sup>157</sup> It may be recalled that the Code requires that the term of the WACC be consistent with estimating the rate of return applicable over the economic life of the railway infrastructure.<sup>158</sup> The Authority notes the long economic life of the major rail infrastructure assets, which approach 50 years or more. The length of these lives means that it is reasonable to assume that the real return on equity will approach its long term average.

<sup>153</sup> McKenzie M. and Partington G., *Risk, Asset Pricing and the WACC*, Report to the AER, 2013, p. 6.

<sup>154</sup> NGR 87(7).

<sup>155</sup> McKenzie M. and Partington G., *Risk, Asset Pricing and the WACC*, Report to the AER, 2013, p. 6.

<sup>156</sup> The Royal Swedish Academy of Sciences, *Understanding Asset Prices*, 2013, p. 20.

<sup>157</sup> Economic Regulation Authority, *Appendices to the Explanatory Statement for the Rate of Return Guidelines*, 16 December 2013, Appendix 16 – Is the return on equity stable? The Authority's analysis in this reference to Appendix 16 relates the nominal return on equity. However, similar analysis on the same data set suggests that the real return on equity is also stationary over the long term.

<sup>158</sup> See paragraph 22 in section 2.1 of this draft decision for the requirements of clause 2 of schedule 4 of the Code.

481. The Authority will estimate the prevailing return on equity in a way that seeks to compensate investors for holding securities with similar risk of return as the regulated asset, over the term of the economic lives of the rail infrastructure assets. In what follows the Authority considers the tools that may be used to establish estimates for the prevailing rate of return on equity.

#### **10.4.2 Estimating the return on equity for regulated rail businesses**

482. The Authority maintains its position set out in the Revised Draft Decision that the five step approach for estimating the return on equity is adopted (see Figure 21 in section 10.2 above). Each of these steps is briefly presented in turn below.

##### **Step 1: identify relevant material and its role**

483. The range of models relevant estimation methods, financial models, market data and other evidence are identified for estimating the return on equity. For this Final Decision, models for the return on equity are considered in section 10.4.3 below.

##### **Step 2: estimate parameter point estimates**

484. Point estimates of the parameters to be used in the relevant return on equity models are developed by drawing on the range of relevant material. Where these estimated parameters are subject to uncertainty or to multiple estimation approaches, the estimates would be first configured as ranges.
485. Where there are multiple ranges for any particular parameter, these may be combined into a single range using judgment, giving an overall upper and lower bound for the parameter range.
486. Once parameter ranges are identified, the point estimates for parameters for use in the relevant models are determined from within the identified range. The Authority uses its judgment to develop the point estimate, informed by any relevant information, such as forward looking indicators.
487. The parameters in the Sharpe Lintner CAPM model are the risk free rate, the equity beta and the market risk premium (**MRP**).

##### *Risk free rate*

488. A point estimate is determined for the risk free rate based on the average of the 10-year CGS observed yields over a 40 day period just prior to the regulatory determination (refer to paragraph 81 and chapter 7). The Authority considers that a 10-year term for the risk free rate provides the longest possible term relating to the risk free rate, while still being reliable.

##### *Equity beta*

489. The point estimate of the equity beta is determined from within an estimated range, taking account of the range of estimates and other information such as the insights of the Black CAPM.
490. The Authority's estimates for equity beta for this Final Decision are set out in Chapter 12.



*Market risk premium*

491. The Authority is of the view that the MRP may vary in response to changes in the risk-free rate. The Authority considers that there is no evidence to support a consistent relationship between the two over the medium term to long term.
492. However, for the long term – consistent with the lives of rail infrastructure assets being considered here – the Authority considered in the Revised Draft Decision that the return on equity is mean reverting; the unconditional average return on equity provides a strong basis for the future average outcome in real terms. The corollary to this view is that, on average over the longer term, the MRP will offset changes in the real long term risk free rate. The result is an estimate of the real return on equity for the market that is consistent with longer term averages.<sup>159</sup>
493. However, the Authority has reviewed its position with regard to estimating the MRP. Other approaches will also be utilised for estimating the long term MRP (see Chapter 11 for the Authority’s determination of the long term MRP for this Final Decision).

**Step 3: Estimate the return on equity**

494. The third step involves applying each relevant model to determine a related point estimate for the return on equity (as noted above, only one model, the Sharpe Lintner CAPM, is considered relevant at the current time for estimating the return on equity for the regulated firm). The point estimates of the parameters relevant to each model, determined under Step 2, would be used as inputs.
495. The resulting range of point estimates would be weighted according to the Authority’s judgment of their performance at the time, and a combined single point estimate of the return on equity would be produced. This weighting step is not necessary at the current time, as the Sharpe Lintner CAPM is judged to be the only relevant model for estimating the return on equity.
496. The initial estimate of the return on equity using the revised rail WACC method is set out in section 10.4.4 below, illustrated with reference to the 2015 rail WACC update.

**Step 4: Consider other relevant material**

497. Checks informed by other relevant material will inform the reasonableness of the overall return on equity, and its ability to achieve the objectives and requirements of the *Railways (Access) Act 1998* and the Code.
498. Checks would include:
- estimates of the return on equity developed by other regulators and by market analysts, such as from independent expert reports related to takeover bids; and
  - ensuring that the return on equity exceeded the cost of debt, in recognition of the higher risk associated with equity investment.

<sup>159</sup> This is the so-called ‘Wright approach’. For further detail, see S. Wright, *Review of Risk Free Rate and Cost of Equity Estimates: A Comparison of UK Approaches with the AER*, 25 October 2012.



499. A summary of the Authority's cross-checks using the revised rail WACC method is set out in section 10.4.4 below, illustrated with reference to the 2015 rail WACC update

#### Step 5: Determine return on equity

500. Taking account of all relevant information and analysis, the Authority will make its final determination on the return on equity for the benchmark firm, ensuring that the return on equity meets the objectives and requirements of the *Railways (Access) Act 1998* and the Code.
501. A final estimate of the return on equity using the revised rail WACC method is set out in section 10.4.4 below, illustrated with reference to the 2015 rail WACC update.

### 10.4.3 Models for the rate of return

502. The Authority notes the submissions from TPI and CBH recommending the adoption of various models – including the Fama-French three-factor model and Dividend Growth Models – in conjunction with the Sharpe Lintner CAPM, to estimate the return on equity for rail businesses.
503. The Authority notes that it evaluated the relevance of the following materials for estimating the return on equity in the Rate of Return Guidelines, in terms of their ability to contribute to the achievement of the allowed rate of return objective:<sup>160</sup>
- the Sharpe Lintner Capital Asset Pricing Model (**CAPM**), as well as other asset pricing models in the CAPM 'family'; and
  - an extensive range of other models and approaches which seek to estimate the return on equity.
504. More recently, the Authority has concluded that the Sharpe Lintner CAPM, the Black CAPM and the Dividend Growth Model are relevant for informing the Authority's estimation of the prevailing return on equity for regulated gas firms.<sup>161</sup> To ensure consistency in its decisions, and informed by similar reasoning, the Authority will adopt the same broad framework for this Final Decision. The reasoning for this change is summarised in the following two sections.

#### 10.4.3.1 Relevant models for the return on equity

##### The Sharpe Lintner CAPM

505. Formally, there are three main components of the Sharpe Lintner CAPM for measuring the return on an asset: (i) the market risk premium (**MRP**), which is the return on the market portfolio in excess of the risk free rate of return, (ii) the beta risk  $\beta$ , which correlates the return on the specific asset, in excess of the risk free rate of return, to the rise and fall of the return on the market portfolio and iii) the risk free rate of return. The most common formulation of the CAPM directly estimates the required return on the equity share of an asset as a linear function of the risk free rate and a

<sup>160</sup> Economic Regulation Authority, *Appendices to the Explanatory Statement for the Rate of Return Guidelines*, 16 December 2013, Appendix 8.

<sup>161</sup> See Economic Regulation Authority, *Final Decision on Proposed Revisions to the Access Arrangement for the Mid-West and South-West Gas Distribution Systems*, 30 June 2015, p. 221.

component to reflect the risk premium that investors would require over the risk free rate:

$$E_t(R_i) = R_{F,t} + \beta_i \times MRP_t \quad (17)$$

Where

$E_t(R_i)$  is the return on asset  $i$ ;

$R_{F,t}$  is the risk free rate of return;

$\beta_i$  is equity beta; and

$MRP_t$  is the Authority's estimate of the forward looking market risk premium for the regulatory period.

506. The Authority notes that the above Sharpe Lintner CAPM equation represents a well-established approach to estimating the return on equity for the benchmark efficient entity. The Sharpe Lintner CAPM was developed from theory, the results are robust and the model is widely adopted by practitioners and academics for determining the return on equity.
507. The Authority also has considered criticisms in relation to the poor empirical performance of the Sharpe Lintner CAPM. The Authority remains of the view that these criticisms remain contentious, with no clear agreement among the experts (for example, with regard to the estimate of beta, exemplified in the consideration of the Black CAPM above). Nonetheless, the Authority's adoption of equity beta at the upper bound of the estimated range of equity beta takes account of this issue.
508. The Authority notes that, in their report prepared for the AER in October 2014, Professors McKenzie and Partington concluded that:<sup>162</sup>
- With regard to the CAPM, its efficacy comes from the test of time. This model has been around for in excess of half a century and has become the standard workhorse model of modern finance both in theory and practice. The CAPMs place as the foundation model is justifiable in terms of its simple theoretical underpinnings and relative ease of application. The competing alternatives, which build upon the CAPM, serve to add a level of complexity to the analysis.
509. The Authority does recognise that recent market conditions since the Global Financial Crisis have raised important issues with regard to the application of the Sharpe Lintner CAPM. The Authority considers that its revised approach to estimating the Sharpe Lintner CAPM, which is adopted for this Final Decision, allows for much greater flexibility in the estimates of the return on equity, thereby improving the overall estimates of that return. That approach, among other things, involves establishing a range for the forward looking MRP and then determining a point estimate at the time of each decision, based on the prevailing conditions in the market.

<sup>162</sup> McKenzie, M. and Partington, G. "A Return on Equity", a report prepared for the Australian Energy Regulator, October 2014, p. 9.

## The DGM

510. The Authority concluded in the gas Rate of Return Guidelines that it would give weight to relevant outputs from the DGM when estimating the market risk premium (**MRP**), which is an input to the Sharpe Lintner CAPM. In its most recent gas decision, the Authority utilised the DGM for this purpose.
511. The Authority has determined to revert to utilising multiple estimates of the MRP in this Final Decision, rather than just the (implied) 'Wright' estimate of the MRP adopted in the Revised Draft Decision (for the Authority's reasoning, see Chapter 11 below).
512. Accordingly, the Authority will revert to using the DGM as a method for informing the MRP for this Final Decision.

## The Black CAPM

513. The Authority has come to the view that the Black CAPM is relevant for the purpose of estimating the return on equity.<sup>163</sup> All of its underlying assumptions except for one are the same as those underlying the Sharpe Lintner CAPM. The Black model therefore satisfies the criterion of having a theoretical foundation.
514. The concept of zero beta portfolio, however, is not well established. Estimates of the zero beta premium are both unstable and unreliable, particularly in the Australian context. Neither is the Black CAPM widely adopted by academics or practitioners in Australia or overseas for estimating a return on equity directly. None of the estimates of a return on equity that are made using the Black CAPM are sufficiently robust. The Authority considers that it is therefore impractical to utilise the Black CAPM to determine the return on equity directly.
515. However, the Authority will recognise the theoretical insight from the Black CAPM when estimating a return on equity with the Sharpe Lintner CAPM. The Authority will have regard to these outcomes when estimating the equity beta from within the estimated range. This approach is adopted for this Final Decisions

### 10.4.3.2 Other models for the rate of return

516. The Authority concludes for this Final Decision that other models and approaches, such as the Fama-French three-factor model and use of Dividend Growth Models to estimate a return on equity for the rail businesses directly, are not relevant, at the current time. This is because there are shortcomings with regard to robustness of these approaches in the Australian context. On this basis, the Authority considers that these two approaches are not 'fit for purpose', or able to be 'implemented in accordance with best practice'. As such, these two models will not be used to determine the return on equity directly for the regulated rail businesses.
517. The Authority's reasoning for these positions are set out in the following two sections.

### The Fama French three-factor model

518. The Authority noted that the FFM has consistently been put forward by regulated businesses as a means to estimate the return on equity. However, in its previous regulatory decisions, the Authority concluded that there is no strong theoretical basis

<sup>163</sup> See Economic Regulation Authority, *Final Decision on Proposed Revisions to the Access Arrangement for the Mid-West and South-West Gas Distribution Systems*, 30 June 2015, p. 238.

to support the inclusion of the two additional risk factors to estimate the rate of return on equity, as occurs in the FFM. This is because the FFM is dependent on empirical justification – that is, the systematic observance of the FFM risk premia. In contrast, given that the FFM risk premia are not systematically observed in the Australian market, there is no reasonable basis for the FFM to be applied in Australia.

519. The Authority is of the view that there is no accepted good practice in relation to an implementation of the FFM because there is no widely accepted correct method of applying the FFM. For example, in its own study in relation to the application of the FFM in Australia, using the same dataset, the Authority has demonstrated that outcomes obtained from the FFM will be significantly different when the approach to portfolio formation is different.
520. The Authority remains of the view that the FFM cannot contribute to the rate of return objective. A wide range of evidence, together with its own empirical analysis, suggests that the FFM is not fit for the purpose of estimating the return on equity, because:
- applications of the FFM in Australia fail to produce consistent outcomes;
  - the key contribution from the FFM is that the additional factors – the size (**SMB**) and value (**HML**) factors – are priced in explaining the return on equity;
    - however, studies in the Australian context do not consistently report this pricing – some studies price the size factor, while others price the value factor;
    - different proxies are adopted in different empirical studies, with the result that the estimates from the FFM vary significantly from study to study;
  - in its own empirical work the Authority found that adopting different portfolio formation on the same dataset will provide different outcomes, yet portfolio formation is a key characteristics of the FFM;
  - more than 300 different factors have been examined in empirical studies to date, but there is no body of theory to support which factors should be considered; and
  - Fama himself now recognises that the Fama French three factor model is an empirical test, and is not based on theory, confirming the oft stated view of Australian regulators.<sup>164</sup>
521. These points are further considered in what follows.

*The Fama French three factor model was not developed on a theoretical foundation*

522. Network service providers have argued that the FFM was developed on the basis of the Arbitrage Pricing Theory (**APT**) (Ross, 1976) as an alternative to the CAPM. The APT predicts that the return to any risky asset is linearly related to a set of k factors. This is in contrast with the CAPM's prediction that all returns of any risk security are linearly related to a single factor; the return on the market portfolio. Under the APT, the relationship between risk and return can be expressed as:

$$R_i = R_f + (R_1 - R_f)\beta_1 + (R_2 - R_f)\beta_2 + \dots + (R_k - R_f)\beta_k \quad (18)$$

where:

<sup>164</sup> E. Fama and K. French, *A Five-Factor Asset Pricing Model*, 2014, Working Paper available at [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2287202](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2287202)

- $R_i$  stands for an expected return on asset  $i$ ;
- $\beta_k$  represents the security's beta with respect to the  $k^{\text{th}}$  factor;
- $R_k$  stands for an expected return on the  $k^{\text{th}}$  factor; and
- $R_f$  represents a risk free rate of return.

523. It is noted that the APT model does not specify any factors which may be included in the estimate of a return on equity. As a result, it may be argued that the APT model fails in terms of fully specifying a model. That leaves the relevant model factors open to interpretation, of which there have been many.
524. Fama and French (1993) presented a three factor model of asset returns. Their model incorporates the predictions of the CAPM by including the return on the market portfolio as a factor. In addition to this factor, Fama and French (1993) also included two additional factors that had been found to be statistically significant in explaining the cross section of average returns. These two factors are: (i) firm size, which is measured by market capitalisation (the SMB factor), and (ii) the ratio of the book value of equity to the market value of equity (the HML factor). The Authority considers that these two factors were selected on the basis of data exploration. These selections were not guided by any economic theory.
525. Four years after the initial publication of the FFM, Carhart incorporated another factor, making it a four-factor model.<sup>165</sup> The fourth factor is intended to capture the momentum in returns. The Authority is of the view that the selection of this factor was also not supported by any economic theory.

*New factors included in the Fama French three factor model are found through data exploration*

526. Most multi factor models including the FFM can be classified as parametric or empirical models. These models are not developed on the foundation of any robust economic theory. The term *empirical* refers to their development on the evidence of interrogating historical financial data for regularities and relationships. It is argued that in creating these empirical models, their authors examine the historical data directly in order to extrapolate relationships between the attributes of the data and expected returns. If the resulting relationships are found to be statistically significant within a given data set, then these attributes (or factors) are used to explain an expected return.<sup>166</sup>
527. Professor Fama, a Nobel Prize's winner in 2013 and one of the two authors of the FFM acknowledged that:<sup>167</sup>

The three-factor model is an **empirical** asset pricing model. Standard asset pricing models work forward from assumptions about investor tastes and portfolio opportunities to predictions about how risk should be measured and the relation between risk and expected return. Empirical asset pricing models work backward. They take as given the patterns in average returns, and propose models to capture them. The three-factor model is designed to capture the relation between average return and size (market capitalization) and the relation between average return and

<sup>165</sup> Carhart M. M., On Persistence in Mutual Fund Performance, *The Journal of Finance*, 52, 1997, pp. 57–82.

<sup>166</sup> Fama, E. (2014). "Two Pillars of Asset Pricing", *American Economic Review*, Vol. 104 (6), 1467-1485, p. 1480.

<sup>167</sup> Fama, E. (2014). "Two Pillars of Asset Pricing", *American Economic Review*, Vol. 104 (6), 1467-1485, p. 1480.

price ratios like the book-to-market ratio, which were the two well-known patterns in average returns at the time of our 1993 paper. [emphasis added]

528. Since the introduction of the FFM in 1992, Fama and French have held to the view that their two new factors, being: (i) firm size, which is measured by market capitalisation; and (ii) the ratio of the book value of equity to the market value of equity; can be used to explain a cross section of an expected return for a particular asset. In the years subsequent to the publication of the Fama French model, academic researchers have presented various new factors with the claim that they are also able to explain a cross section of an expected return.
529. The Authority notes that Fama and French have also moved away from the three-factor model. In 2014, Fama and French developed a five-factor model in which portfolios are formed on the basis of:
- (i) market portfolio;
  - (ii) firm's size (Small Minus Big – **SMB**);
  - (iii) the ratio of the book value of equity to the market value of equity (High Minus Low – **HML**);
  - (iv) profitability (Robust Minus Weak profitability – **RMW**); and
  - (v) investment (Conservative Minus Aggressive investment – **CMA**).
530. Fama and French concluded that their new five-factor model provides better descriptions of average returns than their three-factor model. They also found that a market to book factor is no longer “priced” when it is included in the five factor model, although this effect may be sample specific:<sup>168</sup>

The five-factor model **outperforms** the original three-factor model on all metrics and it generally outperforms other models, with one major exception. Specifically, the five-factor model and the four-factor model that excludes *HML* are similar on all measures of performance, including the *GRS* statistic. [emphasis added]

and that:

We note above that the five-factor model never improves the description of average returns from the four-factor model that drops *HML*. The explanation is interesting. The average *HML* return is captured by the exposures of *HML* to other factors. Thus, in the five-factor model, **HML seems to be redundant for explaining average returns**. [emphasis added]

531. The introduction of the Fama French five-factor model has placed the validity of the book-to-market value factor in doubt. Fama and French have argued the validity of this *HML* factor in explaining cross section of equity returns in the last two decades. However, they argued that the findings in their five-factor model in relation to the *HML* factor happens due to a sample specific issue.

<sup>168</sup> E. Fama and K. French, *A Five-Factor Asset Pricing Model*, 2014, Working Paper available at [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2287202](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2287202), p. 19.



532. In their report prepared for the AER in October 2014, Professors McKenzie and Partington concluded that:<sup>169</sup>

Following the work of Roll and Ross (1980), Chen (1983), Chen, Roll and Ross (1986), Burmeister, and Wall (1986), Burmeister and McElroy (1988) and McElroy and Burmeister (1988) inter alia, an alternative strand of the literature explains equilibrium returns using macroeconomic factors. These include factors such as unanticipated shock to industrial production or inflation, movements in the default premium or shifts to the slope of the term structure of interest rates.

533. McKenzie and Partington note that there is no real overlap between the factors used in this literature and those used in Fama and French (1993, 2014 inter alia) type studies.

534. More recently, Harvey et al (2014) presented a useful review of the available literature seeking to explain asset returns. Papers focussing on small groups of stocks, or employing data collected over short periods of time were omitted from the study. This review found 312 papers suggesting a total of 315 different factors that might be used to explain asset returns. It is important to note that Harvey et al (2014) are quick to acknowledge that this list of factors is not exhaustive:<sup>170</sup>

Our collection of 315 factors likely under-represents the factor population. First, we generally only consider top journals. Second, we are very selective in choosing only a handful of working papers. Third, and perhaps most importantly, we should be measuring the number of factors tested (which is unobservable) — that is, we do not observe the factors that were tested but failed to pass the usual significance levels and were never published.

535. Harvey et al (2014) also stated that:<sup>171</sup>

Our goal is not to catalogue every asset pricing paper ever published. We narrow the focus to papers that propose and test new factors.

Since our focus is on factors that can broadly explain asset market return patterns, we omit papers that focus on a small group of stocks or for a short period of time. This will, for example, exclude a substantial amount of empirical corporate finance research that studies event-driven return movements.

To include the most recent research, we search for working papers on SSRN. Working papers pose a challenge because there are thousands of them and they are not refereed. We choose a subset of papers that we suspect are in review at top journals or have been presented at top conferences or are due to be presented at top conferences. We end up using 63 working papers. In total, we focus on 312 published works and selected working papers. We catalogue 315 different factors.

536. The key conclusion from this paper is that:<sup>172</sup>

Hundreds of papers and hundreds of factors attempt to explain the cross-section of expected returns. Given **this extensive data mining**, it does not make any economic or statistical sense to use the usual significance criteria for a newly discovered factor, e.g., a t-ratio greater than 2.0. However, what hurdle should be used for current research? Our paper introduces a multiple testing framework and provides a time

<sup>169</sup> McKenzie, M. and Partington, G. "A Return on Equity", a report prepared for the Australian Energy Regulator, October 2014, p. 16.

<sup>170</sup> Harvey, C; Liu, Y. and Zhu, H. (2014), ... and the Cross-Section of Expected Returns, Working Paper available at [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2249314](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2249314), p. 3.

<sup>171</sup> Harvey, C; Liu, Y. and Zhu, H. (2014), ... and the Cross-Section of Expected Returns, Working Paper available at [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2249314](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2249314), pp. 2-4.

<sup>172</sup> Harvey, C; Liu, Y. and Zhu, H. (2014), ... and the Cross-Section of Expected Returns, Working Paper available at [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2249314](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2249314), the first page (Abstract).



series of historical significance cut-offs from the first empirical tests in 1967 to today. We develop a new framework that allows for correlation among the tests as well as missing data. We also project forward 20 years assuming the rate of factor production remains similar to the experience of the last few years. The estimation of our model suggests that today a newly discovered factor needs to clear a much higher hurdle, with a t-ratio greater than 3.0. Echoing a recent disturbing conclusion in the medical literature, we argue that most claimed research findings in financial economics are likely false. [emphasis added]

537. In addition, as presented in McKenzie and Partington (2014), Subrahmanyam (2010) documents over 50 variables that have been used to predict stock returns and concluded that:<sup>173</sup>

The research at this point presents a rather unsatisfying picture of a morass of variables, and an inability of us finance researchers to understand which effects are robust and which do not survive simple variations in methodology and use of alternative controls (p. 35)

and that:

As a central theme, I maintain that our learning about the cross-section is hampered when so many predictive variables accumulate without any understanding of the correlation structure between the variables, and our collective inability or unwillingness to adequately control for a comprehensive set of variables (p. 28).

538. Green et al (2014) documented over 330 predictive return signals and concluded that:<sup>174</sup>

given the large number of Return Predictive Signals (RPS) that have already been reported in the literature and the high degree of multidimensionality we empirically find to be present in returns, we propose that an important avenue for future research is to understand why returns are so highly dimensional, and why the most important multi dimensioned RPS are priced the way they are (p. 26).

539. On the basis of the findings from the study by Green et al (2014), McKenzie and Partington concluded that [emphasis added]:<sup>175</sup>

Green et al (2014) find that 24 of 100 readily programmed signals are multi dimensionally priced (i.e. the mean coefficient estimates produced t-statics in excess of 3). The authors suggest that increasing the dimensionality of the cross-section is important **as the size and book-to-market factors are not the most statistically significant predictive signals**. This is an interesting point in the current context as recall from our earlier discussion that in order to operationalise the APT, the number of assets,  $n$ , must exceed the number of factors,  $k$ . Given that we have so few assets in the Australian context, **this presents a serious problem for operationalising a model with many factors** [emphasis added].

540. In response to the extensive data mining in empirical studies on asset pricings, Harvey et al (2014) considered that it is appropriate to change the way in which we think about factors as being important. One possible solution is to introduce additional testable assumptions that a systematic risk factor has to satisfy before it can claim to be significant. In addition, as presented in Pukthuanthong and Roll (2014), a seven-stage protocol could be followed to identify and measure important

<sup>173</sup> McKenzie, M. and Partington, G. "A Return on Equity", a report prepared for the Australian Energy Regulator, October 2014, p. 16.

<sup>174</sup> McKenzie, M. and Partington, G. "A Return on Equity", a report prepared for the Australian Energy Regulator, October 2014, p. 16.

<sup>175</sup> McKenzie, M. and Partington, G. "A Return on Equity", a report prepared for the Australian Energy Regulator, October 2014, p. 17.

factors. Harvey and Liu (2014) on the other hand argue that an evaluation of the economic contribution of a risk factor should be used to determine its importance.

541. Whatever the case, it appears clear that any number of factors can be found to have explanatory power, but that these cannot be relied upon for estimating the return on equity in any meaningfully robust sense.

*The estimates from the Fama French three-factor model vary significantly and produce mixed results*

542. There have been various attempts to apply the Fama French three factor model in Australia using Australian data. It is noted that the results from these studies are mixed, as presented in Table 26 below.
543. Based on the comparison shown in Table 26, the Authority is of the view that these estimates are best characterised as an unsystematic observation of the estimates of the Fama–French risk premium. This is indicative of the inadequacy of estimates that are made on the basis of an empirical relationship without the foundation of an economic theory. This view is also confirmed when the estimates of the HML and SMB risk premia from the FFM are compared across studies for the Australian capital market, as shown in Table 26.
544. Table 26 shows that the ranges of the HML risk premia, from 14.6 per cent to 6 per cent, and of SMB risk premia, from 17.2 per cent to -9 per cent, can be considered too large to confirm the presence of the risk factors when using the FFM in Australia. The FFM predicts that the HML and SMB coefficients estimated from the models should be statistically significantly different to zero. On this prediction, except for an estimate of 4.3 per cent for the SMB risk premium in the 2008 O'Brien et al study, other estimates are significantly different from zero at the five per cent level of confidence. Additionally, the FFM also predicts that the intercept from the regression, which is the proportion of the observed return that is not explained by the FFM, should not be significantly different from zero. While there are some studies where the FFM performs well, such as Ghargori, Chan and Faff (24 out of 27 portfolios have intercepts that are not statistically significant from zero), there are studies in which the FFM performs poorly, such as Ghargori, Lee and Veeraghavan (only 2 out of 12 portfolios have intercepts that are not statistically significant from zero).

**Table 26 Applications of the Fama French three-factor model in Australia**

		HML (%)	SMB (%)	Intercept not significant	HML coefficients significant	SMB coefficients significant
Fama & French, 1998 <sup>176</sup>	1975-1995	12.3	N/A	N/A	N/A	N/A
Halliwell et al., 1999 <sup>177</sup>	1980-1991	14.6	6.0	23 of 25	6 of 25	18 of 25
Faff, 2001 <sup>178</sup>	1991-1999	14.0	-9.0	20 of 24	7 of 24	11 of 24
Faff, 2004 <sup>179</sup>	1996-1999	6.0	-6.5	19 of 24	14 of 24	18 of 24
Gaunt, 2004 <sup>180</sup>	1993-2001	8.5	10.0	19 of 25	21 of 25	13 of 28
Ghargori, Chan & Faff, 2007 <sup>181</sup>	1996-2004	10.4	17.2	24 of 27	20 of 27	14 of 27
O'Brien et al., 2008 <sup>182</sup>	1982-2006	9.4	4.3	14 of 25	22 of 25	16 of 25
Kassimatis, 2008 <sup>183</sup>	1993-2005	12.6	11.5	11 of 25	20 of 25	11 of 25
Ghargori, Lee & Veeraghavan, 2009 <sup>184</sup>	1993-2005	N/A	N/A	2 of 12	10 of 12	5 of 12
Brailsford; Gaunt & O'Brien, 2012 <sup>185</sup>	1982-2006	9.1	-2.6	24 of 25	15 of 25	22 of 25
Brailsford; Gaunt & O'Brien, 2012 <sup>186</sup>	1982-2006	12	N/A	Varies depending on the approach of portfolio formation		

Source: Economic Regulation Authority's analysis

<sup>176</sup> Fama, E. and French, K., "Value versus Growth: The International Evidence", *The Journal of Finance*, Vol. 53, No. 6 (Dec., 1998), pp. 1975-1999.

<sup>177</sup> Halliwell, J. Heaney, R. and Sawicki, J., 'Size and book to market effects in Australian share markets: a time series analysis', *Accounting Research Journal*, 1999, vol. 12, pp. 122-137.

<sup>178</sup> Faff, R. 'An examination of the Fama and French three-factor model using commercially available factors', *Australian Journal of Management*, 2001, vol. 26, pp. 1-17.

<sup>179</sup> Faff, R., 'A simple test of the Fama and French model using daily data: Australian evidence', *Applied Financial Economics*, 2004, vol. 14, pp. 83-92.

<sup>180</sup> Gaunt, 'Fama-French model: Australian evidence', *Accounting and Finance*, 2004.

<sup>181</sup> Ghargori, P.; Chan, H. and Faff, R. 'Are the Fama-French factors proxying default risk?', *Australian Journal of Management*, December 2007, vol. 32(2), pp. 223-249.

<sup>182</sup> O'Brien, Brailsford, and Gaunt, 'Market factors in Australia', Australasian Finance and Banking Conference, 2008.

<sup>183</sup> Kassimatis, K. 'Size, book to market and momentum effects in the Australian stock market', *Australian Journal of Management*, June 2008, vol. 33(1), pp. 145-168.

<sup>184</sup> Ghargori, P.; Lee, R. and Veeraraghavan, M. 'Anomalies and stock returns: Australian evidence', *Accounting and Finance*, 2009, vol. 49, pp. 555-576.

<sup>185</sup> Brailsford, T., Gaunt, C., and O'Brien, M. (2012), 'Size and book-to-market factors in Australia', *Australian Journal of Management*, 2012, vol. 37, pp. 261-81.

<sup>186</sup> Brailsford, T., Gaunt, C., and O'Brien, M. (2012), 'The investment value of the value premium', *Pacific-Basin Finance Journal*, 2012, vol. 20, pp. 416-37.

The Fama French three-factor model is not used by economic regulators either in Australia or overseas

545. The FFM has not been adopted in the estimation of a return on equity by any economic regulators, either in Australia or overseas as presented in Table 27.

**Table 27 Models adopted by Australian and international regulators for estimating the return on equity**

	Australia	Germany	New Zealand	USA	Canada	UK
<b>Regulator</b>	<b>Australian Energy Regulator (AER)</b>	<b>The Federal Network Agency (FNA)</b>	<b>The Commerce Commission (CC)</b>	<b>New York State Public Utilities Commission (NYSPUC)</b>	<b>The Ontario Energy Board (OEB)</b>	<b>The Office of Gas and Electricity Markets (Ofgem)</b>
Primary model	CAPM	CAPM/RPM	CAPM	DDM	RPM	CAPM
Secondary model				CAPM		
Other use of DDM	<i>Cross-check on MRP</i>		<i>Cross-check on MRP</i>		<i>Cross-check on MRP</i>	<i>Cross check on the overall cost of equity but not for individual firms</i>

Notes: CAPM: Sharpe-Lintner Capital Asset Pricing Model

RPM: Risk Premium Model

DDM: Dividend Discount Model

Source: S. Sudarsanam, U. Kaltenbronn, U. and P. Park, *Cost of Equity for Regulated Companies: An international Comparison of Regulatory Practices*, Working Paper, 2011.

546. In the report prepared for the AER in October 2014, Professors McKenzie and Partington concluded that:<sup>187</sup>

...the main discussion of this section of our report highlights the nascent literature suggesting that the use of the Fama and French model is no longer optimal, and may indeed lead to invalid, incorrect or misleading inference. Even the originators of this model, Fama and French (2014) themselves, have contributed to this literature. It would seem unusual to adopt a model 21 years after its publication, when its weaknesses are becoming more evident and contemporary research is just beginning to understand the possible causes and potential solutions.

and that:

We do not view the FFM as having the ability to reliably estimate the required return on equity for a benchmark regulated network service provider. **The FFM is used to estimate the average return in the cross section and the benchmark regulated network services provider is not average given its relatively low economic risk.** The evidence suggests that the estimates for Australia using the Fama and French approach are unstable and depend on both the cross section of firms selected and the sample period chosen [emphasis added].

*Authority's decision on the Fama French three-factor model*

547. Based on the above analyses, the Authority is of the view that the Fama French three-factor model is neither relevant nor fit for the purpose of estimating a return on equity

<sup>187</sup> McKenzie, M. and Partington, G. "A Return on Equity", a report prepared for the Australian Energy Regulator, October 2014, p. 18.

for regulatory decisions in Australia. As a result, the Authority remains of the view that the FFM should play no role in estimating a return on equity for the Rail WACCs. This decision is based on the following considerations:

- The Fama French three-factor model was not developed on a theoretical basis.
- New factors that are now included in the new Fama French five factor model which raise questions about the validity of the FFM three factor model.
- The estimates from the Fama French three factor model vary significantly and produce mixed results.
- The Fama French three factor model is not used by economic regulators either in Australia or overseas.

### **The DGM as a method for estimating the return on equity for the regulated firm**

548. The Authority notes that the DGM was developed on robust theoretical grounds. In addition, the Authority also notes that the DGM is adopted by some regulators in the US. However, the Authority is not aware of any other overseas regulators who use the DGM as a principal model to estimate the return on equity directly.
549. In addition, in the Rate of Return Guidelines released in December 2013, the Authority considered applying the DGM for the purpose of estimating the return on equity for the individual infrastructure firm.<sup>188</sup> However, the Authority noted that the results are very sensitive to inputs, and hence to analyst discretion, particularly relating to the assumption on the growth rates of dividend. The Authority was not convinced that DGM estimates can be relied upon for individual equities, and hence for estimating the return on equity to the benchmark firm.
550. In this context, the Authority notes that the AER investigated the possibility of using the DGM for estimating the return on equity for individual infrastructure businesses in Australia.<sup>189</sup> The AER found that the DGM estimates could not be relied upon as, among other things, the average estimated return on equity is consistently higher than that of the market over recent periods from 2006, even with real growth of dividends at zero; thus failing a basic ‘sanity check’.
551. The Authority remains of the view set out in the Rate of Return Guidelines and its Final Decision on ATCO Gas Australia that the DGM is relevant for the purpose of estimating the market return on equity for its regulatory decisions.
552. However, given the estimates of a market return on equity are unstable and sensitive to analysts’ inputs, the Authority remains of the view that DGM should not be used to directly estimate the market return on equity for regulated rail businesses.
553. On balance, the Authority maintains its view that the DGM can only be used to inform the overall return on the market. This is used to inform the estimates of the forward looking MRP.

<sup>188</sup> Economic Regulation Authority, *Appendices to the Explanatory Statement for the Rate of Return Guidelines*, 16 December 2013, p. 75.

<sup>189</sup> Australian Energy Regulator, *Explanatory Statement: Rate of Return Guideline*, December 2013, p. 119.

### 10.4.4 Estimate of the return on equity

554. This section sets out steps 3, 4 and 5 of the Authority's approach to estimating the return on equity for the benchmark firms, informed by the concurrent estimates which will be used for the 2015 rail WACC update. The 2015 rail WACC update is based on the revised rail WACC method set out in this Final Decision.

#### 10.4.4.1 Step 3 – estimates of the return on equity

555. The estimates of the return on equity for 30 June 2015 – consistent with the method set out in this Final Decision – are set out in Table 28. These estimates are consistent with those set out in Appendix 5. The implied post tax market return on equity (grossed up) is 10.27 per cent.

**Table 28 The 2015 WACC for the regulated rail businesses – Final Decision**

Determination	Public Transport Authority	Brookfield Rail	The Pilbara Infrastructure
Nominal Risk Free Rate (10 year term)	2.97%	2.97%	2.97%
Real Risk Free Rate	0.46%	0.46%	0.46%
Inflation Rate	2.50%	2.50%	2.50%
Gearing	50%	25%	20%
Australian Market Risk Premium	7.30%	7.30%	7.30%
Equity Beta	0.6	0.9	1.3
Asset Beta	0.30	0.70	1.05
Corporate Tax Rate	30%	30%	30%
Franking Credit	40%	40%	40%
<b>Nominal After Tax Cost of Equity (grossed up) for the benchmark firm</b>	<b>7.35%</b>	<b>9.78%</b>	<b>12.55%</b>
Nominal Pre Tax Cost of Equity for the benchmark firm	8.96%	11.93%	15.30%
<b>Real Pre Tax Cost of Equity for the benchmark firm</b>	<b>6.31%</b>	<b>9.20%</b>	<b>12.49%</b>
<b>Nominal After Tax Market Return on Equity (grossed up)</b>	<b>10.27%</b>	<b>10.27%</b>	<b>10.27%</b>

Source Economic Regulation Authority analysis



#### 10.4.4.2 Step 4 – cross-checks for the return on equity

556. For this Final Decision, the Authority has taken account of a range of forward looking information to inform its estimate of the return on equity set out in Table 28:
- a risk free rate of return of 10 years, which provides the most robust indication for the risk free rate for the long term future;
  - a point estimate for the MRP which is informed by historic excess returns and considerations relating to the long term of the rail WACC estimates, as well as by a range of recent results using the DGM model.
557. With regard to the return on equity, a range of other material may provide a cross check for the estimate of the MRP and the resulting estimate of the return on equity:
- views of valuation experts and surveys;
  - decisions of other regulators; and
  - the relationship between the return on equity and the return on debt.
558. This range of other material is discussed in what follows.

#### Views of valuation experts

559. Evidence of market analysts' views suggest that their expectations for the forward average market returns on equity are consistent with the longer term average of the forward looking return on equity underpinning the Authority's estimates.
560. An example is the recent rate of return estimate by used by Grant Samuel in discounting the utility Envestra's cash flows.<sup>190</sup>
- Grant Samuel's estimate of the return on equity is informed by the Sharpe Lintner CAPM, with the risk premium and risk free rate then adjusted to have regard to a range of other evidence, including that from the Gordon DGM.<sup>191</sup>
  - Grant Samuel's initial estimate for the *market* return on equity derived using the Sharpe Lintner CAPM is 10.2 per cent. Grant Samuel states that:<sup>192</sup>

The CAPM is probably the most widely accepted and used methodology for determining the cost of equity capital. There are more sophisticated multivariate models which utilise additional risk factors but these models have not achieved any significant degree of usage or acceptance in practice. However, while the theory underlying the CAPM is rigorous the practical application is subject to shortcomings and limitations and the results of applying the CAPM model should only be regarded as providing a general guide.
  - This estimate is based on a long run historic MRP of 6 per cent, which is added to the prevailing 10 year risk free rate (at the time) of 4.2 per cent. Grant Samuel notes that it:<sup>193</sup>

<sup>190</sup> ATCO Gas Australia, *Access Arrangement Information: 1 July 2014 – 31 December 2019*, 3 April 2014, Appendix 19, p. 84.

<sup>191</sup> Grant Samuel, *Envestra: Financial Services Guide and Independent Expert's Report*, 3 March 2014, Appendix 3.

<sup>192</sup> Grant Samuel, *Envestra: Financial Services Guide and Independent Expert's Report*, 3 March 2014, Appendix 3, p. 1.

<sup>193</sup> Grant Samuel, *Envestra: Financial Services Guide and Independent Expert's Report*, 3 March 2014, Appendix 3, p. 6.



...has consistently adopted a market risk premium of 6% and believes that this continues to be a reasonable estimate. It:

- is not statistically significantly different to the premium suggested by long term historical data;
  - is similar to that used by a wide variety of analysts and practitioners (typically in the range 5-7%); and
  - makes no explicit allowance for the impact of Australia's dividend imputation system.
- The current prevailing 10 year risk free rate is 2.97 per cent (see Appendix 5), 1.23 per cent below that assumed by Grant Samuel. Combining the current risk free rate with an MRP of 6 per cent gives a return on equity to the market of 8.97 per cent. That adjusted estimate is used in what follows for comparison.
  - The Grant Samuel estimate is defined as a 'classical', after tax rate that is based on the estimated nominal ungeared after tax cash flows.<sup>194</sup> On this basis, it is defined consistent with Officer's after tax case (iv).<sup>195</sup> In this case, the  $k_E$  is identical to the  $k_E$  in case (iii), being the total return on equity from all sources.
  - The adjusted Grant Samuel return on equity estimate of 8.97 per cent ignores the impact of imputation credits.<sup>196</sup>
  - The resulting estimate should be grossed up to be consistent with the nominal after tax return set out in the last row of Table 28. Assuming that dividends provide around 4.5 percentage points of the total 8.97 per cent yield – the grossed up return would be 9.74 per cent (utilising the Authority's estimate of gamma of 0.4).
  - Grant Samuel ultimately assess an overall equity *market* return to be in the range of 10.7 to 15.2 per cent, an estimate that is higher than its CAPM-based estimate, which is 10.2 per cent, as noted above. The higher range accounts for:
    - first, estimates from other return on equity models, such as the Gordon DGM;
    - second, for Grant Samuel's view that equity investors have re-priced risk since the global financial crisis (lifting the MRP above 6 per cent); and
    - third, that bond rates are at unsustainably low levels (which Grant Samuel therefore 'normalise' by increasing the risk free rate from the observed current value around 4 per cent to 5 per cent).<sup>197</sup>

<sup>194</sup> The Authority notes that Grant Samuel's 'classical WACC' differs from the 'nominal vanilla WACC' estimate. The classical WACC reduces the cost of debt to account for the impact of the tax shield (that is, the cost of debt component is  $D/V \cdot (1-T) \cdot R_d$ ), whereas the nominal vanilla WACC ignores the impact of the tax shield as this is accounted for in the cash flows. However, both approaches adopt the same estimate for the return on equity component (that is,  $E/V \cdot k_E$  using Handley's terminology).

<sup>195</sup> J.C. Handley, *Further comments on the historical equity risk premium*, Report for the Australian Energy Regulator, 14 April 2009, pp. 16-17.

<sup>196</sup> Grant Samuel, *Envestra: Financial Services Guide and Independent Expert's Report*, 3 March 2014, Appendix 3, p. 9:

In Grant Samuel's view, however, the evidence gathered to date as to the value the market attributes to franking credits is insufficient to rely on for valuation purposes. More importantly, Grant Samuel does not believe that such adjustments are widely used by acquirers of assets at present... Accordingly, it is Grant Samuel's opinion, that it is not appropriate to make any adjustment.

<sup>197</sup> Authority estimate based on Grant Samuel data, assuming a nominal risk free rate of 5.0 per cent.

- The Authority does not accept that adjusting up the risk free rate is reasonable in the context of its rate of return decision. On that basis, Grant Samuel's lower bound would be closer to the 9.74 per cent, rather than the 10.7 per cent estimate.
  - The resulting grossed up range is 9.74 to 15.97 per cent, using the Authority's assumptions on the risk free rate, the dividend yield and on gamma, set out above.
561. The Authority's comparable return on the market of 10.27 per cent (Table 28) is within the resulting range. The Grant Samuel estimates therefore give the Authority no cause to revise its estimate of the return on equity, or its current estimates for the MRP.
562. The survey by ATCO's consultant Ernst & Young of other analysts' estimates gives results that are broadly consistent with the Grant Samuel view. Ernst & Young note that in 2012, independent market experts' market cost of equity estimates averaged 10.7 per cent. Ernst & Young also notes that independent experts typically do not assign a value to imputation credits, and that adjustment for this outcome would raise the estimate of independent brokers.<sup>198,199</sup> Grossed up and adjusted using the Authority's assumptions, consistent with the approach outlined above, the estimate is very close to the Authority's estimate. Again, this outcome would give the Authority no cause to revise its estimate of the return on equity, or its current estimates for the MRP.
563. On this basis, the Authority is satisfied that its current estimate is reasonable.

### Views of other regulators

564. Other regulators' estimates provide a cross check for the outcomes in this decision.

#### *Australian Energy Regulator*

565. The AER's return on the market is derived using the Sharpe Lintner CAPM, with point estimates informed by a range of relevant information and models.
566. The AER has the view that a longer term 10 year perspective is appropriate, based on the view that equity investors have long term investment horizons.<sup>200</sup>
567. In line with this view, the AER adopts a different term for the risk free rate in the Sharpe Lintner CAPM. Specifically, in its most recent decisions, the AER adopted:<sup>201</sup>
- a term for the return on debt of 10 years, with:
  - the risk free rate based on the estimated Commonwealth Government Securities (**CGS**) yield, of 2.55 per cent;

<sup>198</sup> ATCO Gas Australia, *Access Arrangement Information: 1 July 2014 – 31 December 2019*, 3 April 2014, Appendix 35, pp. 14-15.

<sup>199</sup> ATCO Gas Australia, *Access Arrangement Information: 1 July 2014 – 31 December 2019*, 3 April 2014, Appendix 35, p. 23.

<sup>200</sup> S. Pratt and R. Grabowski, *Cost of Capital: Applications and Examples*, 4th edition, 2010, pp. 118–120; A. Damodaran, 'What is the risk free rate? A search for the basic building block', December 2008, pp. 9-10. Lally, M., 'The risk free rate and the present value principle', 22 August 2012. cited in Australian Energy Regulator, *Rate of Return Guidelines, Explanatory Statement*, December 2013, p. 49.

<sup>201</sup> Australian Energy Regulator, *Final decision: Essential Energy distribution determination 2015–16 to 2018-19*, Attachment 3: Rate of return, April 2015, p. 3-13.

- a point estimate for the MRP of 6.5 per cent, from within an estimated range of 5.1 to 7.8 per cent;
  - giving a market return on equity of 9.05 per cent.
568. The estimated range for the MRP adopted by the AER is lower than the Authority's. This reflects the AER's judgment based on a range of information, including:
- historical excess returns – which the AER determine are in the range of 5.1 to 7.8 per cent based on the BHM data;
  - the AER's DGM estimates range from 6.6 (two stage DGM) to 7.8 (three stage DGM).

### IPART

569. IPART uses the average of a current 40 day and 10 year term for the risk free rate.
570. IPART proposes to adopt an estimate of the MRP which is informed by a range that is based on a range for historic estimates (estimated at 5.5 per cent to 6.5 per cent) and a range based on other current market data approaches, including using DGMs which fall in the range 7.2 per cent to 8.6 per cent, giving an overall range for the MRP of 6.0 per cent to 7.9 per cent (as at 31 July 2015). The mid-point of the assessed range is adopted, which is 7.0 per cent (as at 31 July 2015).
571. Given an estimated mid-point risk free rate as at 31 January 2015 of 3.8 per cent, IPART's return on the market is estimated to be around 10.8 per cent.<sup>202</sup>
572. The Authority considers that the IPART estimate is comparable to its own estimate, albeit based on a somewhat different method and judgements.

### Other regulators' decisions

573. Other recent decisions by regulators for the MRP range from 6.0 to 6.5 per cent (Table 29).

**Table 29 Other regulators' recent decisions**

Regulator	Decision date	Sector	MRP (%)
QCA	August 2014	General	6.5
ESCV	June 2014	Water	6.0
NTUC	April 2014	Electricity	6.0

Source Australian Energy Regulator, *Draft decision: Jemena Gas Networks (NSW) Ltd: Access arrangement 2015–20, Attachment 3: Rate of return*, p. 3-205.

### Conclusions with regard to cross checks

574. In accounting for this evidence relating to the views of other analysts and regulators, the Authority considers – based on the material set out above – that its estimate of the market return on equity is appropriate.

<sup>202</sup> Authority analysis, based on IPART, *Fact sheet – WACC biannual update*, August 2015.

#### 10.4.4.3 Step 5 – determination on the return on equity

575. The Authority has determined to adopt the return on equity for the 2015 WACC update as set out in Table 28 above (which is also reproduced in Table 40 in Appendix 5).

### 10.5 Final Decision

576. The Authority will adopt an approach to estimating the return on equity for each rail WACC update that is consistent with the five step approach set out in Figure 21.

577. With regard to Step 1, the following conclusions have been reached in relation to the approach for estimating the return on equity in this Final Decision:

- The Sharpe Lintner CAPM will be utilised to estimate the return on equity.
- The Black CAPM is relevant for the purpose of estimating the return on equity. However, given it is not reliable and practical to estimate a robust return on equity using this model, the model will not be used directly, but only to inform the point estimate of the equity beta from within its range for input to the Sharpe Lintner CAPM.
- The DGM is a relevant model for informing the market return on equity and also the forward looking MRP.
- The Fama French three factor model is not relevant and as such, this model is not used for the purpose of estimating a return on equity.

578. These models will be retained for the purpose of estimating the return on equity for each annual rail WACC update. However, at each rail WACC update, the following parameters will be re-estimated for the purpose of developing the updated estimate of the return on equity for input to the Sharpe Lintner CAPM:

- the 10 year risk free rate; and
- the MRP.

579. The following parameters will not be re-estimated prior to the next rail WACC method update and therefore the values set out for the 2015 rail WACC update will contribute to each subsequent annual rail WACC update:

- equity beta; and
- gamma.

## 11 Market risk premium

580. The market risk premium (**MRP**) is the required return, over and above the risk free rate of return, on a fully diversified portfolio of assets. The MRP, a key component of the estimate of the required rate of return on equity, compensates an investor for the systematic risk of investing in the 'market' portfolio (see section 4.4.2).
581. The required rate of return on equity for future regulatory periods is a forward-looking concept. It is the expected return that is of importance when pricing capital in order to attract efficient investment. While estimates of the cost of debt can be obtained by observing debt instruments, the financial markets do not provide a directly observable proxy for the cost of equity for either individual firms or the market as a whole.
582. In chapter 10, the Authority set out the framework which it will use for combining relevant material when determining the return on equity. This chapter considers issues related to the estimate of the MRP.

### 11.1 Current approach

583. Since the MRP is not directly observable, the preferred approach of Australian regulators has been to estimate the MRP using historical data on equity returns from the Australian stock market.
584. In the 2003 Determination, the Rail Access Regulator adopted a MRP of 6 per cent, informed by capital market observations of historical returns to equity and precedent decisions of Australian regulators. At the time, the value of 6 per cent was consistent with almost all regulatory determinations on infrastructure pricing in Australia.
585. In 2008, the Allen Consulting Group (**ACG**) recommended that the Authority continue to use an MRP of 6 per cent. ACG considered this value to be at the upper end of a reasonable range, based on its consideration of the capital market evidence. This evidence included:
- capital market observations of historical returns to equity;
  - studies on imputed expectations of the market risk premium;
  - surveys of opinions and assumptions of capital-market participants; and
  - qualitative consideration of factors that may cause the expected market risk premium to change over time and to vary from historically observed returns.
586. Accordingly, the Authority maintained the view in 2009 that the value of the market risk premium should be determined taking into account a range of evidence (including both historically observed equity premia and evidence for the current assumptions of market practitioners) and on this basis adopted a value of 6 per cent for the MRP.

## 11.2 Revised Draft Decision

587. The Authority conducted an extensive analysis of the MRP for the gas Rate of Return Guidelines.<sup>203</sup> The Authority undertook various empirical studies, using different datasets and methodologies, to inform its understanding of the relationship between the MRP and risk free rate in Australia. In particular, the Authority conducted a study to examine the behaviour of return on equity, the risk-free rate, and the MRP using the longest possible dataset of 128 years, from 1883 to 2010.
588. The findings of the analysis suggest that there is no statistically reliable relationship between the risk-free rate of return and the return on equity within the Australian context. Further, this analysis also supported the view that the risk-free rate is non-stationary, whilst the return on equity is 'stationary'.<sup>204</sup>
589. The implication is that the historical mean and variance of the historical return on equity series provide meaningful information relating to future outcomes. However, the Authority notes that the return on equity still exhibits very high levels of volatility and is thus not considered 'relatively stable or constant'.
590. The analysis also indicated that the return on equity is likely to be more stable than the MRP. As a consequence, there is evidence for a negative relationship between the risk free rate and the MRP. The Authority notes that studies based on overseas data – such as from Siegel (1998); Smithers and Co (2003); and Wright (2012) – present evidence to suggest that the return on equity is more stable than the market risk premium, which implies a negative relationship between the MRP and risk free rate.<sup>205</sup>
591. A key consideration in the context of the rail WACC relates to its purpose/application. The estimate is required to contribute to the annuity that will deliver the value of the rail infrastructure assets, over their economic life. With rail asset economic lives approaching a very long term, the estimate is long term.
592. Given the estimate is to be applied in a manner which delivers a long term estimate of costs, the Authority in the Revised Draft Decision considered it most likely that the real return on equity *for the market* will approach its long term real average. The Authority, therefore, was of the view that the real return on equity is the most reliable starting point for the estimate of the MRP. The corollary is that the MRP will move at any point in time to offset exactly current expectations for the long term risk free rate.<sup>206</sup>
593. The Authority considered in the Revised Draft Decision that the so-called 'Wright approach' provided the best estimate of the return on equity for the benchmark firm over the long term.

<sup>203</sup> For more detail, see Economic Regulation Authority, *Explanatory Statement for the Rate of Return Guidelines: Meeting the Requirements of the National Gas Rules*, 16 December 2013, chapter 11.

<sup>204</sup> A stationary series is mean reverting over time, whereas a non-stationary series is a random walk, without discernible central tendency.

<sup>205</sup> Smithers and Co, *A Study into Certain Aspects of the Cost of Capital for Regulated Utilities in the UK*, February 2003, p.v49; Siegel, J., *Stocks for the Long Run*, McGraw-Hill Second Edition, 1998; and Wright S, *Review of Risk Free Rate and Cost of Equity Estimates: A Comparison of UK Approaches with the AER*, University of London, 2012.

<sup>206</sup> The Authority considers that the MRP is not mean reverting, and that therefore it is inappropriate to rely on the unconditional historic mean of the MRP for informing the future.



594. The starting point for estimating the MRP for the long term rail WACC therefore was the Authority's estimate of the expected return on equity for the longer term, of 11.2 per cent. The 'on the day' estimate of the 10 year risk free rate at the time of the Revised Draft Decision was 3.3 per cent. It followed that the Wright estimate of the *long term* nominal MRP at that time was (11.2 – 3.3 per cent=) 7.9 per cent.

## 11.3 Submissions

### 11.3.1 CBH

595. CBH's consultant on the WACC issue, Frontier Economics, argues that the approach adopted in the Revised Draft Decision is not appropriate for the following four reasons.<sup>207</sup>
596. First, the ERA has simply assumed that it is possible to estimate separate short-term and long-term MRPs (i.e. that the MRP has a term structure). There is no persuasive evidence that this is the case.
597. Second, even if the ERA's assumption of a term structure is correct, the term premium implied by the ERA's two determinations is implausibly large. This is evidenced by a number of sense checks, which the ERA has not applied.
598. Third, when choosing its approach to estimating a 'long-term' MRP, the ERA has conflated two distinct concepts: the term to maturity and the periodicity of data used to estimate the MRP. The ERA's decision to rely on long-run data simply does not follow from the requirement to estimate a long-term WACC.
599. Fourth, Frontier submits that in its recent Draft Decision in relation to the Mid-West and South-West Gas Distribution System ('the gas decision'), the ERA relied on a range of different methods to estimate the MRP. Frontier considers this sensible because no approach is perfect, all are subject to estimation error and, in a statistical sense, it is generally possible to improve the accuracy of any individual estimate by combining it with additional independent estimates. Frontier considers that in striving to estimate a long-term MRP, the ERA has abandoned the range of evidence used in the gas decision and relied on a single method (the 'Wright method'). In relying on a single method, the risk of estimation error increases significantly.

### 11.3.2 Brookfield Rail

600. Brookfield Rail engaged Synergies Economic Consulting (Synergies) to provide an expert's advice in response to the Authority's Draft Decision.
601. Synergies submitted that the Authority's approach in taking a long-term forward looking view to estimate the required return on equity is appropriate because this long term is compatible with the horizon of investors in rail network infrastructure, which has long economic lives.<sup>208</sup>

<sup>207</sup> Frontier Economics, *A submission on the ERA's Revised Draft Decision on the WACC method for Brookfield Rail, a report prepared for CBH*, February 2015, p. v.

<sup>208</sup> Synergies Economic Consulting, *Review of the Method for Estimating the WACC for the Freight and Urban Railway Networks*, a report prepared for Brookfield Rail, February 2015, p. 6.



602. Synergies considered that the Wright approach should have a more prominent role in informing the estimation of the MRP. However, Synergies also submitted that there can still be benefits in also referencing other approaches, in particular, long-term historical averages and the forward-looking approach.<sup>209</sup>
603. Synergies also submitted that while it endorsed the use of market information to inform parameters such as the MRP, significant caution needs to be exercised in the ultimate weight that is placed on this data, having regard to their use as predictors of the expected trend in, or direction of, the MRP over the next ten years.<sup>210</sup>

### 11.3.3 Brockman Mining Australia

604. Brockman submitted that it is surprising that the Authority can simultaneously have two different views on a generic (economy-wide) parameter like the MRP with the difference of approximately 240 basis points (7.90 per cent in the Revised Draft Decision for regulated rail businesses and 5.5 per cent on the Draft Decision for ATCO Gas Australia).<sup>211</sup>
605. Brockman submitted that the Authority has erred in at least two more ways in respect of the Market Risk Premium. First, in an attempt to estimate a long-term MRP, the Authority has adopted an estimation technique (the so-called 'Wright method') that makes use of very long-run historical data (on equity returns to the market). Brockman argued that making use of long-run historical data does not necessarily ensure a good estimate of a long-term MRP. Second, Brockman argued that, in the Revised Draft Decision for rail regulated businesses, the Authority discarded the range of approaches used in the ATCO Gas Draft Decision and relied on a single technique (the Wright method) to derive its MRP estimate. Brockman considered that doing so increases greatly the risk of estimation error.<sup>212</sup> Brockman argued that there is no need for the Authority to abandon altogether the techniques in the ATCO Gas Draft Decision, and replace those exclusively with the Wright approach, in order to produce a long-term MRP estimate.
606. Brockman also submitted that the Authority should reconsider its approach to MRP in its final determination and align its position on MRP, and use the techniques it applied in the ATCO Gas Draft Decision, in order to estimate an appropriate MRP for the Final Decision.<sup>213</sup>

## 11.4 Considerations of the Authority

607. The Authority notes that all three submissions in response to the estimate of the MRP which was set out in the Revised Draft Decision focus on two key issues: (i) the nature

<sup>209</sup> Synergies Economic Consulting, *Review of the Method for Estimating the WACC for the Freight and Urban Railway Networks*, a report prepared for Brookfield Rail, February 2015, p. 6.

<sup>210</sup> Synergies Economic Consulting, *Review of the Method for Estimating the WACC for the Freight and Urban Railway Networks*, a report prepared for Brookfield Rail, February 2015, p. 12.

<sup>211</sup> Brockman Mining Australia, *Submission in response to the Economic Regulation Authority Western Australia Review of the method for estimating the Weighted Average Cost of Capital for the Regulated Railway Networks*, 2015, p. 12.

<sup>212</sup> Brockman Mining Australia, *Submission in response to the Economic Regulation Authority Western Australia Review of the method for estimating the Weighted Average Cost of Capital for the Regulated Railway Networks*, 2015, p. 13.

<sup>213</sup> Brockman Mining Australia, *Submission in response to the Economic Regulation Authority Western Australia Review of the method for estimating the Weighted Average Cost of Capital for the Regulated Railway Networks*, 2015, p. 13.

of the MRP in the short term versus the long term; and (ii) the use of a wider range of methods/approaches in estimating a forward looking MRP. These two issues are discussed in turn below.

#### 11.4.1 *The MRP in the short and long term*

608. The Authority notes that some submissions argued that the Authority has erred by assuming that it is possible to estimate separate short-term and long-term MRPs.
609. The Authority also notes that, in its submission, Brockman argued that it is surprising that the Authority can simultaneously have two different views on a generic (economy-wide) parameter like the MRP with the difference of approximately 240 basis points (the difference between the estimated MRP of 5.5 per cent in the ATCO Draft Decision and the MRP of 7.9 per cent in the rail Draft Decision).
610. CBH's consultant Frontier, on the other hand, considers that the difference in the estimated MRP implies that the Authority has assumed a term structure in the MRP, with a long term MRP adopted for rail businesses and a short term MRP adopted for electricity and gas businesses.
611. The Authority does not agree with these arguments.
612. In its Revised Draft Decision, the Authority did not argue that the MRP has a term structure. The Authority was of the view that the return on equity is stationary over a long period of time. This view was based on the Authority's empirical study, noted above, which involved testing the stationarity of the return on equity and of the MRP. The Authority considered that it is appropriate to utilise historical information on the return on equity as a guide for estimating the return on equity over the long run – which is relevant for the purpose of estimating the return on equity for rail businesses.
613. The Authority revised its MRP in the ATCO Final Decision, with the 5 year forward looking estimate being 7.6 per cent (as at 2 April 2015). Informing this estimate of the forward looking MRP for the ATCO Final Decision, various sources of information and a number of alternative approaches were considered. For that decision, the Authority was of the view that forward looking approaches (such as the DGM) and forward looking indicators can complement the estimates which are derived based on historical excess return to determine the forward looking MRP.
614. In relation to the estimate of the MRP for the regulated rail businesses, the Authority is of the view that historical information on the return on equity (the Wright approach) plays a more significant role in comparison with other sources of information and approaches that use forward looking information. This is because the evidence is that in the very long run, the return on equity is stationary and mean reverting. As a result, the estimate of the forward looking MRP for the regulated rail businesses is required to contribute to the annuity that will deliver the value of the rail infrastructure assets, over their economic life. Given the length of the rail asset economic lives, approaching 50 years or more, the estimate is long term.
615. On balance, the Authority notes that while similar sources of information and approaches are utilised to estimate the forward looking MRP for both gas and rail businesses, the relevance of each source of information (being historical excess equity return or forward looking information such as the DGM and the four conditioning forward looking indicators) is different in each case.

616. Importantly, the Authority does not argue for a term structure in the MRP or the return on equity. It is noted that the Authority considers that the process of continually estimating returns for five-year terms (as occurs in its gas decisions) will average, over time, to the historical long run average return. For some five-year periods the estimates of the return on equity will be above the long run average, while for other five year periods the estimates of the return on equity will be below the long run average.
617. At the same time, it may be that over the successive five year periods the concomitant *long run* estimates of the return on equity may be above or below the long run average.
618. Exactly how these successive long run estimates relate to the successive five year estimates, which is implied by the idea of a term structure, is not the point. The point is that the Authority considers that over successive periods, the long run return on equity is stable and mean reverting, such that the long run historic return on equity provides a useful guide to the long run future average return on equity.

#### 11.4.2 A wider range of approaches/methods in estimating the MRP

619. The Authority notes that, in response to the Authority's Revised Draft Decision on the rail WACC method, all submitters argued for a wider range of approaches/methods to be adopted in estimating the forward looking MRP.
620. The Authority notes that adopting a wider range of approaches/methods in estimating the forward looking MRP would be consistent with the Authority's approach utilised for the 2015 Final Decision for ATCO Gas Australia. In that decision, the Authority considered that the forward looking MRP is unobservable, such that various relevant approaches will provide together more information for deriving the final estimate.
621. Specifically, a range for the five year forward looking MRP was adopted based on the long term historic excess premiums as well as forward looking DGM estimates. With regard to this range, the lower bound of the range is informed by the Ibbotson average excess premium; and the upper bound of the range is informed by the upper bound of recent DGM estimates.
622. Accordingly, the Authority has reconsidered its approach to the rail WACC in light of the submissions made in response to the Revised Draft Decision. In the process, the Authority has come to the view that the Wright method may not provide the only relevant source of information as to possible future outcomes for the return on equity, and by extension, the MRP. The Authority's reasoning on the alternatives is set out in the following sections.

##### 11.4.2.1 Historic excess returns

623. Historic data on market returns in Australia is available spanning the period from 1887 to the present day.<sup>214</sup> The data may be used to develop estimates of the historic excess (market risk) premium, over and above historic risk free rates.
624. Based on its analysis of that data, the Authority considers that:

<sup>214</sup> Brailsford T., Handley J. and Maheswaran K, Re-examination of the historical equity risk premium in Australia, *Accounting and Finance*, 48, 2008.

- it is not clear whether the MRP is stationary (or in other words, mean reverting);
  - the MRP is time variant; and
  - any estimate requires judgment to balance a range of relevant information, in order to develop the best estimate reflecting prevailing market conditions.
625. The Authority is of the view that, in an application of the Sharpe Lintner CAPM, the interrelationship between a risk free rate of return and the MRP is a key consideration for estimating the return on equity. Given that view, the Authority considers that the two polar approaches (Wright and Ibbotson) provide relevant information for the determination of the MRP. These polar approaches are discussed in the following sections.

### Wright approach

626. The Wright approach is based on the view that a real market return on equity will be more stable than the forward looking MRP. This means that any reduction in the real risk free rate of return will be associated with an increase in the MRP, leaving the real market return on equity unchanged.
627. The Authority considered the properties of the risk free rate of return and the MRP in detail in the Rate of Return Guidelines released in December 2013 using Australian data.<sup>215</sup> The Authority notes that its tests of the historic time series support the 'stationarity' of the return on equity, which suggests that the observed historic mean is stable, and that the return on equity is 'mean reverting' over time. However, the risk free rate does not exhibit stationarity. Rather, there is evidence that it has the characteristics of a random walk in Australian capital markets.<sup>216</sup> The best predictor for a random walk is the most recent estimate.
628. Similar tests provide mixed evidence for the 'stationarity' for the MRP, which suggest that annual fluctuations in the MRP may not be mean reverting, and that an estimate for the future that is based on the historic estimate of the mean of the MRP may be biased. In consequence, the Authority has decided to use a range of evidence on expectations for the MRP, including the historic means, in order to assess the value of the MRP looking forward.
629. Overall, the empirical evidence analysed by the Authority, using Australian data, indicates that there is no statistically reliable relationship between the risk free rate of return and the return on equity. At the same time, there is no convincing evidence of mean reversion in the MRP. The return on equity, however, does exhibit mean reversion, and therefore is more predictable in the Australian context.
630. The Wright approach aligns with this evidence. It concludes that the MRP is not mean reverting, rather it is the long run *real* historical market return on equity that is mean reverting. With the Wright interpretation, at any point in time the real average market return on equity may be combined with the estimate of the long run *expected* inflation rate using the Fisher equation, to provide a best estimate of the expected nominal future average value of the return on the market. It follows then that deducting the on the day estimate of the risk free rate from that nominal estimate will

<sup>215</sup> Economic Regulation Authority, *Appendices to the Explanatory Statement for the Rate of Return Guidelines*, 16 December 2013, Appendix 8.

<sup>216</sup> Economic Regulation Authority, *Appendices to the Explanatory Statement for the Rate of Return Guidelines*, 16 December 2013, Appendix 16.

provide the contemporaneous on the day forward looking estimate of the MRP. This approach implies that the MRP and risk free rate are perfectly correlated one for one.

### The Ibbotson approach

631. The Ibbotson approach is consistent with the view that MRP is stationary and hence will return to some constant long run average that is a good predictor for the MRP in future. If stationarity of the MRP is borne out in reality, then the Ibbotson approach, despite being based on historical data, could be used as a reasonable 'on-the-day' prediction of the MRP over a future period. It can be combined with the on-the-day estimate of the risk free rate, which is considered to be the best predictor of future rates in light of the efficient market hypothesis.
632. The Authority notes that in their 2011 study, Dimson, Marsh and Staunton focused on the historical average equity risk premium as a relevant approach for estimating the MRP. The authors have noted that 'many people argue that the historical equity premium is a reasonable guide to what to expect in the future'.<sup>217</sup>
633. This accords with the view that there are good reasons to expect that the equity premium varies over time. Market volatility clearly fluctuates, and investors' risk aversion also varies over time. However, these effects are perhaps brief. Sharply lower (or higher) stock prices may have an impact on immediate returns, but the effect on long-term performance will be diluted. Moreover, volatility does not usually stay at abnormally high levels for long, and investor sentiment may be mean reverting. Consistent with this view, when forecasting the long run equity premium, it is hard to improve on extrapolation from the longest history of that premium that is available at the time the forecast is being made.
634. The Authority also notes evidence indicating that estimates of the MRP using historical data on the equity risk premium are biased. For example, McKenzie and Partington and Damodoran are of the view that an estimate of the MRP using an historical average of the equity risk premium is likely to overestimate the true expectation due to the presence of survivorship bias.<sup>218</sup> In this method of deriving an estimate for the MRP, a national stock exchange index is used as a proxy for the equity market return. In Australia, a proxy for the equity market return is the Australian All Ordinaries Index. These authors argue that stocks with consistently negative returns, no longer in the market have been excluded from the Australian All Ordinaries Index.
635. Siegel considers that historical equity returns are likely to overstate returns actually realised and earned because of historically high transaction costs and the historical lack of low cost opportunities for diversification.<sup>219</sup> The implication is that the long-term forward-looking MRP is expected to be lower over time relative to the historical estimate. Brailsford, Handley and Maheswaran, note that for the purposes of asset valuation in Australia, historical estimates of the MRP have been used. Using a more comprehensive data set than previous studies, they found estimates that were

<sup>217</sup> Dimson E., Marsh P. and Staunton E., *Equity Premiums Around the World*, 2011, p. 44 (in Hammond Jr., P.B., Leibowitz M.L. and Siegel L.B., *Rethinking the equity risk premium*, 2011, pp. 32-52.

<sup>218</sup> McKenzie M. and Partington G., *Review of Aurizon Network's Draft Access Undertaking*, 5 October 2013, p. 13; Damodoran A., *Equity Risk Premiums (ERP): Determinants, Estimation and Implications – The 2011 Edition*, February 2011, p. 30.

<sup>219</sup> Siegel, J., *Stocks for the Long Run*, McGraw-Hill Second Edition, 1998.



substantially lower.<sup>220</sup> This was attributed to lower estimated stock returns prior to 1958, and to a lower extent, higher bill returns prior to 1960.

636. The Authority notes that the above evidence suggests that any estimate of the historical equity risk premium that is based on historic data is conservatively high. Using a historical equity risk premium therefore provides one estimation method to determine a forward looking MRP. The Authority is also aware that well regarded financial services providers such as Credit Suisse and Duff and Phelps provide risk premium reports based on historical averages of equity risk premium data. This information indicates that investors are likely to place some weight on historical information on equity risk premiums to form their expected MRP. The Authority is therefore of the view that historical estimates of the mean of the MRP provide relevant evidence for any forward looking MRP in the Australian context.
637. In addition, the Authority also notes that in a report prepared for the AER in 2013, based on available evidence on empirical studies conducted for various countries, McKenzie and Partington concluded that:<sup>221</sup>

In the context of equity valuation, we argue that there may be times when it is changes in expected cash flow that largely drive changes in equity values and there may be times when it is changes in the cost of equity that largely drive changes in equity values, and it is likely that there are times when equity values change because of changes in both the expected cash flow and the cost of equity. There is little doubt that understanding the relative importance of discount rate and cash flow news in asset pricing is a crucial and unresolved issue. However, it is implausible that the overall cost of equity is a constant in either nominal or real terms.

And that:

Despite the consultants' strong support for a negative relationship, we find that a pro- and a counter-cyclical market risk premium are possible. An examination of the relevant evidence leads us to conclude that the relation between the MRP and the level of interest rates is an open question and that the relation, if any, is not sufficiently well established to form the basis for a regulatory adjustment to the MRP.

638. The Authority notes that McKenzie and Partington support the use of a forward looking MRP derived from historical risk premium, a widely used approach by the Australian regulators, in estimating a return on equity.<sup>222</sup>

We interpret the AER's approach as combining an estimate of the current risk free rate with an estimate of the current market risk premium and this is both an internally consistent approach and consistent with finance theory. The argument of the consultants that the AER approach mixes current and historic estimates of the risk-free rate in the CAPM misses the point. What matters is getting the best estimate of the current risk free rate and the best estimate of the current market risk premium. Using the same estimate of the risk free rate for both provides no assurance whatsoever that the best estimates will be obtained.

639. Based on the above academic evidence, the Authority is of the view that a long-term average of the historical data on the MRP is relevant for estimating a forward looking MRP. The Authority considers that this approach is transparent and verifiable, and therefore fit for purpose. In addition, given the possible alternative interpretations of

<sup>220</sup> Brailsford T., Handley J. and Maheswaran K, Re-examination of the historical equity risk premium in Australia, *Accounting and Finance*, 48, 2008.

<sup>221</sup> McKenzie, M. and Partington, G. 2013 *Review of the AER's overall approach to the risk free rate and market risk premium*, a report prepared for the Australian Energy Regulator, 28<sup>th</sup> February 2013, pp. 5-6.

<sup>222</sup> McKenzie, M. and Partington, G. 2013 *Review of the AER's overall approach to the risk free rate and market risk premium*, a report prepared for the Australian Energy Regulator, 28<sup>th</sup> February 2013, p. 6.

the stationarity of the MRP, the Authority is of the view that the Ibbotson approach and Wright approach provide relevant information for the purpose of estimating a forward looking MRP.

#### 11.4.2.2 *Forward looking information*

640. The Authority is of the view that selected conditioning variables, which are proxies for the prevailing market conditions, may also be used to determine the point estimate of the MRP from the range.

#### **Forward looking indicators**

641. The estimates of the range for the market return on equity derived from the Ibbotson approach and the Wright approach are based on historical data for the excess risk premium on equity.
642. In its Final Decision for ATCO Gas Australia, the Authority adopted four forward looking indicators of market conditions for the next 5 years that are readily available and up to date, in order to select a point estimate within the range of the MRP derived from the historic excess premiums. These indicators included:
- (i) dividend yields on the All Ordinaries, a financial metric;
  - (ii) interest rate swap spreads, which can be viewed as a type of term structure variable;
  - (iii) default spreads, another term structure variable that makes forward looking expected returns explicit; and
  - (iv) the Australian Stock Exchange (ASX) 200 volatility index (VIX) which measures investors' perceptions of equity market risk.
643. The Authority notes that while the above four conditioning forward looking indicators are relevant in the context of gas and electricity, these indicators are of limited relevance in the context of setting the rail WACC. This is because the rate of return is long term, approaching 50 years. The four indicators used for the ATCO gas decision are all of shorter term than this period. The Authority therefore considers that the indicators have limited relevance for the rail WACC estimates, and has not taken the indicators into account for this Final Decision.

#### **The Dividend Growth Model**

644. The Authority notes that the estimates from the DGM also provide forward looking information on the market return on equity.
645. The Authority is of the view that estimating a market return on equity (or, by derivation, the MRP) using the DGM will likely provide an outcome which is closer to the estimate of the MRP from the Wright approach; that is, the implied forward looking MRP will tend to increase as the risk free rate falls. This view is supported by the fact that DGM estimates of the return on equity tend to be forward looking over a term 'to perpetuity'. It may then be observed that changes in the risk free rate tend to be offset by changes in the MRP.<sup>223</sup>

<sup>223</sup> This tendency may be observed in Figure 22 below.



### 11.4.2.3 Overall conclusions

646. The Authority maintains its position from the Revised Draft Decision for rail businesses that the real return on equity for the market will play a significant role in estimating a long term forward looking MRP. Nonetheless, given the complex nature of estimating an (unobservable) MRP, the Authority agrees with the view put forward in the public submissions that it is more appropriate to consider a wider range of available evidence on the estimate of a long term forward looking MRP.
647. In the Authority's Final Decision for ATCO Gas Australia, the Ibbotson approach, the Wright approach' and the DGM were all used to inform the Authority's estimate of the MRP. The Authority is now of the view that it is appropriate to maintain a similar approach for this rail WACC method Final Decision.
648. Accordingly, for this Final Determination, three different approaches will be utilised in estimating a long term forward looking MRP for regulated rail businesses in WA: (i) the Ibbotson approach; (ii) Wright approach; and (iii) the DGM approach.
649. The following framework is therefore adopted to derive the forward looking MRP/return on equity:
- first, estimate the forward looking MRP/return on equity using the Ibbotson approach and the Wright approach;
    - these two estimates will form the initial range of the forward looking MRP/return on equity using historical equity excess return;
  - second, estimate the range of the forward looking MRP/return on equity using the DGM;
  - third, develop an overall range for the forward looking MRP based on the three estimates; and
  - fourth, select a point estimate from within the above range based on judgment and any other additional relevant information.

### 11.4.3 Estimates of the forward looking MRP

650. The estimates associated with each of the three estimation approaches are developed.

#### Historical risk premium approaches

##### *Wright approach*

651. To estimate the historical average return on equity, the Authority extended the Brailsford, Handley and Maheswaran (**BHM**) and NERA historic returns series through to 2014.<sup>224,225</sup>

<sup>224</sup> T.J. Brailsford, J.C. Handley and K. Maheswaran, The Historical Equity Risk Premium in Australia: Post-GFC and 128 Years of Data, *Accounting and Finance*, 52, 2012, Table 2, pp. 237-247; NERA Economic Consulting, *The Market Risk Premium: Analysis in Response to the AER's Draft Rate of Return Guideline*, A Report for the Energy Networks Association, October 2013.

<sup>225</sup> This is consistent with the approach adopted in the Authority's recent GDS decision (see Economic Regulation Authority, *2015 Final Decision on Proposed Revisions to the Access Arrangement for the Mid-West and South-West Gas Distribution Systems*, 30 June 2015, p. 253).

652. The Authority notes that the difference between the long run average (nominal) market return on equity based on the BHM and NERA series is 36 basis points (Table 30).

**Table 30 BHM and NERA long run historic nominal and real annual average market returns for 1883 to 2014 (excluding imputation credits)**

	NERA approach	BHM approach	Difference
Nominal return	12.00%	11.64%	0.36%
Real return	8.76%	8.40%	0.36%

Source: NERA (2013), Brailsford, Handley and Maheswaran (2012) and ERA Analysis

653. The Authority notes that Handley's advice to the AER prepared in October 2014 raised a number of concerns regarding the analysis underlying the NERA (2013) data.<sup>226</sup> In particular, Handley highlighted a lack of consistency between NERA's source of dividend yields and those employed by Lamberton on which the BHM series was based. In addition, Handley highlighted that NERA had not reconciled their adjusted yields with those of Lamberton. The Authority therefore is of the view that the analysis underlying the NERA (2013) data is insufficient grounds to justify the full upward adjustment to the BHM series performed by NERA.
654. Given the uncertainty surrounding the most appropriate adjustment to the market return series, the Authority considers that it is appropriate to use an average of the two series to minimise any potential error with use of either series alone.

#### Imputation Gross-Up Adjustment

655. The real long term average market return of the BHM and NERA series is estimated as the 'gross return' investors in equity would expect to receive on the market. That is, it is reported inclusive of yields from capital gains and dividends. The series do not account for the introduction of imputation after 1987, so need to be adjusted up from that point forward to account for the imputation credit yields.<sup>227</sup>
656. The post-tax financial model utilised for the Authority's gas decisions compensates for required returns lost to taxation by providing an explicit allowance in the model cash flows for the taxes payable, which are then recovered in regulated tariffs.<sup>228</sup> At the same time, the reduction for the value of imputation credits is also explicitly accounted for in the cash flows.
657. Therefore, applying a return on equity in the post-tax model which was not 'grossed up' for imputation credits would result in under compensation for the investor. This would result because the value of imputation credits would be removed twice, first from the rate of return, and second from the revenue cash flows.
658. It follows that the Authority needs to 'gross up' the observed post 1987 market returns in the BHM data for the estimated value of imputation credits. Applying this in the

<sup>226</sup> J. Handley, *Advice on the Return on Equity*, A Report prepared for the Australian Energy Regulatory, 16 October 2014, p. 19.

<sup>227</sup> T.J. Brailsford, J.C. Handley and K. Maheswaran, The Historical Equity Risk Premium in Australia: Post-GFC and 128 Years of Data, *Accounting and Finance*, 52, 2012, Table 2, pp. 237-247.

<sup>228</sup> Gamma in the post-tax approach is factored in through a reduction in the compensation for company tax, reflecting the estimated cash flows received by investors from imputation credits through their personal tax.

post-tax revenue model will then ensure that the investor receives an ‘after company tax, after some personal tax’ return.<sup>229</sup> The final component of the required return on equity is then received through the investor’s tax return.

659. To calculate the value of imputation credit yields in each year from 1988 (inclusive) onwards, equation (19) based on that set out by Handley (2008), accounting for theta directly, is used:<sup>230,231</sup>

$$c_t = F \times d_t \left( \frac{T_t}{1-T_t} \right) \times \theta \quad (19)$$

Where

$\theta$  is the value of distributed imputation credits consistent with the Authority’s estimate of gamma;

$d_t$  is the dividend yield in year  $t$  ;

$F$  is the proportion of dividends which are franked; and

$T_t$  is the corporate tax prevailing in that year.

660. The yield is then added on to the total return in each year 1988 through to 2014. The results for both series for the period following the introduction of imputation are the same, as the NERA and BHM total return series do not differ over this period. The average yield value of imputation credits to investors from 1988 to 2014 based on these assumptions and the real return data is an estimated 0.88 per cent.
661. The imputation credit yields for each year are then added to the real total returns for both the BHM and NERA series from 1988 on and the two series are then averaged (Table 31).

**Table 31 Average annual imputation credit yields and grossed up arithmetic average returns (nominal, consistent with the estimate of gamma of 0.4)**

	NERA	BHM	Average
Nominal returns excluding imputation yield (1883-2014)	12.00%	11.64%	11.82%
Nominal imputation credit yield (1988-2014)	0.91%	0.91%	0.90%
Grossed up nominal returns (1883-2014)	12.19%	11.83%	12.01%
Grossed up real returns (1883-2014)	8.94%	8.58%	8.76%
Expected inflation for the long term	2.50%	2.50%	2.50%
Grossed up nominal return commensurate with current inflation expectations	11.67%	11.3%	11.48%

Source: ERA Analysis, NERA (2013), Brailsford, Handley and Maheswaran (2012)

662. The estimate of the 10-year risk free rate is 2.97 per cent as at 30 June 2015.

<sup>229</sup> J.C. Handley, *Further comments on the historical equity risk premium*, 14 April 2009, pp. 16-17.

<sup>230</sup> T.Brailsford, J.Handley and K.Maheswaran, *Re-examination of the Historical Equity Risk Premium in Australia*, Accounting and Finance, vol. 48, 2008, p. 85. The F in equation 13 is taken to be 0.75, hence a value for theta of 0.53 corresponds to an estimate of gamma of 0.4.

<sup>231</sup> The imputation credit regime commenced from 1 July 1987.

663. Based on the estimate of the nominal return on equity of 11.48 per cent and the 10-year risk free rate of 2.97 per cent, the implied forward looking MRP is 8.5 per cent (rounded). That estimate is consistent with the Wright approach, taking account of inflation expectations and current risk free rates.

*The Ibbotson approach*

664. The Ibbotson approach is based on the concept of a long run average MRP and combines this with an 'on the day' risk free rate to arrive at an on the day estimate of the market return on equity.

665. The estimates of a forward looking MRP using Ibbotson are based on the Authority's own dataset, which updates BHM's data through to 2014. The resulting Ibbotson estimate is consistent with that adopted in the Final Decision for ATCO Gas Australia, with the only difference being that the 10-year risk free rate is utilised for the estimates adopted in this Final Decision for regulated rail businesses.

666. The nominal 10 year MRP estimates (grossed up for imputation credit yields) were calculated on both the NERA and BHM data by subtracting relevant bond yields from the nominal NERA and BHM annual grossed up returns. The average arithmetic and geometric means of the resulting four series were then calculated (Table 32). Utilising the bond based MRPs for both NERA and BHM produces 10 year MRP estimates that range between 5.7 per cent and 6.4 per cent for the arithmetic means and 3.9 per cent and 4.9 per cent for the geometric means.<sup>232</sup>

667. The Authority notes that there are mixed views as to the best estimator of historic returns. Arithmetic average returns will tend to overstate returns, whereas geometric returns will tend to understate returns.<sup>233</sup> An unbiased estimator is likely to lie somewhere between the two estimates. The Authority's view is that arithmetic means are preferred in most circumstances.

**Table 32** Estimates of bill and bond-based 10 year grossed up nominal average Market Risk Premiums

Period	BHM	NERA	Average	BHM	NERA	Average
	Arithmetic mean			Geometric mean		
1883-2014	6.2%	6.2%	6.2%	4.9%	4.9%	4.9%
1937-2014	5.9%	5.9%	5.9%	4.0%	4.0%	4.0%
1958 - 2014	6.4%	6.4%	6.4%	4.0%	4.0%	4.0%
1980 - 2014	6.2%	6.2%	6.2%	3.9%	3.9%	3.9%
1988 - 2014	5.7%	5.7%	5.7%	4.0%	4.0%	4.0%

Source: Brailsford, Handley, Maheswaran (2012) and ERA Analysis

668. That said, the Authority in this instance is looking for a reasonable lower bound for its range. On this basis, the Authority is inclined to the arithmetic mean as a preferred estimator. A lower bound informed by the lowest arithmetic mean estimate from

<sup>232</sup> This approach contrasts with the average of the bond and bill MRP estimates utilised for the 2015 ATCO gas decision. Averaging the short term bill MRP estimates and the 10 year bond MRP estimates in that case gave a term that was close to 5 years. Here, the 10 year bond MRP estimates are used, as it is the closest estimate to the long term required for the rail WACC method.

<sup>233</sup> M. McKenzie and G. Partington, *Supplementary report on the equity MRP*, 22 February 2012, p. 5.

Table 32 would be 5.7 per cent. However, the Authority considers that this lower bound may be too high, given potential upward bias in the arithmetic estimate.

669. The Authority therefore exercises its judgment to adjust this bound down, informed by the lower estimates of the average MRP that are provided by the geometric means (Table 32). The Authority considers that 5.3 per cent provides a reasonable lower bound, being the average of the lowest arithmetic mean of 5.7 per cent and the highest geometric mean of 4.9 per cent.
670. The Authority therefore considers that the mid-point estimate of 5.3 per cent using the Ibbotson approach provides a lower bound of the initial range of the forward looking MRP estimated using historical excess returns on equity, as at 30 June 2015.

*The range of MRP informed by the historical risk premium approaches*

671. For the purpose of this Final Decision, as at 30 June 2015, the two estimates from the two different approaches to the historical risk premium will inform the Authority's estimate of the *historical range* for the MRP, with the lower bound estimate of 5.3 per cent (obtained from the Ibbotson approach) and the upper bound estimate of 8.51 per cent (obtained from Wright approach).
672. The Authority notes that the initial range of the MRP of 5.3 per cent and 8.5 per cent is equivalent to the range of 8.27 per cent and 11.48 per cent for the market return on equity, given the 10-year risk free rate of 2.97 per cent.

**Forward looking approach: the DGM**

673. The Authority has revisited the DGM estimates, gathering a range of grossed up market return on equity estimates from the more recent DGM models as presented in Table 33 below.
674. The majority of studies in Table 33 use the accepted franking proportion of 0.75 to gross up returns. The commensurate estimate of theta for that franking proportion, which delivers a gamma of 0.4, is just under 0.55. Based on the results in Table 33 the Authority judges that a range for the MRP commensurate with a gamma of 0.4 is 5.6 to 9.7 per cent. The lower bound is established by the Authority's August 2013 lower bound estimate for a theta of 0.55, while the upper bound is given by Capital Research's February 2012 estimate.

**Table 33 Recent estimates of the MRP using the DGM, per cent**

Study/ Author	Date	Dividend Yield	Theta	Risk free rate	MRP (Per cent)
Capital Research	Feb 2012	Factset	0.5	3.8	9.7
NERA	Sep 2012	Bloomberg	0.35	3.13	8.03
CEG	Nov 2012	RBA	0.35	3.05	8.89
Lally	Mar 2013	Bloomberg	0.35	3.26	5.90-8.39
ERA	Aug 2013	Bloomberg	0.35 – 0.7	3.31	5.34 – 7.57
SFG	Dec 2014	Thomson Reuters I/B/E/S	0.35 - 0.7	2.95 – 3.58	7.84 - 9.58
CEG	May 2014	RBA			7.21 – 7.61
AER	Sep 2014	Bloomberg	0.7	3.48	6.6 – 7.8
AER	Apr 2015	Bloomberg	0.6	2.55	7.4 – 8.6
SFG	Jan 2015	Thomson Reuters I/B/E/S		3.01	7.48
ERA	Jun 2015	Bloomberg	0.48	3.01	7.31
<b>Range</b>					<b>5.6 – 9.7</b>

Source: Capital Research, *Forward Estimate of the Market Risk Premium: Update*, A response to the draft distribution determination by the AER for Aurora Energy Pty Ltd, February 2012, p. 20.

NERA Economic Consulting, *The Market, Size and Value Premiums*, June 2013, p. 49;

Competition Economists Group, Update to March 2012 Report, November 2012, p. 31.

M. Lally, *The Dividend Growth Model*, 4 March 2013, p. 16.

ATCO Gas Australia, *ATCO Gas Australia's Response to the ERA's Draft Decision*, 22 December 2014, Appendix 9.1, p. 32.

Australian Energy Regulator, *Draft decision: Jemena Gas Networks (NSW) Ltd: Access arrangement 2015–20*, Attachment 3: Rate of return, November 2014, p. 3-200.

Australian Energy Regulator, *Final Decision: Essential Energy Distribution determination 2015-16 to 2018-19*, Attachment 3: Rate of return, November 2014 p. 3-309.

SFG Consulting, *The required return on equity: Initial review of the AER draft decision, Note for ActewAGL, Ausgrid, Essential Energy and Endeavour Energy*, 19 January 2015, p. 36.

Competition Economists Group, *WACC estimates – A report for NSW DNSPs*, May 2014, p 22- 23.

Authority estimates (2015 estimate utilises a 10 year risk free rate, whereas the 2013 estimates use the 5 year risk free rate in determining the MRP).

Source: Australian Energy Regulator and ERA Analysis



675. In addition, the Authority updated its two stage DGM estimate (Box 1) for this Final Decision, to be current as 30 June 2015.<sup>234</sup>

### Box 1 The two stage DGM

The return implied by the Gordon DGM is based on a forecast dividend based on a forecast dividend growth rate to calculate a forecast dividend yield and then augments this yield with the growth forecast itself. This is shown in equation (20).

$$r_e = \left( \frac{E(D_1)}{P_0} \right) + g \quad (20)$$

Where  $E(D_1) = D_0(1 + g)$  and is the last dividend per share paid.

The Authority's current estimate of the DGM is based on a simple two stage approach as outlined in equation (21).

$$P_0 = \frac{m \times E(D_0)}{(1+k)^{m/2}} + \sum_{t=1}^N \frac{E(D_t)}{(1+k)^{m+t-0.5}} + \frac{E(D_N)(1+g)}{(1+k)^{m+N-0.5}} \quad (21)$$

Where

$D_t$  is current price the of the equity index;

$m$  is the fraction of the current year remaining;

$t$  is the dividend per share expected in the current year;

$E(D_t)$  is the dividend per share expected years into the future;

$k$  is the return on equity implied by the model;

$N$  is the year of the furthest out dividend forecast; and

$g$  is the long run dividend growth rate.

Monthly net dividend per share forecasts for the All Ordinaries Index were sourced from Bloomberg for the current year, the next year and the year after. The monthly closing price for the All Ordinaries index was also sourced from Bloomberg.

676. The assumption for the long run dividend growth rate in the updated DGM model,  $g$ , at 4.6 per cent, is consistent with the analysis in Lally's 2013 study.<sup>235</sup> This equates  $g$  to the estimated long run nominal GDP growth, of 5.6 per cent, less 1.0 per cent to account for new share issues and new companies. The resulting grossed up DGM estimate of the required return on the market is 10.3 per cent as at 30 June 2015.

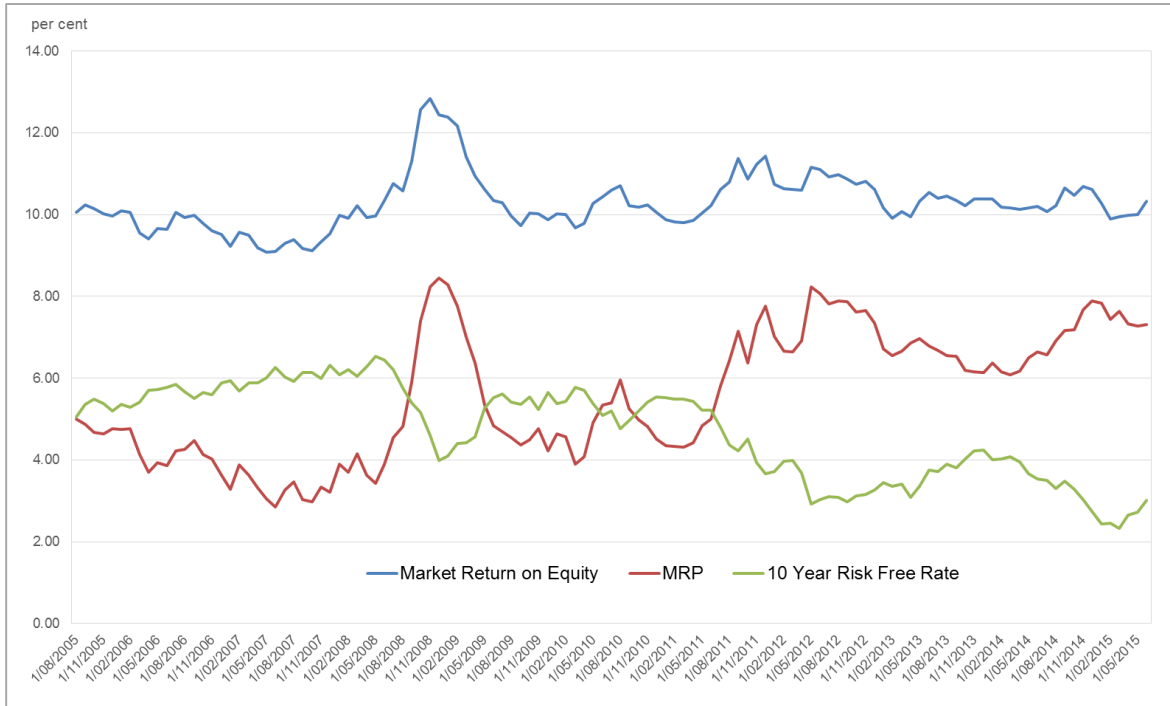
<sup>234</sup> The model was used to develop the range for the MRP in the Rate of Return Guidelines (see Economic Regulation Authority, *Appendices to the Explanatory Statement for the Rate of Return Guidelines*, 16 December 2013, p. 122).

<sup>235</sup> M. Lally, *The Dividend Growth Model*, 4 March, 2013, p. 17.



677. The corresponding results for  $g$  of 4.6 per cent – when combined with the historic consensus dividend forecasts and share prices from Bloomberg going back to 2005 – are shown in Figure 22.

**Figure 22 Dividend Growth Model implied return on equity: All Ordinaries Index (monthly, grossed up)**



Source: Bloomberg and ERA analysis

678. The implied expected market return on equity (grossed up for imputation credit yields) typically fluctuates, in this case between 9 per cent and 11 per cent, only breaking higher in periods of perceived heightened risk, such as 2008 to 2009 and 2011 to 2012. The model indicates that, from the end of 2014 through March 2015, expected returns declined somewhat, before recovering somewhat through to June 2015.
679. The most recent available monthly observation of the market return on equity for 30 June 2015, at 10.3 per cent, is above the middle of the ‘more typical’ range for the return on equity (that is, excluding the GFC type periods). It is at the 60<sup>th</sup> percentile of the observations reported in Figure 22.
680. Deducting the Authority’s estimate of the 10 year risk free rate, of 2.97 per cent, from the return on the market for the end of June 2015, gives a forward looking 10 year MRP of 7.35 per cent, which also may be observed in Figure 22. The MRP series suggests that the current forward looking estimate is towards the top end of its typical range.
681. The estimates from the DGM are sensitive to input assumptions, particularly the long run growth rate. Varying the long run growth rate,  $g$ , around the central 4.6 per cent from 4.0 per cent to 5.2 per cent, leads to a range for the MRP estimate at 30 June 2015 of 6.8 per cent to 7.9 per cent.

682. The Authority notes that DGM estimates are recognised to have shortcomings, including that:<sup>236</sup>
- analyst forecasts have a tendency to be upwardly biased, as they are based on over-optimistic expectations for target prices and earnings;
  - DGMs proxy the free cash flow to equity through the estimated dividends, however, dividends may not react to changes in market conditions, for example in downturns where companies may maintain their dividend policy, which will upwardly bias returns;
  - DGMs do not capture non-dividend cash flows, such as share repurchases or dividend re-investment plans.
683. The Authority notes that there is no clear agreement among experts as to the best form for the DGM, or its input assumptions. For that reason, the Authority adopts a wide range, informed by a spectrum of recent studies. Table 33 suggests that a representative range for the estimate of the grossed up MRP from the DGM is 5.6 per cent to 9.7 per cent.
684. Ideally, DGM return on equity estimates should be based on the most current on-the-day dividend forecasts. However, the Authority notes that the number of studies estimating return on equity using the DGM in Australia is limited and that it is not possible to update all of the various estimates available. Therefore, to allow for a broad range of information, DGM return on equity estimates since 2012 have been accounted for. The Authority is of the view that it is appropriate that the most recent estimates (since mid-2014) provide the more relevant and up-to-date information, as presented in Table 33.
685. Overall, the Authority infers from the DGM MRP series that the market expectation is for an MRP that has generally moved upwards to offset the declines in the risk free rate in recent times.
686. The Authority maintains its position that the estimates of the MRP using the DGM approach tends to provide an upward biased estimate.

## 11.5 Final Decision

687. In order to derive the final point estimate for the forward looking MRP, the Authority considers that it is appropriate to follow the framework set out above (section 11.4.2.3).
688. First, the Authority notes that the estimate of the MRP informed by historical excess equity risk premiums falls within the range of 5.3 per cent (based on the Ibbotson approach) and 8.5 per cent (based on the Wright approach).
689. Second, the Authority also notes the forward looking MRP derived from various DGM studies is likely to fall within the wide range of 5.6 per cent and 9.7 per cent.
690. Third, the Authority considers that the forward looking MRP – taking into account all approaches – is likely to fall with the range of 5.3 per cent and 9.7 per cent provided by the bounds of both the historic and the DGM ranges combined.

<sup>236</sup> See for example M. McKenzie and G. Partington, *Report to the AER, Part A: Return on equity*, October 2014, pp. 26-31.

691. Fourth, the Authority considers that the Wright estimate provides a strong indicator for the likely return on equity for the next 50 years, given the statistical evidence for the mean reversion of the return on equity. This is consistent with the position set out in the Revised Draft Decision. The implication is that the (implied) forward looking MRP for the rail WACC should be close to 8.5 per cent as at 30 June 2015.
692. However, the Authority also notes that the potential for interest rates to achieve the historic long term average over the next 50 year period (which also is implied by the Wright method) is uncertain. Given this uncertainty, consideration is also given to the estimate for the MRP of 5.3 per cent derived from the Ibbotson approach.
693. Therefore, within the range of 5.3 per cent and 8.5 per cent derived from historical excess equity risk premium, the Authority is inclined somewhat more toward the Wright view of the world, given the long term nature of the estimate, which would place the estimate of the MRP in the upper half of the historic range.
694. With regard to the DGM, the Authority noted above that the DGM approach tends to provide upwardly biased estimates. Therefore, the Authority is inclined to give more weight to those estimates which are in the lower half of the recent range.
695. The Authority also notes that the DGM estimates vary significantly across studies. The Authority is of the view that, unless there was some significant outperformance in earnings/economic growth expected, as compared to history, estimates of the forward looking MRP using the DGM should tend to align with the Wright estimate over the long term.
696. On balance, taking all of the above information into account, the Authority is of the view that the forward looking MRP of 7.3 per cent represents a reasonable balance of the range of estimates provided by the historical excess premiums and DGM approaches – at the current time – consistent with the long term forward view required for the rail WACC method.

## 12 Equity beta

697. Under the capital asset pricing model (**CAPM**) model, the total risk of an asset is divided into: (i) systematic risk and (ii) non-systematic risk. Systematic risk is a function of broad macroeconomic factors (such as economic growth rates) that affect all assets and cannot be eliminated by diversification of the investor's asset portfolio.
698. The key insight of the CAPM is that the contribution of an asset to the systematic risk of a portfolio of assets is the correct measure of the asset's risk (known as beta risk) and the only systematic determinant of the asset's return, over and above the return on a risk free asset.
699. In contrast, non-systematic risk relates to the attributes of a particular asset. The CAPM assumes that this risk can be managed by portfolio diversification. Therefore, the investor in an asset does not require compensation for this risk.
700. In the CAPM, the equity beta value is a scaling factor applied to the market risk premium, to reflect the relative risk for the return to equity of the firm in question. Two types of risks are generally considered to determine a value of equity beta for a particular firm: (i) the type of business, and associated capital assets, that the firm operates; and (ii) the amount of financial leverage (gearing) employed by the firm.

### 12.1 Current approach

#### 12.1.1 The PTA rail network

701. The 2003 Weighted Average Cost of Capital Review, performed by the Authority's predecessor, the Rail Access Regulator, determined that an asset beta of 0.30 was appropriate for the PTA rail network (which is equivalent to an equity beta of 0.46 for a gearing of 35 per cent).<sup>237</sup> This determination was based on an analysis performed by Network Economics Consulting Group (**NECG**), who conducted an analysis of the required asset beta for passenger rail by utilising Bloomberg data based on a sample of overseas rail providers. The average unadjusted asset beta of the group was 0.32. NECG considered the contractual relations WAGR (now PTA) had with the State Government as being a factor that would lower WAGR's asset beta. NECG also noted WAGR officers' perceptions of a low beta being applicable to their operations. Consequently, an asset beta of 0.30 was adopted. In conjunction with an assumed gearing level of 35 per cent, an equity beta of 0.46 was determined.
702. In the Final Determination for the 2008 WACC, the Authority maintained the view that the equity beta of the PTA network should be set at 0.46.<sup>238</sup> The Authority's method for deriving its equity beta estimates followed the advice from the Allen Consulting Group (**ACG**).<sup>239</sup> Again, this value was consistent with an asset beta of 0.30 which fell within the range determined by ACG and a gearing level of 35 per cent.

<sup>237</sup> Network Economics Consulting Group, *Review and Determination of Weighted Average Cost of Capital for Rail Infrastructure Operated by WestNet Rail and Western Australian Government Railway Commission: Final Report for the Office of the Rail Access Regulator*, June 2003, p. 67.

<sup>238</sup> Economic Regulation Authority, *2008 Weighted Average Cost of Capital for the Freight (WestNet Rail) and Urban (Public Transport Authority) Rail Networks: Final Decision*, June 2008 pp. 23-31.

<sup>239</sup> The Allen Consulting Group, *Railways (Access) Code 2000: Weighted Average Cost of Capital 2008 WACC Determinations*, October 2007.

703. ACG used a sample of Australian and international toll road companies, for which Bloomberg raw equity betas were collected. These were de-levered using gearing levels calculated from Bloomberg data to arrive at asset betas. Based on the sample, a range of asset betas from 0.25 to 0.30 were recommended corresponding to a range of equity beta values from 0.38 to 0.46. The Australian average was above the upper end of this as a result of Macquarie Infrastructure Group having a substantially higher asset beta than the rest of the sample. A sample average of 0.25 was calculated on the sample without Macquarie forming the lower end of the range while the full sample average forming the upper end.
704. ACG recommended the application of beta values at the lower end of these ranges in light of the passenger rail system in Western Australia involving solely government-supported passenger services.

### 12.1.2 Brookfield Rail

705. In 2008 for the WestNet Rail (now Brookfield Rail) WACC determination, the Authority took the view that the equity beta for the freight network is 1.0.<sup>240</sup> This was also based on the advice of ACG, who recommended a range of 1.0 to 1.15 based on 35 per cent gearing and an asset beta of 0.65 to 0.75. The sample of comparable firms included rail infrastructure businesses in the United States and Canada and listed transport infrastructure services firms in Australia and New Zealand.
706. ACG's view was that an assumed asset beta in this range would overstate an asset beta for the freight rail system in Western Australia. This was because the above comparator companies were thought to have a higher proportion of revenues derived from intermodal traffic, which is expected to have a higher beta than the freight rail system in Western Australia. Accordingly, ACG recommended an asset beta of 0.6 at a 35 per cent gearing level, giving an equity beta of 0.92.
707. The Authority also acknowledged submissions that the high operating leverage (ratio of variable to fixed costs) of the freight-network business may, all other things being equal, contribute to a relatively high sensitivity of profits to changes in levels of demand and a higher beta value for the freight network business. However, the Authority was of the view that the Western Australian freight network is likely to have a lower beta than the comparators due to the predominance of bulk grain and minerals freight which were found to have asset betas closer to 0.45.<sup>241</sup> Based on this, its view was that there was limited justification to adopt a beta value outside of the range derived from comparator businesses.

### 12.1.3 The Pilbara Infrastructure

708. In the 2009 Final Determination for the TPI WACC, the Authority decided that an asset beta within the range of 0.7 to 1 was appropriate for TPI. A value of 0.69 was calculated by Charles River Associates (**CRA**) as the average asset beta estimated for a sample of eight US and Canadian freight railways. An asset beta of 1.00, which was at the top of the range, was considered appropriate. This value with a gearing level of 30 per cent gave an equity beta of 1.43 for TPI.

<sup>240</sup> Economic Regulation Authority, *2008 Weighted Average Cost of Capital for the Freight (WestNet Rail) and Urban (Public Transport Authority) Rail Networks: Final Decision*, June 2008 pp. 23-31.

<sup>241</sup> Economic Regulation Authority, *2008 Weighted Average Cost of Capital for the Freight (WestNet Rail) and Urban (Public Transport Authority) Rail Networks: Final Decision*, June 2008 pp. 23-31.

709. In its 2009 Final Determination, the Authority considered that an appropriate asset beta for TPI's railway would be higher than the average overseas comparator. The Authority also noted that a single commodity railway in a remote location that exclusively serves mining related export demand is likely to have a higher level of risk than intermodal or general freight railway.<sup>242</sup> The Authority considered that Genesee & Wyoming Inc. was likely to be the best comparator being a class II/III type railway operator which has more similar characteristics to TPI than the other firms in the sample.

## 12.2 Revised Draft Decision

### 12.2.1 PTA Rail Network

710. Based on its empirical evidence, the Authority considered that the average asset beta across comparable companies for PTA is 0.40. Excluding Vinci SA<sup>243</sup> reduces the average asset beta of the remaining comparable companies to 0.34.
711. Given the low level of systematic risk present in the PTA rail network, the Authority considered that an asset beta on the lower end of this range is appropriate. Utilising regulatory discretion, the Authority considered that an asset beta of 0.3, at the lower end of this range and slightly lower than the average asset beta excluding Vinci SA is appropriate.
712. Utilising a gearing of 50 per cent, this corresponds to an equity beta of the PTA network of 0.6. This represents an increase of the equity beta of the PTA from the 2008 decision, in which the Authority determined that the equity beta of the PTA network should be set at 0.46.<sup>244</sup> The Authority noted that this increase is due solely to the increase in the benchmark gearing from 35 per cent to 50 per cent, with the asset beta unchanged from 0.3.

### 12.2.2 Brookfield Rail

713. The Authority noted that Aurizon is potentially the best comparator company to the Brookfield Rail network, given that it operates in Australia and transports similar freight. In addition, the Authority considered that non-rail operators are a less valid proxy company compared to rail operators. However, given they were previously included on the basis that they provide information relating to the systematic risk of general freight operations, they were retained for the purposes of the revised draft determination.
714. The Authority has the *a-priori* expectation that overseas rail operators will possess a higher level of systematic risk, relative to an Australian railway operator, given that American and Canadian railway operators are expected to face higher degrees of competition from alternative forms of transportation such as roads. The Authority

<sup>242</sup> Economic Regulation Authority, *The Pilbara Infrastructure (TPI): Final Determination on the 2009 Weighted Average Cost of Capital for TPI's Railway Network*, June 2009, pp. 36-45.

<sup>243</sup> Vinci SA is a France-based company which is involved in construction and engineering. It designs, builds, finances and manages facilities such as transport systems, public and private buildings, urban developments, and water, energy and communication networks. <http://www.reuters.com/finance/stocks/companyProfile?symbol=SGEF.PA>

<sup>244</sup> Economic Regulation Authority, *2008 Weighted Average Cost of Capital for the Freight (WestNet Rail) and Urban (Public Transport Authority) Rail Networks: Final Decision*, June 2008 pp. 23-31.



therefore employed significant regulatory discretion when determining an appropriate asset beta for the Brookfield Rail network.

715. The Authority considered that the Brookfield Rail network will have a lower level of systematic risk relative to overseas rail operators, with Aurizon being the most comparable company in Brookfield's sample. The Authority considered that an asset beta of 0.7 for the Brookfield Rail network is consistent with the Authority's prior reasoning, being consistent with the observed asset betas of Aurizon, and being at the lower end of the observed confidence intervals of asset betas for overseas rail companies
716. Utilising a gearing of 25 per cent, an asset beta of 0.7 corresponds to an equity beta for the Brookfield Rail network of 0.93. This is a decrease in the assumed equity beta for Brookfield, with the Authority determining that an equity beta of 1.0 was appropriate in its 2008 determination.<sup>245</sup> The Authority noted that this is due to the reduction in the benchmark assumed gearing for Brookfield Rail, falling from 35 per cent to 25 per cent in the current determination. Furthermore, the asset beta for the benchmark efficient entity representing Brookfield has increased from 0.65 to 0.7 between determinations.

### 12.2.3 The Pilbara Infrastructure

717. The Authority has previously noted that TPI's current reliance on a single commodity, iron ore, transported across one long distance significantly differentiates it from the intermodal or general freight railway.<sup>246</sup> The Authority has previously noted in this context that Genesee & Wyoming Inc., a class II/III railway business headquartered in the United States, was likely to be the best comparator for TPI.<sup>247</sup>
718. However, the Authority also considered that an appropriate asset beta for TPI's railway network will be generally higher than that of the *average* of the overseas comparator rail networks.<sup>248</sup>
719. The Authority noted that the average asset beta for the companies included in TPI's benchmark sample is 1.06, whilst Genesee & Wyoming Inc.'s average asset beta across different regression procedures is 1.15. The Authority further noted that Kansas City Southern's asset beta has increased substantially since the previous determination, resulting in it having the highest asset beta in the benchmark sample. The range of confidence intervals across TPI's benchmark sample is 0.5 to 1.6. The Authority noted that the upper bound of 1.6 is a result of the large confidence intervals associated with the OLS estimator for Kansas City Southern, and when more robust estimators are employed this upper bound falls to 1.5.
720. An asset beta of 1.25, together with an assumed gearing of 0.2 results in an equity beta of 1.56. The Authority considered this equity beta appropriate for the TPI railway network. This represents an increase in the equity beta for TPI from the 2009

<sup>245</sup> Economic Regulation Authority, *2008 Weighted Average Cost of Capital for the Freight (WestNet Rail) and Urban (Public Transport Authority) Rail Networks: Final Decision*, June 2008 pp. 23-31.

<sup>246</sup> Economic Regulation Authority, *The Pilbara Infrastructure (TPI): Final Determination on the 2009 Weighted Average Cost of Capital for TPI's Railway Network*, June 2009, pp. 36-45.

<sup>247</sup> Economic Regulation Authority, *The Pilbara Infrastructure (TPI): Final Determination on the 2009 Weighted Average Cost of Capital for TPI's Railway Network*, June 2009, p. 39.

<sup>248</sup> Economic Regulation Authority, *The Pilbara Infrastructure (TPI): Final Determination on the 2009 Weighted Average Cost of Capital for TPI's Railway Network*, June 2009, pp. 40.



determination, in which an asset beta of 1.00 was determined. With a gearing of 30 per cent, an equity beta of 1.43 was obtained.<sup>249</sup>

721. In its Revised Draft Decision, the Authority considered an asset beta of 1.25 best reflects the systematic risk of the TPI rail network, being at the upper end of the 95 per cent confidence interval of the asset beta for Genesee & Wyoming Inc., whilst being contained in the 95 per cent confidence interval for each of the regression estimators for Kansas City Southern. The Authority noted that this asset beta is consistent with the prior reasoning that TPI's asset beta should be at the upper end of systematic risk for overseas railway operators.

## 12.3 Submissions

722. The Authority has received three submissions in relation to the estimate of equity beta in the Authority's Draft Decision. Each of these submissions is summarised in turn below.

### 12.3.1 CBH

723. Frontier Economics, CBH's consultant on the WACC issue, submitted that the ERA has set beta values for Brookfield that are likely to be too high. Frontier argued that this reflects both that it has unduly limited the comparator set, and because its judgement on WACC does not reflect similar judgements made by other regulatory authorities on similar rail networks in Australia. Frontier concluded that the broader range of comparable businesses would support an asset beta no higher than that of Aurizon (0.67) with an associated equity beta of 0.89.<sup>250</sup>

### 12.3.2 Brookfield Rail

724. Brookfield Rail engaged Synergies Economic Consulting (Synergies) to provide advice in relation to the estimate of equity beta in response to the Authority's Draft Decision.
725. Synergies submitted that it agreed with the process the Authority has used to arrive at the estimate of the asset beta of 0.7. However, Synergies argued that comparators that are not relevant to informing an assessment of Brookfield Rail's systematic risk, such as Auckland International Airport and Infratil, should not be relied upon as this could lead to error.<sup>251</sup>
726. Synergies agreed with the Authority's requirement of five years' of share price history as having a sufficient number of observations is an important pre-requisite in reducing the risk of estimation error. As such, Synergies was of the view that Aurizon should be excluded from the Authority's sample for this review.<sup>252</sup>

<sup>249</sup> Economic Regulation Authority, *The Pilbara Infrastructure (TPI): Final Determination on the 2009 Weighted Average Cost of Capital for TPI's Railway Network*, June 2009.

<sup>250</sup> Frontier Economics, 2015, *A submission on the ERA's Revised Draft Decision on the WACC method for Brookfield Rail, a report prepared for CBH*, February 2015, p. vi.

<sup>251</sup> Synergies Economic Consulting, 2015, *Review of the Method for Estimating the WACC for the Freight and Urban Railway Networks*, a report prepared for Brookfield Rail, February 2015, p. 7.

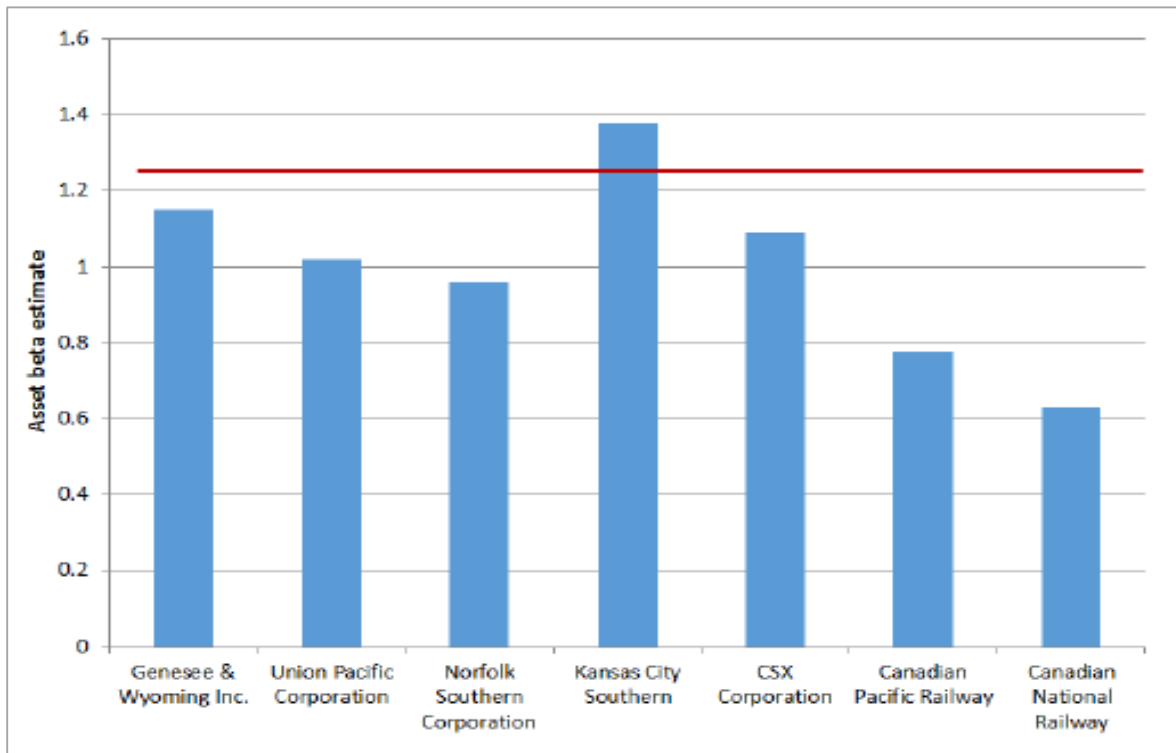
<sup>252</sup> Synergies Economic Consulting, 2015, *Review of the Method for Estimating the WACC for the Freight and Urban Railway Networks*, a report prepared for Brookfield Rail, February 2015, p. 10.

### 12.3.3 Brockman Mining Australia

727. Brockman asked the Authority to also consider the following key issues in relation to the benchmark selection and beta, including:

- How the Authority's asset beta estimate for the TPI network is supported by its estimates of asset beta from the adopted set of comparators, which Brockman illustrated as follows (Figure 23).

**Figure 23 ERA asset beta estimates**



Source: Brockman Mining Australia, *Submission in response to the Economic Regulation Authority Western Australia Draft Determination – Review of the method for estimating the Weighted Average Cost of Capital for Freight and Urban Railway Networks*, 4 June 2014, p. 8.

- The reason the Authority dismissed international comparators in favour of a sample of domestic comparators in its ATCO Gas Draft Decision, but has entirely dismissed the domestic comparators in favour of at most two international comparators in its Rail Draft Determination.
- The material difference in asset betas between the Brookfield Rail and the TPI, United States benchmark group and the Brookfield Rail comparative groups in Canada, Australia and New Zealand.
- The weight that has been applied to each of the seven international comparators in order to produce the final asset beta estimate. Brockman observes an equity beta of 1.56 can only be justified by:
  - (a) using the two specific companies GWI and KCS, no more, no less;
  - (b) using the specific five-year period considered by the ERA;
  - (c) using weekly data; and
  - (d) using Friday-to Friday returns

and that any variation at all to any of these choices results in a material reduction in the beta estimate.

- The reason beta estimates are based entirely on Friday-to-Friday returns.
  - Why no weight is given to monthly beta estimates.
  - The extent to which beta estimates can vary, and whether such variation reflects true systematic risk.
  - An explanation of whether the Authority considers TPI and Brookfield are in the same, or different risk classes. As a corollary, how the two benchmarks can have overlapping but non-identical benchmark samples.
  - An explanation of why ‘only overseas railway operators are able to adequately capture the risks faced by the TPI rail network’, and why Aurizon was excluded as a comparator.
728. Brockman expressed concerns about the reliability of the comparator sample adopted by the Authority when estimating beta for TPI. Brockman notes the issues<sup>253</sup> in relation to: (i) the size of the sample; (ii) the lack of any Australian comparators (and the lack of analysis to justify the appropriateness of the overseas comparators which possess a higher level of risk, relative to an Australian railway operator); and (iii) the lack of focus on comparators with characteristics that reflect pure ‘below rail’ activities.
729. Brockman submits that it is very difficult to find a sample of pure-play (or even near pure-play) below rail operators in practice. However, in such circumstances, Brockman notes that the usual practice is to identify comparators that are not necessarily drawn from the same industry but, rather, share characteristics that are likely to share the same risk drivers as the assets in question. Brockman considers that firms in infrastructure dominated, natural monopoly industries are likely to have similar risk drivers to below-rail assets.<sup>254</sup> Brockman considers that examples of such infrastructure-based industries include electricity networks; gas networks; water networks; ports; airports; roads and other infrastructure firms.<sup>255</sup>

## 12.4 Considerations of the Authority

730. The Authority maintains its position in the Revised Draft Decision that empirical evidence must be used to inform its judgment in relation to the estimates of equity beta. However, Australian regulators, including the Authority and the Australian Energy Regulator (**AER**), have consistently acknowledged a high level of imprecision for any empirical estimates of equity beta.<sup>256</sup>

<sup>253</sup> Brockman Mining Australia, *Submission in response to the Economic Regulation Authority Western Australia Review of the method for estimating the Weighted Average Cost of Capital for the Regulated Railway Networks*, 20 February 2015, p. 15.

<sup>254</sup> Brockman Mining Australia, *Submission in response to the Economic Regulation Authority Western Australia Review of the method for estimating the Weighted Average Cost of Capital for the Regulated Railway Networks*, 20 February 2015, p. 16.

<sup>255</sup> Brockman Mining Australia, *Submission in response to the Economic Regulation Authority Western Australia Review of the method for estimating the Weighted Average Cost of Capital for the Regulated Railway Networks*, 20 February 2015, p. 16.

<sup>256</sup> Australian Energy Regulator, *Final decision: WACC review*, May 2009.

731. As discussed in the Revised Draft Decision, the Authority considers that issues of imprecision are best addressed via the use of multiple models and statistical techniques to inform a possible range for any equity beta estimate.
732. Therefore the primary evidence used to inform the value for the equity beta of a regulated rail entity should be based the quantitative evidence. This requires empirical studies on a sample of comparable businesses to the relevant benchmark, in order to estimate the comparable equity beta and asset betas.
733. The Authority considers that two aspects of ‘relevance to a benchmark entity’ should be considered. First, estimates of asset beta from the benchmark samples should be of relevance to the economy in which the efficient benchmark entity is operating (in this case, the Australian economy). Second, these estimates should also be of relevance to the industry/sector in which the efficient benchmark entity is operating (in this case, the rail industry).
734. The Authority notes that the submissions express concerns in relation to three key issues: (i) the benchmark samples; (ii) the robustness of the estimates; (iii) the use of the benchmark sample. Each of these issues is discussed in turn below. The estimates for each rail benchmark are then developed.

#### 12.4.1 The benchmark sample

735. The Authority considers that there is insufficient domestic data to construct solely domestic benchmark samples for the rail networks, given the limited number of Australian comparator companies. As a consequence, the Authority has in past decisions relied on overseas railway network operators to augment the benchmark samples for estimating the betas for the PTA, Brookfield Rail and TPI railway networks.
736. The Authority remains of the view that benchmark samples that include both Australian and developed countries in Europe and America are appropriate. The additional overseas firms increase the size of the sample. Europe and America have similar political, social and economic characteristics as Australia, so meet the first two of the Authority’s considerations when developing the criteria for selecting the benchmark sample (see paragraph 154).
737. The resulting range of criteria for overseas comparable businesses for each of the benchmark samples are set out at section 4.4.4. The Authority considers that the criteria adopted inform the most relevant approach to developing a benchmark sample.
738. The Authority notes the concerns raised in some submissions that the Authority is inconsistent in its approach to forming a benchmark sample in the decisions for rail and gas businesses. However, the Authority considers that there are sufficient comparable regulated Australian electricity and gas businesses at the current time.<sup>257</sup> However, for regulated rail businesses there are only one or two comparable Australian businesses, which the Authority considers are insufficient to form benchmark samples on their own. That said, there *are* comparable Australian firms represented in each of the empirical estimates of the asset beta:
- for the PTA – two comparable Australian firms in the sample of five firms;

<sup>257</sup> The gas and electricity benchmark sample of five Australian businesses in electricity and gas provides – in the Authority’s view – for an adequate sample for an empirical study to estimate equity betas.

- for Brookfield Rail – three comparable Australian firms in the sample of 13 firms; and
  - for TPI – one comparable Australian firm in the sample of eight firms.
739. The inclusion of Aurizon for TPI is a change for this Final Decision. It responds to Brockman Mining’s concern that there are no Australian comparators in the TPI sample, and also recognises that Aurizon provides relevant information for the TPI benchmark as well as that for Brookfield Rail.
740. The Authority considers that it is reasonable that there are overlaps in the benchmark samples for Brookfield Rail and TPI. As noted in section 4.4.4, the Brookfield and TPI benchmarks have a number of similarities. However, that does not necessarily imply the following argument from Brockman is correct:<sup>258</sup>
- Logically, it would seem that either (a) TPI and Brookfield are in the same risk class, in which case the same set of firms would be comparable to both; or (b) they are in materially different risk classes, in which case there should be no overlap – the firms that are comparable in risk to TPI would not be comparable to Brookfield, and vice versa.
741. The Authority’s view is that while the two rail networks have common risks, for example being reliant on export commodities from within the Australian economy, they are also different in key areas. That means that the comparators in each sample are slightly different. In particular, Brookfield Rail has greater exposure to general freight, and to a diversity of customers and freight tasks more generally, allowing a somewhat different mix of comparators to TPI (see section 4.4.4). The resulting benchmark sample for Brookfield Rail therefore is somewhat different to TPI.
742. At the same time, the Authority’s interpretation of the best use of each respective benchmark sample is also different (see discussion on the actual beta estimates for Brookfield Rail and TPI below). In particular, the Authority’s beta estimates are based on a comparative analysis of the characteristics of the particular benchmark firm in question, and those of the relevant comparator firms in each associated benchmark sample. That comparative analysis then informs the Authority’s judgment as to the most appropriate beta in each case.
743. As a final point, the Authority notes Brockman Mining’s concern as to the lack of comparators in the TPI sample which involve purely the below rail operations. Brockman Mining submits:<sup>259</sup>
- ...all of the comparators within the TPI Railway sample appear to be engaged in ‘below-rail’ and ‘above-rail’ activities. This means that the overall beta estimates for each of the comparators will be a blend (i.e. a weighted average) of the systematic risks associated with the below-rail and above-rail activities of each operator. It is reasonable to infer that above-rail activities are likely to be more risky than below-rail activities. As such, the overall betas for each comparator are likely to overstate the below-rail betas. In practice, it is very difficult to find a sample of pure-play (or even near pure-play) below rail operators. In such circumstances, the usual practice is to identify comparators that are not necessarily drawn from the same industry but, rather, share characteristics that are likely to share the same risk drivers as the assets in question. Firms in infrastructure dominated, natural monopoly industries are likely to

<sup>258</sup> Brockman Mining Australia, *Submission in response to the Economic Regulation Authority Western Australia Draft Determination – Review of the method for estimating the Weighted Average Cost of Capital for Freight and Urban Railway Networks*, 4 June 2015, p. 15.

<sup>259</sup> Brockman Mining Australia, *Submission in response to the Economic Regulation Authority Western Australia Review of the method for estimating the Weighted Average Cost of Capital for the Regulated Railway Networks*, 20 February 2015, p. 15.

have similar risk drivers to below-rail assets. Examples of such infrastructure-based industries include:

- electricity networks;
- gas networks;
- water networks;
- ports;
- airports;
- roads; and
- other infrastructure firms.

The Authority included comparators from some of these industries (e.g. a port operator, an airport and some infrastructure firms) in the comparator sample for Brookfield Rail. The Authority should expand the comparator sample relevant to TPI Railway by identifying and including firms from the industries noted above.

744. The Authority agrees that the lack of pure play comparators for the defined benchmark firm is an issue. However, the Authority does not agree that simply taking a large range of infrastructure industries, as suggested by Brockman Mining, and assuming that the average beta for those firms will best inform the benchmark beta, is the best approach.

745. First, there is a lack of evidence to justify why these firms are more comparable to 'below rail' operations, as compared to the benchmark sample rail freight firms. Rather, the Authority has accepted the view that diverse infrastructure do not necessarily provide good comparators for freight networks. For example, the Authority removed Auckland Airport and Infratil from the benchmark sample on the basis that:

- Auckland Airport's revenues are driven principally by passenger movements and associated retail activities;<sup>260</sup>
- electricity and gas businesses, such as those owned by Infratil, tend to have a diversified demand across a spectrum of consumer and business activities;
- both of these industries therefore are likely to have a lower exposure to cyclical demand conditions as compared to highly export commodity exposed rail networks such as Brookfield Rail and TPI.
  - that will lead to a lower covariance of the earnings of the benchmark firm with the business cycle, and therefore to a lower beta for those activities, all other things equal.

746. Second, the Authority notes that (heuristically) a below rail network may have a similar beta to a *revenue* share weighted average of the betas of its above rail customers (assuming that those above rail customers are not diversified across other lines).<sup>261</sup> In that case, it would not matter if the sample of comparators was based on the above rail entities, as the above rail betas, all other things equal, would inform the beta of the below rail operation.<sup>262</sup>

<sup>260</sup> Morningstar, Analyst note: *Auckland Airport is well placed to ride on the coattails of Asia's booming tourism sector*, 24 August 2015.

<sup>261</sup> See for example, A. Damodaran, *Estimating discount rates*, 1 May 2011, p. 31.

<sup>262</sup> 'All other things equal' is an important caveat on this statement. For example, the above and below rail betas may be significantly different if the below rail network was highly regulated, but the above rail



747. Extending the above example to the rail industry, it is also likely that the industry beta would be the revenue weighted average of all the rail industry firms operating within a particular industry boundary (assuming in this case that the rail firms are not diversified into other industries or geographic locations). In this case, there would be a need to judge the relative risk of the particular rail network, as compared to the industry, when seeking to determine its beta. Nonetheless, the industry beta, the individual betas of the companies within the industry, and a relative risk assessment, could provide relevant information for the determination of the rail network beta.
748. With those considerations in mind, the Authority notes that the benchmark samples for the two freight networks are comprised predominantly of rail companies. Those companies have above and below rail operations and will therefore reflect a mix of directly comparable (below rail) activity and indirectly comparable (above rail) activity. However, the Authority considers, based on the considerations set out in the previous two paragraphs, that it is likely that the resulting comparators can provide highly relevant information for the below rail operations of the benchmark entities.
749. On that basis, the Authority will not add additional non-rail firms to the benchmark sample, initially developed on Allen’s Consulting Group’s advice, for this Final Decision. The Authority only includes non-rail businesses in the benchmark samples where it considers that the characteristics of the non-rail industry firms have strong similarities to that of the benchmark.

### 12.4.2 The robustness of the estimates

750. With regard to the robustness of the estimates, the Authority notes that Brockman has raised concerns with regard to the day of the week issue, the stability of the estimates, and also sensitivity of the beta estimates to the modelling assumptions employed.

#### 12.4.2.1 Day of the week issues

751. The Authority notes Brockman Mining’s contention that adopting Friday to Friday or not accounting for monthly estimates will lead to upward bias in the beta estimates.
752. With regard to the day of the week effect, the Authority notes that Brockman Mining has submitted that US derived estimates for GWR and KCS tend to have higher Friday beta estimates than the average of the weekday betas.<sup>263</sup>
753. To examine the issue, the Authority estimated the equity beta based on the 2015 sample for Genesee & Wyoming (Figure 24). The Authority notes that the daily patterns are highly variable, which is consistent with the Authority’s prior expectation – actual beta outcomes on any day can vary quite markedly when the period is changed. However, the Authority has taken into account the pattern for 2015 shown in Figure 24. That shows that the Friday estimate for Genesee & Wyoming is slightly higher than the average of the five daily estimates.
754. The Authority has also undertaken similar analysis for the Aurizon 2015 estimates (Figure 25). Again, the Authority has taken into account the pattern for 2015 shown

---

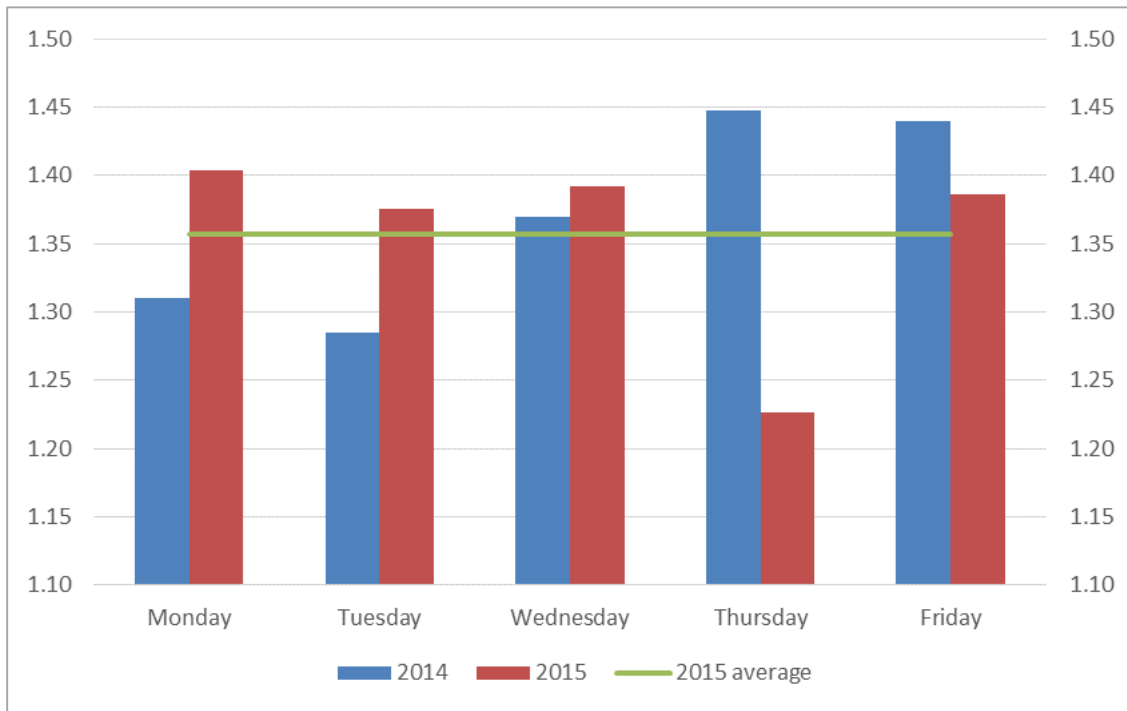
operations were not, or if the take or pay contracts for use of the below rail network were different to those covering the above rail operations.

<sup>263</sup> Brockman Mining Australia, *Submission in response to the Economic Regulation Authority Western Australia Draft Determination – Review of the method for estimating the Weighted Average Cost of Capital for Freight and Urban Railway Networks*, 4 June 2014, p. 11.



in Figure 25. That shows that the Friday estimate for Aurizon is slightly below the average of the five daily estimates.

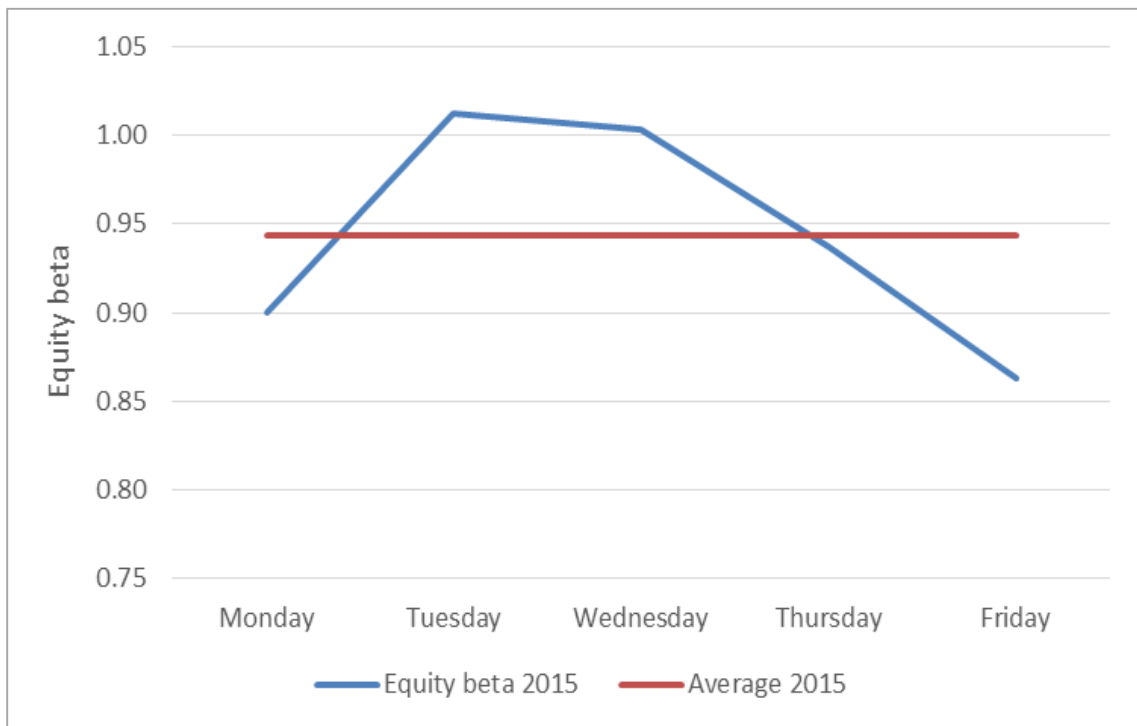
**Figure 24 Genesee & Wyoming equity beta estimates by day of the week 2014 and 2015**



*Note* Equity beta based on re-levering of estimated asset betas using gearing of 20 per cent.

*Source* ERA estimates

**Figure 25 Aurizon equity beta estimates by day of the week 2015**



*Note* Equity beta based on re-levering of estimated asset betas using gearing of 20 per cent.

*Source* ERA estimates

755. With regard to the validity of day of the week versus monthly estimates, the Authority has previously noted:<sup>264</sup>

The Authority is of the view that weekly data is preferred to monthly data. It is noted that estimates of equity beta using monthly data create a smaller sample which is likely to result in a reduced statistical efficiency of the estimates. In addition, the Authority notes that estimates using monthly data are also vulnerable to the “day-of-the-week effect”. This means that if prices are dependent on the day-of-the-week, then this effect is required to be controlled to ensure that returns are observed on the same weekday (Monday, Tuesday, Wednesday, Thursday, Friday). This effect cannot be controlled when the monthly data is used because a calendar month can end on any day of the week.

In his advice to the AER in 2008, Henry discussed the issue of daily versus monthly estimates.<sup>265</sup> He then concluded that weekly data is an appropriate trade-off between noisy daily data and lack of degrees of freedom (due to smaller samples) using monthly data.

756. Based on that evidence, the Authority remains of the view that it is inappropriate to rely on monthly data for estimating betas.
757. However, the Authority accounts for the day of the week issue in its estimates of the benchmark rail WACC betas. The issue is most relevant for the TPI estimate, where the Authority places most reliance on the Genesee & Wyoming and Aurizon estimates.

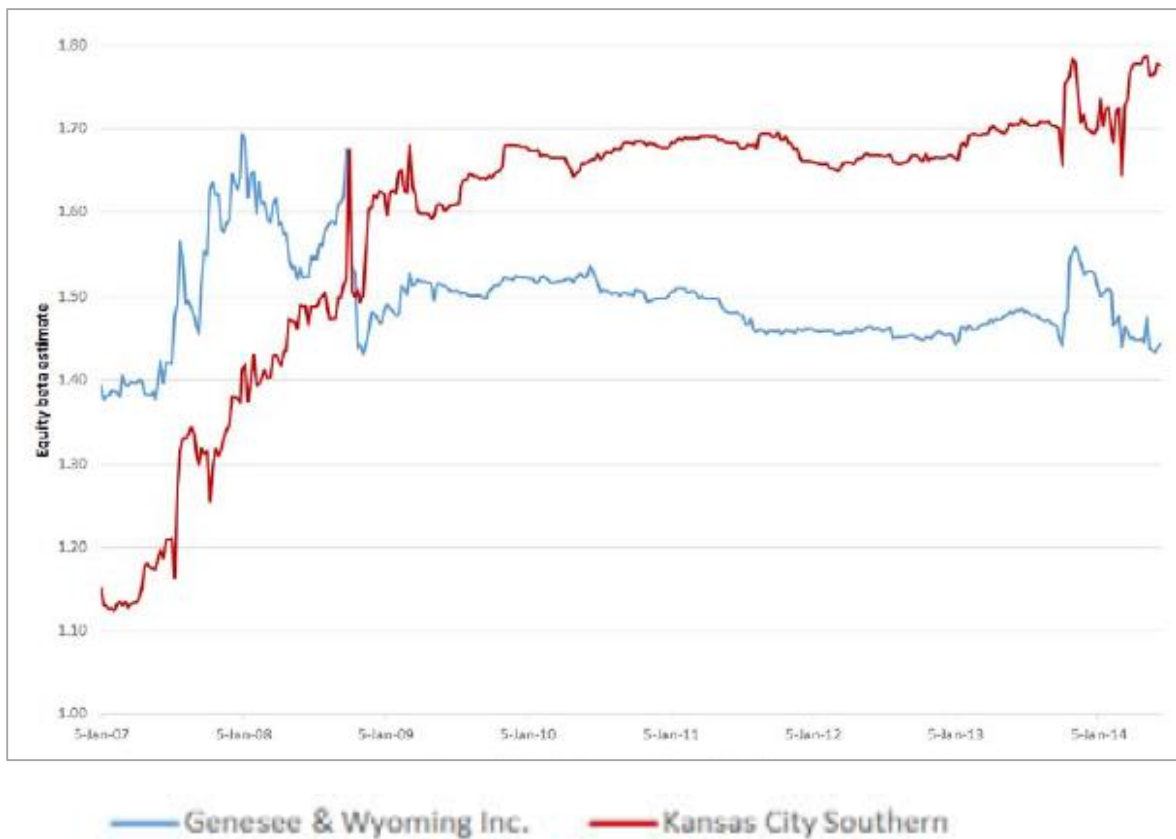
#### 12.4.2.2 Stability of the estimates

758. Brockman Mining presents evidence to suggest that the beta estimates are not stable through time, and that this undermines the robustness of those estimates (Figure 26).
759. The Authority has examined this issue previously, observing that the rolling beta estimates tend to change as economic conditions change.<sup>266</sup> In addition, the relative sensitivity to systematic risk can vary quite dramatically.
760. The Authority has no reason to believe that this does not reflect a re-rating by the market of the respective firms, in terms of risk relative to the market. The Authority notes that the most significant variation occurred during the Global Financial Crisis, a period where excessive leverage was marked down, followed by a period in which firms significantly reduced leverage and investors chose to chase the ‘safe yields’ offered by infrastructure firms.
761. The Authority has addressed this issue by re-estimating the betas for the five years prior to this Final Decision date, which is 30 June 2015.

<sup>264</sup> Economic Regulation Authority, *Explanatory Statement for the Rate of Return Guideline*, December 2013, p. 189.

<sup>265</sup> O. Henry, *Econometric advice and beta estimation*, November 2008.

<sup>266</sup> Economic Regulation Authority, *Explanatory Statement for the Rate of Return Guidelines*, 16 December 2013, p. 194.

**Figure 26 Rolling 5 year equity beta estimates for key comparables**

Source Brockman Mining Australia, *Submission in response to the Economic Regulation Authority Western Australia Draft Determination – Review of the method for estimating the Weighted Average Cost of Capital for Freight and Urban Railway Networks*, 4 June 2014, p. 12.

### 12.4.2.3 Sensitivity of the beta estimates

762. Brockman Mining presents evidence that the sample beta estimates are sensitive to the period over which they are estimated, contending that ‘either the true systematic risk of these firms varies dramatically in this manner, or the equity beta estimates are unreliable’.<sup>267</sup>
763. However, the Authority considers, first, that the estimates of the betas are robust in the sense that they are unbiased. That said, the Authority accepts that estimates of the sample asset betas are likely to be imprecise. To reduce the imprecision, the Authority has adopted various econometric techniques to ensure that the estimates obtained from its empirical studies are as robust as possible. By observing that a range of different approaches provide similar estimates of the betas, the Authority is able to infer that its beta estimates for the benchmark samples are unbiased, even if the confidence intervals around those estimates may be high.<sup>268</sup>

<sup>267</sup> Brockman Mining Australia, *Submission in response to the Economic Regulation Authority Western Australia Draft Determination – Review of the method for estimating the Weighted Average Cost of Capital for Freight and Urban Railway Networks*, 4 June 2014, p. 13.

<sup>268</sup> See for example, M. McKenzie and G. Partington, *Estimation of the equity beta (conceptual and econometric issues) for a gas regulatory process*, 3 April 2012, p. 15. The Authority examined the confidence interval of the estimates for the Draft Decision, finding that these were acceptable (see Economic Regulation Authority, *Review of the method for estimating the Weighted Average Cost of Capital for the Regulated Railway Networks: Revised Draft Decision*, 28 November 2014, Appendix 3, p. 135).

764. Second, the Authority considers that the beta estimates do vary, as noted in the previous section. For that reason, as noted, the Authority has re-estimated the betas for the most recent five years of data. The five year sample provides sufficient data to estimate the betas without bias, while retaining as much information as to the changing asset betas of the comparator firms as possible.
765. For these reasons, the Authority does not accept that the sensitivity of the sample beta estimates is an issue. The estimates are robust. Variation through time reflects changing risk perceptions. Allowing for the most recent five years of data ensures that the sample estimates are based on timely information.

#### 12.4.2.4 Summary of views

766. In conclusion, the Authority is of the view that the estimates of asset beta obtained from empirical studies using various econometric techniques are robust, timely and the best available for the task at hand, which is to estimate the beta of the benchmark firms. The estimates therefore are fit for the purpose of estimating equity beta for regulated rail businesses in Western Australia.

#### 12.4.3 Use of the benchmark estimates

767. Brockman submitted that on the basis that all benchmarks in a sample qualify as 'efficient', an average should be the most acceptable approach to estimating the equity beta.<sup>269</sup> However, Brockman consider that, given the difficulty noted in the Issues Paper in arriving at suitable benchmarks, it seems inevitable that the Authority will need to apply some discretion in the determination of suitable benchmark samples and any sample data that appears inconsistent with the general distribution. The Authority agrees.
768. Brockman also submitted that to the extent that any of the comparators within the available sample may be 'outliers' or unrepresentative of the desired benchmark, a median may be more suitable to avoid any sample bias impact on the average. The Authority does not agree with this point, as it assumes that the centrally located comparators are of equal risk to others. The Authority considers that judgment is required.
769. Brockman further submitted that the equity beta should not be derived from a particular company, as the WACC is being derived for a hypothetical replacement railway by an 'efficient' railway owner.<sup>270</sup> The nature of the contracts (casual, periodic or take or pay) will influence the systematic risk of the benchmark firm. Brockman also suggests that investors in 'captive' infrastructure, such as facilities with take or pay contracts, should face lower risk and thus have equity betas less than one. The Authority agrees that contractual arrangements may influence risk, but within an estimated range, implying that the equity beta need not necessarily be less than one.
770. Flinders submitted that given that the equity beta should relate to the relevant industry, then the use of comparators from industries other than rail should only be considered if the overseas rail businesses do not correlate well with the regulated

<sup>269</sup> Brockman Mining Australia Pty Ltd, *Submission in response to Issues Paper- Railways (Access) Code 2000: Weighted Average Cost of Capital WACC Determination – Railway Networks*, February 2013.

<sup>270</sup> Brockman Mining Australia Pty Ltd, *Submission in response to Issues Paper- Railways (Access) Code 2000: Weighted Average Cost of Capital WACC Determination – Railway Networks*, February 2013.

freight businesses.<sup>271</sup> The Authority notes that it has included both overseas rail businesses, in addition to businesses from other sectors related to the provision of the relevant rail service. The Authority agrees evidence from rail networks will generally be superior to that from other sectors.

771. As discussed in chapter 4, Benchmark firm and risk, the Authority has constructed three benchmark samples to represent the three regulated rail networks. The Authority considers that this is consistent with Brockman's submission to estimate the parameters of the WACC as being derived from a hypothetical replacement railway.
772. In summary, given the lack of directly comparable companies to the three regulated rail networks, the Authority considers it necessary to exercise significant regulatory judgement as to the relative systematic risk faced by the regulated entities and the corresponding benchmark sample. In particular, given the lack of comparable companies, the Authority cannot utilise a median approach, or select only comparator companies that have take or pay contracts as Brockman suggests. The Authority's selection of the relevant comparator companies for each of the rail networks is discussed in chapter 4.

#### 12.4.4 Estimating the betas

773. The Authority's econometric method for estimating the benchmark asset beta and associated equity beta is outlined in Appendix 1.
774. Given the use of overseas comparator companies, stock market indices were used as proxies for the relevant market portfolio for each of the corresponding countries (Table 34).

---

<sup>271</sup> Flinders Mines, *Submission to the Economic Regulation Authority In response to Issues Paper under Railways (Access) Code 2000: Weighted Average Cost of Capital*, February 2013.

**Table 34 Stock exchange Index for benchmark sample companies**

Company Names	Bloomberg Tickers	Country	Stock Market Index	Bloomberg Ticker
Vinci SA	DG	France	CAC 40	CAC Index
Abertis Infraestructuras S.A.	ABE	Spain	IBEX 35	IBEX Index
Atlantia S.P.A	ATL	Italy	FTSE MIB	FTSEMIB Index
Transurban Group, Asciano Limited, Aurizon Holdings Ltd, Macquarie Atlas Roads Group, Toll Holdings Limited	TCL,AIO,AZJ,MQA,TOL,	Australia	All Ordinaries	AS30 Index
Genesee & Wyoming Inc., Union Pacific Corporation, Norfolk Southern Corporation, Kansas City Southern, CSX Corporation	GWR, UNP, NSC, KSU, CSX	United States	S&P 500	SPX Index
Canadian Pacific Railway Limited, Canadian National Railway Company, Clarke Inc.	CP,CNR, CKI,	Canada	Toronto Stock Index 300	TS300 Index
Port of Tauranga Limited	AIA, IFT, POT	New Zealand	New Zealand Exchange All Ordinaries Index	NZSE Index

Source: Bloomberg, Economic Regulation Authority analysis.

775. Price data used was the last price for all stocks provided by the Bloomberg Terminal. The Authority has used a data set from each firm encompassing a five year period from 1 July 2010 to 30 June 2015.
776. Dividend data used in this analysis was gross dividends including cash distributions, but omitting unusual items such as stock distributions and rights offerings. The dividend was then added to the closing price on the Friday after the ex-dividend dates as this is the first day the price would reflect the payout of the dividend in the data. For each market index, which is taken as a proxy for each country's market portfolio, the gross last dividend per share was used, which includes the net dividend and any tax credit where applicable.
777. No adjustments were made to historical volume in Bloomberg. It is noted that net debt information for all comparator companies is the sum of short and long-term borrowings less cash and near cash items, marketable securities and collaterals, as provided by Bloomberg. In addition, market capitalisation for all comparator companies was measured as the current monetary value of all outstanding shares stated in the pricing currency. Some adjustments were made to be consistent with Bloomberg's reporting of data. Further details can be found in Appendix 2.
778. All regression results, associated standard errors and test statistics, were computed using R 2.13.2 open source software.

#### 12.4.4.1 PTA Rail Network

779. The PTA asset beta regression results are set out below (Table 35).

**Table 35 Public Transport Authority asset beta sample 2015**

Company	Country	Industry	OLS	LAD	MM	Thiel-Sen	Average Asset Beta	Change from 2014
Vinci SA	France	Toll Roads	0.40	0.41	0.40	0.40	0.40	-0.27
Albertis Infraestructuras SA	Spain	Toll Roads	0.36	0.36	0.34	0.33	0.35	0.03
Atlantia SPA	Italy	Toll Roads	0.39	0.36	0.38	0.35	0.37	0.05
<b>European Average</b>							<b>0.37</b>	<b>-0.06</b>
Macquarie Atlas Roads Group	Australia	Toll Roads	0.55	0.45	0.52	0.51	0.50	0.05
Transurban Group	Australia	Toll Roads	0.28	0.29	0.30	0.27	0.29	0.02
<b>Australian Average</b>							<b>0.40</b>	<b>0.04</b>
<b>Average</b>							<b>0.38</b>	<b>-0.02</b>

Source: Bloomberg data and ERA analysis

780. The Authority notes that the systematic risk present in the benchmark sample above is expected to be higher than that of the PTA rail network. The PTA rail network primarily transports passengers via rail across the Perth Metropolitan area. The Authority considers that comparing the service provided by the PTA and the comparator companies of the benchmark sample is likely to be inaccurate as toll road companies are only an approximation to the service provided by passenger rail. In particular, the Authority considers the systematic risk of a passenger rail network owned and operated by government, and located in a metropolitan area, to be far lower than that of a toll road company. As a consequence, the Authority will use its discretion to select a relevant asset beta at the lower end of the empirically estimated range derived from the relevant comparator companies.
781. In addition, the Authority notes that the comparator company Vinci SA provides other services, such as civil engineering and construction, and owns and operates bridges, parking garages and a stadium. As a consequence, the Authority considers that the systematic risk of Vinci SA to be substantially higher than that of the PTA network. Given this company was included in ACG's review in 2008, and acknowledging the limited number of comparator companies for the PTA network, the Authority has retained it for the purposes of this WACC determination.
782. Based on the above regression results contained in Table 35, the Authority notes that the average asset beta across comparable companies for PTA is 0.38 from within a range of 0.28 to 0.55. Excluding Vinci SA allows calculation of the average asset beta of the remaining comparable companies, which is 0.38.
783. Given the low level of systematic risk present in the PTA rail network, the Authority considers that an asset beta on the lower end of the overall range is appropriate. Utilising regulatory discretion, the Authority considers that an asset beta of 0.3, at the lower end of the range and slightly lower than the average asset beta excluding Vinci SA is appropriate.
784. Utilising a gearing of 50 per cent, this corresponds to an equity beta of the PTA network of 0.60. This represents an increase of the equity beta of the PTA from the 2008 decision, in which the Authority determined that the equity beta of the PTA



network should be set at 0.46.<sup>272</sup> The Authority notes that this increase is due solely to the increase in gearing from 35 per cent to 50 per cent, with the asset beta unchanged from 0.3.

785. On balance, the Authority considers that an asset beta of 0.30, equivalent to an equity beta of 0.60 at gearing of 55 per cent, is appropriate given the low level of systematic risk present in the PTA rail network. The Authority rounds that to 0.6 for this Final Decision, reflecting the uncertainty in estimating the equity betas.

#### 12.4.4.2 Brookfield Rail

786. The Authority considers that Aurizon is potentially the best comparator company to the Brookfield Rail network, given that it operates in Australia and transports a somewhat similar mix of bulk commodities and general freight. However, the Authority also notes the differences between Aurizon and Brookfield Rail, particularly the reliance of Brookfield Rail on the local grain supply each year (sections 4.4.4.6 and 4.4.4.7).
787. The other Australian firms in the Brookfield Rail benchmark sample are the non-rail comparators, Toll and Asciano. The Authority considers that non-rail operators are a less valid proxy company compared to the rail operators. That said, they either incorporate rail operations (Asciano) or operate in similar markets for transport services (Toll).
788. With regard to the overseas rail operators, the Authority has an expectation that they will possess a higher level of systematic risk, relative to an Australian railway operator, given that American and Canadian railway operators are expected to face higher degrees of competition from alternative forms of transportation such as roads. The Authority therefore employs significant regulatory discretion when determining an appropriate asset beta for the Brookfield Rail network.
789. With regard to the New Zealand port comparator, the Authority has an expectation that it will have a lower level of systematic risk, given the diverse nature of port operations covering road, rail and shipping activities.
790. Turning now to the 2015 regression results, the Authority notes that the asset beta of the benchmark sample has the range of 0.58 (for New Zealand) to 1.40 (for the US), with the average for the entire sample being 0.91 (Table 36). The Authority considers that the benchmark sample range provides relevant information for Brookfield Rail's asset beta.

<sup>272</sup> Economic Regulation Authority, *2008 Weighted Average Cost of Capital for the Freight (WestNet Rail) and Urban (Public Transport Authority) Rail Networks: Final Decision*, June 2008 pp. 23-31.

**Table 36 Brookfield Rail asset beta sample 2015**

Company	Country	Industry	OLS	LAD	MM	Thiel-Sen	Average Asset Beta	Change from 2014
Genesee & Wyoming Inc.	United States	Rail Freight	1.10	1.10	1.12	1.12	1.11	-0.04
Union Pacific Corporation	United States	Rail Freight	1.03	1.07	1.05	1.03	1.05	0.03
Norfolk Southern Corporation	United States	Rail Freight	0.96	0.90	0.92	0.93	0.93	-0.03
Kansas City Southern	United States	Rail Freight	1.40	1.34	1.38	1.35	1.36	-0.01
CSX Corporation	United States	Freight	1.01	0.99	1.02	0.99	1.00	-0.09
<b>United States Average</b>							<b>1.09</b>	<b>-0.03</b>
Canadian Pacific Railway	Canada	Rail Freight	0.84	0.67	0.79	0.75	0.76	-0.02
Canadian National Railway	Canada	Rail Freight	0.63	0.63	0.62	0.61	0.62	-0.01
<b>Canadian Average</b>							<b>0.69</b>	<b>-0.01</b>
Toll Holdings Limited	Australia	Freight	1.01	0.89	0.92	0.90	0.93	0.04
Aurizon Holdings	Australia	Freight	0.67	0.70	0.69	0.71	0.69	0.02
Asciano Limited	Australia	Ports and Rail operations	0.64	0.65	0.64	0.63	0.64	-0.02
<b>Australian Average</b>							<b>0.75</b>	<b>0.01</b>
Port of Tauranga	New Zealand	Ports and Cargo	0.63	0.58	0.60	0.60	0.60	0.29
<b>New Zealand Average</b>							<b>0.60</b>	<b>0.08</b>
<b>Average</b>							<b>0.91</b>	<b>0.26</b>

Source: Bloomberg data and ERA analysis

791. The Authority also notes that the asset beta of Aurizon falls within a range of 0.67 to 0.71 depending on the estimation method adopted, averaging 0.69. The Authority considers that Aurizon is the most relevant comparator for the Brookfield Rail network, given that it: (i) is an Australian entity; (ii) is in the rail industry; and (iii) has a similar mix of freight task to the Brookfield Rail benchmark.
792. Based on the foregoing information, the Authority determines that an asset beta of 0.7 for the Brookfield Rail network is appropriate. An asset beta of 0.7 is judged consistent with the observed asset beta of Aurizon, the best comparator for the

Brookfield Rail benchmark. It is around the lower end of range of the observed confidence intervals of asset betas for the overseas rail companies, which is consistent with the Authority's *a-priori* expectations.<sup>273</sup> It is also above the asset beta for the New Zealand comparator, which also is consistent with the Authority's expectation. Overall, the Authority considers that an asset beta of 0.7 best accounts for all of the foregoing evidence, and accounts for a particular emphasis on the best comparator, Aurizon.

793. Utilising a gearing of 25 per cent, this corresponds to an equity beta of the Brookfield Rail network of 0.93. This is a decrease in the assumed equity beta for Brookfield since the 2008 determination, where the Authority determined that an equity beta of 1.0 was appropriate.<sup>274</sup> The Authority notes that this is due to the reduction in the benchmark assumed gearing for Brookfield rail, falling from 35 per cent to 25 per cent in the current determination. On the other hand, the asset beta for the benchmark efficient entity representing Brookfield has increased from 0.65 in the 2008 determination, to 0.7 here, but by not enough to offset the lower benchmark gearing.
794. In conclusion, the Authority determines an equity beta of 0.93 for Brookfield Rail for this Final Decision, which combines the asset beta of 0.7 and gearing of 25 per cent. The Authority rounds that to 0.9 for this Final Decision, reflecting the uncertainty in estimating the equity beta.

#### 12.4.4.3 *The Pilbara Infrastructure*

795. The previous benchmark sample used in the Authority's estimate of the asset beta for TPI only included US and Canadian rail businesses.<sup>275</sup> Therefore, the benchmark was less able to inform the level of systematic risk associated with being an Australian business, as there were no Australian comparators included.
796. The Authority notes Brockman Mining's view that where there are no direct Australian rail comparators, comparators from other Australian industries should be considered. Brockman considers that firms in infrastructure-dominated, natural monopoly industries are likely to have similar risk drivers to the below-rail assets of TPI. Brockman considers that examples of such infrastructure-based industries include electricity networks; gas networks; water networks; ports; airports; roads and other infrastructure firms.
797. The Authority is of the view that the benchmark sample should ideally include Australian firms operating in the rail industry. The inclusion of Aurizon in the TPI benchmark sample in part responds to Brockman's concerns. However, the Authority considers that at the present time it is not useful to include Australian infrastructure-based industries in the benchmark sample for TPI. These issues are discussed in more detail in what follows.
798. To determine the asset beta for TPI, the Authority focuses on the available empirical evidence which is relevant to the TPI benchmark.

<sup>273</sup> Economic Regulation Authority, Review of the method for estimating the Weighted Average Cost of Capital for the Regulated Railway Networks: Revised Draft Decision, 28 November 2014, pp. 113 - 115.

<sup>274</sup> Economic Regulation Authority, 2008 Weighted Average Cost of Capital for the Freight (WestNet Rail) and Urban (Public Transport Authority) Rail Networks: Final Decision, June 2008 pp. 23-31.

<sup>275</sup> Economic Regulation Authority, Review of the method for estimating the Weighted Average Cost of Capital for the Regulated Railway Networks: Revised Draft Decision, 28 November 2014, section 4.2.4.

## Estimates of the asset betas

799. The Authority has re-estimated the asset betas of the benchmark sample to TPI for 2015 (Table 37). The sample includes five US businesses, two Canadian businesses and the Australian comparator, Aurizon, all of which operate in the rail and freight industry.
800. The range of the sample is from 0.62 (Canadian National Railway) to 1.40 (Kansas City Southern).
801. The average asset beta for the sample of US comparable companies is 1.12, while the average asset beta for the Canadian sample is 0.71. The average asset beta of the total US and Canadian overseas comparators is 0.92. Aurizon's average asset beta of 0.69 is close to that of average Canadian rail business.
802. The Authority considers that an appropriate asset beta for TPI's railway network will be generally higher than that of the *average* overseas comparator rail network, given the importance of general freight for the overseas networks.
803. This is because TPI is a single commodity railway in a remote location that exclusively serves mining related export demand. The Authority considers that it is likely to have a higher level of risk than an intermodal or general freight railway.<sup>276</sup>

### *Genesee & Wyoming*

804. The US company Genesee & Wyoming is an operator of Class II/III railroads, predominantly comprising short spur networks which connect to the major US interstate trunk lines. Genesee & Wyoming has an asset beta at the upper end of the overseas range.
805. The Authority previously has set out its view that Genesee & Wyoming is the best, (albeit an imperfect) comparator for TPI:<sup>277</sup>

The eight sampled US and Canadian railways are commonly used by regulators as potential comparators for Australian freight railways. However, there are few comparable companies for the nature of the risk faced by TPI's bulk iron ore traffic. The Authority accepts that while a number of comparators (e.g. listed rail infrastructure businesses in the US and Canada) may be appropriate comparators for most Australian regulated railways, as noted by CRA, there are a number of reasons why they not be appropriate comparators for TPI.

The Authority noted that amongst the comparators, Genesee & Wyoming Inc. (GWI) is likely to be the best comparator for a short-line railway, notwithstanding that GWI has significantly greater diversity than TPI. GWI has the highest asset beta (1.07) of all the comparator railways. Unlike the other railway comparators, GWI derives around 30 per cent of its operating revenues from overseas assets (primarily Australia and Canada). The Australian Wheat Board (AWB) is GWI's largest single freight customer, contributing around 17 per cent of GWI's operating revenue. GWI notes that the revenue from AWB is sensitive to seasonal conditions, while the level of revenue from overseas operations increases the company's exposure to exchange rate risks.

<sup>276</sup> Economic Regulation Authority, The Pilbara Infrastructure (TPI): Final Determination on the 2009 Weighted Average Cost of Capital for TPI's Railway Network, June 2009, pp. 36-45.

<sup>277</sup> Economic Regulation Authority, The Pilbara Infrastructure (TPI): Final Determination on the 2009 Weighted Average Cost of Capital for TPI's Railway Network, June 2009, p. 39.

**Table 37 TPI asset beta sample 2015**

Company	Country	Industry	OLS	LAD	MM	Thiel-Sen	Average Asset Beta	Change from 2014
Genesee & Wyoming Inc.	United States	Rail Freight	1.10	1.10	1.12	1.12	1.11	-0.04
Union Pacific Corporation	United States	Rail Freight	1.03	1.07	1.05	1.03	1.05	0.03
Norfolk Southern Corporation	United States	Rail Freight	0.96	0.90	0.92	0.93	0.93	-0.03
Kansas City Southern	United States	Rail Freight	1.40	1.34	1.38	1.35	1.36	-0.01
CSX Corporation	United States	Freight	1.01	0.99	1.02	0.99	1.00	-0.09
<b>United States Average</b>							<b>1.09</b>	<b>-0.03</b>
Canadian Pacific Railway	Canada	Rail Freight	0.84	0.67	0.79	0.75	0.76	-0.02
Canadian National Railway	Canada	Rail Freight	0.63	0.63	0.62	0.61	0.62	-0.01
<b>Canadian Average</b>							<b>0.69</b>	<b>-0.01</b>
Aurizon Holdings	Australia	Freight	0.65	0.67	0.69	0.71	0.69	0.02
<b>Australian Average</b>							<b>0.69</b>	<b>0.02</b>
<b>Average</b>							<b>0.94</b>	<b>-0.02</b>

Source: *The Economic Regulation Authority, 2014, Review of the method for estimating the Weighted Average Cost of Capital for the Regulated Railway Networks, Revised Draft Decision, Table 25, p. 111*

806. The Authority has no cause to change its view that Genesee & Wyoming Inc. is likely to be the best comparator for TPI of all the companies in the benchmark sample. Genesee & Wyoming's average asset beta estimated in 2015 is 1.11. With a benchmark gearing of 20 per cent, that equates to an equity beta of 1.39.

#### *Aurizon*

807. The Authority considers that Aurizon (formerly QR National) provides an important comparator for TPI, given that it operates in Australia and has a reliance on transporting export commodities to coastal ports. However, the Authority is of the view that TPI is likely to face a relatively higher risk of operation and investment in comparison with Aurizon (refer section 4.4.4.7).

808. The Authority's average asset beta estimate for Aurizon in 2015 is 0.71 (Table 37). With a benchmark gearing of 20 per cent, that equates to an equity beta of 0.86.

809. The Authority's estimate is based on stock exchange data, consistent with the other estimates set out in Table 37.

810. The Authority is aware that the Queensland Competition Authority engaged Incenta Economic Consulting (**Incenta**) to estimate the asset beta of Aurizon.<sup>278</sup> Incenta consider that a key characteristic of the Aurizon network is that it is regulated through a revenue cap, which provides buffering for its cash flows, and which therefore distinguishes it from overseas railroads in the US and Canada.<sup>279</sup>

Overall, our first principles analysis suggests that Aurizon Network's systematic risk is likely to be similar to regulated energy and water businesses, with the key similarity being regulation and review at periodic intervals in line with cost. For example, the resilience of Aurizon Network's cash flows at the time of the Global Financial Crisis (2008-09), and the stable cash flows of regulated energy and water businesses contrasts with the GFC's uniformly negative impact on the cash flows of US Class 1 railroads.

811. Informed by this key characteristic of Aurizon Network, Incenta developed a sample of 107 comparable businesses. The Authority notes that Incenta's benchmark sample of 107 comparable firms includes a large number of regulated energy and water network businesses in Australia, North America, New Zealand and the UK. This benchmark sample also includes coal mining firms and four specific transport industries (railroads, ports, airports and toll roads).<sup>280</sup>

812. Based on the above benchmark sample, Incenta concluded that the range of 0.35 to 0.49 is appropriate to apply to Aurizon Network. Incenta noted that:<sup>281</sup>

- *First*, the bottom of this range (0.35) being defined by independent expert Grant Samuel's assessment of the asset beta of the Dalrymple Bay Coal Terminal (DBCT), which is a regulated asset in the same coal chain as, and in its view similar systematic risk characteristics to, Aurizon Network;
- *Second*, the middle of this range (0.42) being the estimated asset beta of a large international group of regulated energy and water businesses; and
- *Third*, the top of this range (0.49) being the estimated asset beta for toll roads, which share some similar risk characteristics to Aurizon Network but, in its view, are subject to significantly more volume (revenue) risk.

813. In conclusion, Incenta's analysis indicates that the asset beta for Aurizon is likely to fall with the range of 0.35 and 0.49 with the mid-point (best) estimate of 0.42. Based on the same sample, Incenta estimate Aurizon's gearing to be 55 per cent. Combining the two, Incenta's implied equity beta is 0.73.<sup>282</sup> The Authority notes that Incenta adopts a debt beta of 0.12 and uses the Conine formula to estimate the 0.73 equity beta. In contrast, a simple Brealey Myers re-levering – which is the approach used by the Authority and has an assumed debt beta of 0 – would give an equity beta of 0.93 with the same parameters.

<sup>278</sup> Incenta Economic Consulting, 2013, *Review of Regulatory Capital Structure and Asset/Equity Beta for Aurizon Network*, a report prepared for the Queensland Competition Authority, December 2013. The estimates of the asset beta for the Aurizon Network in the report were estimated by Associate Professor Joe Hirschberg at the University of Melbourne (p. 4).

<sup>279</sup> Incenta Economic Consulting, 2013, *Review of Regulatory Capital Structure and Asset/Equity Beta for Aurizon Network*, December 2013, p. 8.

<sup>280</sup> Incenta Economic Consulting, 2013, *Review of Regulatory Capital Structure and Asset/Equity Beta for Aurizon Network*, a report prepared for the Queensland Competition Authority, December 2013, p. 12.

<sup>281</sup> Incenta Economic Consulting, 2013, *Review of Regulatory Capital Structure and Asset/Equity Beta for Aurizon Network*, a report prepared for the Queensland Competition Authority, December 2013, pp. 3-4.

<sup>282</sup> Incenta Economic Consulting, 2013, *Review of Regulatory Capital Structure and Asset/Equity Beta for Aurizon Network*, a report prepared for the Queensland Competition Authority, December 2013, pp. 16-17.



814. However, the Authority considers the estimates from Incenta not relevant for the purpose of estimating the asset beta for TPI. This is because the majority of the companies included in the benchmark sample used in the Incenta study are not comparable to TPI. For example, the Authority considers that regulated infrastructure assets, such as water, electricity and gas, have very different systematic risk characteristics to TPI. The Authority therefore will rely instead on the estimates presented in Table 37.
815. In this context, an important issue relates to the indirect nature of the Authority's estimates in Table 37. The Authority notes that all of its estimates are based on stock exchange data, which covers the whole firm in each case, generally a mix of below and above rail operations. These estimates are higher than those assembled by Incenta. At the same time, the comparable gearing is much lower. The Authority has determined gearing of 20 per cent based on its benchmark sample. This is much lower than the 55 per cent adopted by Incenta, but is internally consistent with the benchmark sample and the emphasis placed on the various firms within the sample for this Final Decision.
816. So for example, the Authority estimates Aurizon's asset beta at 0.69, based on the ASX data. With assumed gearing of 20 per cent, that equates to an equity beta of 0.86, which is reasonably close to Incenta's estimate of 0.93, using the same Brealey Myers re-levering method used elsewhere in this decision by the Authority.
817. The Authority considers it extremely important to maintain internal consistency with the rest of the benchmark sample. For that reason, the Authority will utilise its own econometric estimates of the asset beta of Aurizon set out in Table 37. Incenta's estimates will not inform the determination of the asset beta for TPI.

#### **Overall Assessment for the asset beta for TPI**

818. The Authority considers that TPI's asset beta will be higher than Aurizon's, given that Aurizon has a mix of freight tasks and a more diversified customer base. The Authority considers therefore that it is appropriate to use the estimate of the asset beta for Aurizon, of 0.69 as the lower bound for the asset beta of TPI. Nonetheless, the Authority places some weight on this estimate in its overall assessment, given that Aurizon operates in Australia and has a significant proportion of bulk export commodity traffic in its freight task.
819. The Authority also notes that the range of the international comparators is 0.62 to 1.40 (Table 37). Within that range, the Authority considers that Genesee & Wyoming, with an asset beta of 1.11 is most relevant. The Authority considers that this provides a key benchmark for the operations of TPI.
820. On balance, based on available evidence presented (Table 37), the Authority judges that a best estimate of TPI's asset beta is 1.05. This estimate places the most weight on the Genesee & Wyoming estimate, but also accounts for the asset beta of Aurizon, given that it is an Australian rail operator and that it has a high proportion of bulk export commodities in its overall freight task.
821. With an estimated gearing of 20 per cent, an asset beta of 1.05 corresponds to an equity beta of 1.31. The Authority rounds that to 1.3 for this Final Decision, reflecting the uncertainty in estimating the equity beta.



## 12.5 Final Decision

822. The Authority has determined the following betas for this Final Decision, for:

- PTA – an asset beta of 0.3, combined with estimated gearing of 50 per cent, which gives an equity beta of 0.6;
- Brookfield Rail – an asset beta of 0.7, combined with estimated gearing of 25 per cent, which gives an equity beta of 0.9;
- TPI – an asset beta of 1.05, combined with estimated gearing of 20 per cent, which gives an equity beta of 1.3 for this Final Decision.

## 13 Debt raising costs

823. Debt raising costs are the administrative costs and other charges incurred by businesses in the process of raising or refinancing debt.<sup>283</sup>

### 13.1 Current approach

824. In the 2003 Determination, the Rail Access Regulator provided for an addition to the debt margin of 12.5 basis points as an allowance for the costs of raising debt finance.

825. The Authority in its 2008 review maintained the allowance of 12.5 basis points for debt raising costs, based on advice from the Allen Consulting Group (**ACG**).<sup>284</sup>

### 13.2 Revised Draft Decision

826. The Authority was of the view that debt raising costs should be incorporated as a component in the rate of return on debt. However, these debt raising costs should only include the direct cost components recommended by ACG in its 2004 report to the ACCC and accepted by Australian regulators since then.

827. The Authority considered that its 2013 estimate of 12.5 basis points per annum provides for a current estimate of debt raising costs for the benchmark efficient entity

### 13.3 Submissions

828. The Authority did not receive any submissions in relation to debt raising costs. As such, the following section is unchanged from the Revised Draft Decision.

### 13.4 Considerations of the Authority

829. Regulators across Australia have typically included an allowance to account for debt raising costs in their regulatory decisions. Debt raising costs may include underwriting fees, legal fees, company credit rating fees and any other costs incurred in raising debt finance. A company has to pay debt raising costs over and above the debt risk premium. Such debt raising costs are likely to vary between each issuance of debt depending on the borrower, lender and market conditions.

<sup>283</sup> The Authority does not consider that an allowance for hedging costs is warranted for the rail WACC. Hedging costs relate to the costs involved in undertaking interest rate swaps to hedge the periodic resets of the regulated 'risk free rate', for example every five years as occurs in gas. The Authority considers that as rail service providers have control over the term of the contract negotiated with users, they are able match their preferred capital term. Further, as the rail WACC is the long term WACC, firms which adopt a shorter term than 10 years for their debt would typically have lower costs. As such, the interest rate risk associated with the open ended term of debt is adequately compensated for by the use of a 10 year term for the regulated risk free rate and so hedging the risk associated with periodic regulatory resets is not necessary.

<sup>284</sup> The Authority did not provide an allowance for the equity raising costs, as it considered that this cost should be taken into account in the valuation of assets, rather than in the regulated rate of return.

830. The Authority considered debt raising costs in detail as part of the development of the gas Rate of Return Guidelines.<sup>285</sup> That analysis observed that the formative work on debt raising had been undertaken by ACG in 2004.
831. Based on the advice from ACG, the Australian Competition and Consumer Commission (**ACCC**) in December 2004, concluded that debt raising costs were a legitimate expense that should be recovered through the revenues of a regulated utility.<sup>286</sup>
832. The costs included in the estimates of the debt raising costs, as indicated by the ACG in its 2004 estimate and adopted by the ACCC, are the direct costs outlined below:
- gross underwriting fee: this includes management fees, selling fees, arrangement fees and the cost of an underwriter for the debt;
  - legal and roadshow fee: this includes fees for legal documentation and fees involved in creating and marketing a prospectus;
  - company credit rating fee: a credit rating is generally required for the issue of a debt raising instruments so a company is charged annually by the credit rating agency for the services of providing a credit rating;
  - issue credit rating fee: a separate credit rating is obtained for each debt issue;
  - registry fee: the maintenance of the bond register; and
  - paying fee: payment of a coupon and principal to the security holder on behalf of the issuer.
833. ACG's 2004 study determined debt raising costs based on long-term bond issues, consistent with the assumptions applied in determining the costs of debt for a benchmark regulated entity. Debt raising costs were based on costs associated with Australian international bond issues and for Australian medium term notes sold jointly in Australia and overseas. Estimates of these costs were equivalent to 8 to 10.4 basis points per annum when expressed as an increment to the debt margin.<sup>287</sup>
834. Based on the ACG study, the Authority and other Australian regulators, except the ACCC and AER, have consistently adopted an estimate of debt raising costs of 12.5 bppa in previous regulatory decisions. The ACCC and the AER on the other hand chose to incorporate the estimated costs in the operating expense cash flows.
835. The Authority is not aware of any new alternatives to the ACG method. Recent estimates of debt raising costs, including Deloitte's 2010 estimate; PricewaterhouseCoopers' 2011 estimate; the AER's 2013 estimate; and the Authority's estimate in 2013, have all adopted the same approach as in ACG's 2004 estimate.<sup>288</sup>

<sup>285</sup> For more detail, see Economic Regulation Authority, *Explanatory Statement for the Rate of Return Guidelines: Meeting the Requirements of the National Gas Rules*, 16 December 2013, section 11.2.6.

<sup>286</sup> The Australian Competition and Consumer Commission, 2005, Final Decision, *NSW and ACT Transmission Network Revenue Cap, TransGrid 2004/5 to 2008/9*, April 2005, p. 144.

<sup>287</sup> Allen Consulting Group, *Debt and Equity raising transaction costs: Final report to ACCC*, December 2004.

<sup>288</sup> For respective estimate, see Deloitte, *Envestra Limited: Debt Financing Costs*, September 2010; PricewaterhouseCoopers, *Debt and Equity Raising Costs: Report for Powerlink Queensland, Appendix K*, 2011, p. 20; Australian Energy Regulator, *Access arrangement final decision: SPI Networks (Gas): 2013-17*, March 2013; and Economic Regulation Authority, *Explanatory Statement for the Rate of Return Guidelines: Meeting the Requirements of the National Gas Rules*, 16 December 2013, p. 202.

836. Therefore, the Authority is of the view that the approach set out in the ACG's 2004 study is appropriate for the purpose of estimating debt raising costs.
837. The Authority considers that its most recent 2013 estimate of debt raising costs of 12.5 basis points per annum (bppa) (Table 38), remains relevant.<sup>289</sup> The estimate continues the allowance for debt raising costs provided for in the Authority's previous rail WACC decisions.
838. The Authority notes that Flinders submitted that the Authority should survey financial institutions, as the ACG estimate cannot be updated. However, the Authority considers that its 2013 estimate provides for an update, so considers that this step is not required. Brockman supported the Authority's approach to estimating debt raising costs.

**Table 38 The Authority's estimate of debt raising costs (bppa), 2013**

Fee	Explanation/Source	1 Issue	2 Issues	4 Issues	6 Issues	10 Issues
Total Amount Raised	Multiples of median MTN issue size (\$250m)	\$250m	\$500m	\$1,000m	\$1,500m	\$2,500m
Gross Underwriting Fees	Bloomberg for Australian international issues, upfront per issue, amortised	8.31	8.31	8.31	8.31	8.31
Legal and Roadshow	\$195K upfront per issue, amortised	1.85	1.85	1.85	1.85	1.85
Company Credit Rating	\$55K for the entire company, per year	2.20	1.10	0.55	0.37	0.22
Issue Credit Rating	4.5 bps up-front per issue, amortised	1.07	1.07	1.07	1.07	1.07
Registry Fees	\$4K upfront per issue, amortised	0.04	0.04	0.04	0.04	0.04
Paying Fees	\$9K per issue per year	0.36	0.36	0.36	0.36	0.36
<b>Totals</b>	<b>Basis Points p.a.</b>	<b>13.8</b>	<b>12.7</b>	<b>12.2</b>	<b>12.0</b>	<b>11.8</b>

Source: Economic Regulation Authority, *Explanatory Statement for the Rate of Return Guidelines: Meeting the Requirements of the National Gas Rules*, 16 December 2013, p. 202.

## 13.5 Final Decision

839. The Authority is of the view that debt raising costs should be incorporated as a component in the rate of return on debt. However, these debt raising costs should only include the direct cost components recommended by ACG in its 2004 report to the ACCC and accepted by Australian regulators since then. These costs will be recompensed in proportion to the average annual issuance, and will cover: (i) gross underwriting fees; (ii) legal and roadshow fees; (iii) company credit rating fees; (iv) issue credit rating fees; (v) registry fees; and (vi) paying fees.
840. The Authority considers that its 2013 estimate of 12.5 basis points per annum provides for a current estimate of debt raising costs for the benchmark efficient entity.

<sup>289</sup> The estimate is amortised over 5 years, so is conservative with respect to the 10 year term of the rail WACC.

## 14 Gamma

841. Gamma is the parameter in the WACC that takes into account the value generated by the distribution of franking credits to investors. As a general rule, investors will accept a lower required rate of return on an investment that has franking credits compared with an investment that has similar risk and no franking credits. The precise value investors place on franking credits is ambiguous, given that individual investors have differing circumstances (for example, differential marginal tax rates and eligibility). In addition, the distribution of franking credits by companies differs, primarily as a result of differences in shares of profit that are liable for taxation and the proportion of profits paid as dividends. As a consequence of this variability, the precise value of gamma required for use in the rail WACC is difficult to identify.

### 14.1 Current approach

842. It has been common practice to estimate gamma ( $\gamma$ ) as the product of two estimated components: (i) the payout ratio or distribution rate ( $F$ ); and (ii) the market value of imputation credits, theta ( $\theta$ ).<sup>290</sup> This may be represented as follows:

$$\gamma = F \times \theta \quad (22)$$

843. In line with this accepted approach, the Authority adopted a value for gamma of 0.5 in the previous 2008 Rail WACC Determination.<sup>291</sup> At the time the Authority acknowledged that the valuation of taxation imputation credits in determining the WACC was complicated by unresolved theoretical issues. The Authority maintained the view that until the debate on the value of imputation credits was resolved, it was appropriate to apply a value of gamma of 0.5.

844. Subsequently, Strategic Finance Group's (**SFG**) 2011 study on the estimate of theta was adopted by the Australian Competition Tribunal (**ACT**) for its deliberations with regard to the application by Energex Limited on the issues of the distribution ratio and gamma. This study used a dividend drop off framework to estimate the value of theta.

845. The Authority then adopted the payout ratio of 0.70 and a theta of 0.35, – which produced a gamma value of 0.25 – in order to be consistent with the ACT's decision on the Energex matter. Accordingly, the Authority's 2013 rail WACC Determination adopted a gamma value of 0.25.<sup>292</sup>

<sup>290</sup> This follows the analysis by Monkhouse in relation to the impact of imputation credits on the effective tax rate of companies. See equation 2.5 in P. Monkhouse, *The valuation of projects under the dividend imputation tax system*, *Accounting and Finance*, vol.36, no.2, 1996, p. 192.

<sup>291</sup> This was based on the recommendations of the Allen Consulting Group, which chose its point estimate from within a range of 0.4 to 0.8, informed by a study by the Essential Services Commission (The Allen Consulting Group, *Railways (Access) Code 2000: Weighted Average Cost of Capital 2008 WACC Determinations*, October 2007, p. 37):

The Essential Services Commission's recent review of evidence for the value of franking credits indicates that the value of gamma may be determined with reference to a proportion of franking credits distributed of 71 to 100 per cent, and a value of franking credits to investors of 0.57 to 0.81 per cent, indicating a possible range of gamma values of 0.4 to 0.8.

<sup>292</sup> The payout ratio of 0.7 is based on Australian Competition Tribunal, *Application by Energex Limited (Distribution Ratio (Gamma)) (No. 3) [2010] ACompT 9*, 2010. Theta of 0.35 is based on Australian

## 14.2 Revised Draft Decision

846. In the rail WACC method Revised Draft Decision the Authority re-visited the estimate of the gamma parameter. Based on its revised analysis, the Authority adopted a point estimate for gamma of 0.5. This estimate was based on the product of a distribution rate of 0.7 and utilisation rate, theta, of 0.7.
847. The distribution rate of 0.7 was based on estimates that are consistent with a broad definition of ‘all equity’, rather than just ‘listed equity’.<sup>293</sup> The Revised Draft Decision noted that this estimate has been widely accepted in recent times, and is supported by a range of evidence.
848. For the utilisation rate, the Authority exercised its judgment across a range of estimates. The Authority considered that an estimate of theta of 0.7 provided a most likely estimate of the utilisation rate from the various approaches, and the Authority’s weighting of their robustness. The range of approaches for estimating the utilisation rate encompassed:
- dividend drop off studies – which suggested an estimate of the utilisation rate in the range of 0.3 to 0.7 – this was given low weight;
  - equity share ownership estimates – which suggested an estimate of the utilisation rate of 0.7, based on the ownership of listed and unlisted equities – this estimate was given the most weight;
  - taxation statistics – which suggested the utilisation rate is in the range of 0.4 to 0.8 – these estimates were given low weight; and
  - the conceptual goal posts approach – which suggested the utilisation rate is in the range of 0.6 to 1 – this estimate was given some weight.
849. The resulting estimate of 0.49 was rounded to 0.5, in acknowledgement that the estimate is based on a fairly wide range, and subject to imprecision.

## 14.3 Submissions

850. Brookfield’s consultant Synergies Economic Consulting notes that the revised estimate of gamma reflected a fundamental change in method.<sup>294</sup> Synergies cites SFG Consulting’s arguments to argue that franking credits are likely to be valued at less than their face value. Consistent with the view, Synergies considers that the Authority should revert to its previous approach, which utilised only the dividend drop off method. Synergies places emphasis on SFG’s study, as being consistent with the findings of the Australian Competition Tribunal.
851. TPI’s consultant Houston Kemp expresses reservations about the revised estimate for gamma. Houston Kemp also consider that the Authority should give more weight

---

Competition Tribunal, *Application by Energex Limited (Gamma) (No. 5), [2011] AcompT 9*, 2011. The final value of 0.25 was used in Economic Regulation Authority, *Determination on the 2013 Weighted Average Cost of Capital for the Freight and Urban Railway Networks*, July 2013, p. 5.

<sup>293</sup> The Draft Decision also noted recent evidence by Lally for F of 0.84 for listed equity. The Draft Decision did not use this estimate, as its estimate for gamma was based on all equity, listed and unlisted.

<sup>294</sup> Brookfield Rail, *Submission on the Revised Draft Decision relating to the 2014 review of the method for estimating the weighted average cost of capital for the regulated railway networks*, Attachment, 20 February 2015, p. 16.



to the findings of the Australian Competition Tribunal, which emphasises dividend drop off studies as being the 'best source of information on the market value of distributed imputation credits'.<sup>295</sup>

852. Neither CBH nor Brockman Mining took issue with the Authority's revised estimate of gamma.

## 14.4 Considerations of the Authority

853. In developing its position on gamma for the Revised Draft Decision, the Authority took into account:

- considerations relating to the theoretical framework for estimating gamma;
- the Authority's recent prior position, set out in its Draft Decision on the Mid-West and South-West Gas Distribution System (**GDS**), which accounted for stakeholder input, a range of consultants' reports and the decisions of other regulators;
- Lally's November 2013 report to the Australian Energy Regulator (**AER**);<sup>296</sup>
- the conclusions of the AER in responding to Lally's report, set out in its gas Rate of Return Guidelines;<sup>297</sup>
- Lally's November 2013 report to the Queensland Competition Authority (**QCA**), and his responses to submissions to the QCA on that report;<sup>298</sup>
- a 2013 report on tax statistics by Hathaway commissioned by the Energy Networks Association;<sup>299</sup> and
- the conclusions of the (**QCA**) in its recent cost of capital determination, which also considered the foregoing material, as well as additional material with regard to the estimation of gamma.<sup>300</sup>

854. The Authority has further considered its approach to estimating gamma for this Final Decision.

855. In reaching this Final Decision, the Authority also has considered:

- ATCO's submission on the GDS Draft Decision, including the report by its consultant, SFG Consulting;
- a report for the Queensland Resources Council by McKenzie and Partington;<sup>301</sup> and
- a report on gamma by Associate Professor John Handley for the AER.<sup>302</sup>

<sup>295</sup> The Pilbara Infrastructure, *Submission to Revised Draft Decision of weighted average cost of capital methodology for regulated railway networks*, Attachment, 20 February 2015, p. 5.

<sup>296</sup> M. Lally, *The estimation of gamma*, 23 November 2013.

<sup>297</sup> Australian Energy Regulation, *Explanatory Statement – Rate of Return Guideline*, December 2013.

<sup>298</sup> M. Lally, *Review of submissions to the QCA on the MRP, risk-free rate and gamma*, 12 March 2014.

<sup>299</sup> N. Hathaway, *Imputation credit redemption ATO data 1988–2011: Where have all the credits gone?*, September 2013.

<sup>300</sup> Queensland Competition Authority, *Final decision: cost of capital: market parameters*, August 2014.

<sup>301</sup> M. McKenzie and G. Partington, *Report to the Queensland Resources Council: Review of Aurizon Network's draft access undertaking*, 5 October 2013.

<sup>302</sup> J.C. Handley, *Advice on the Value of Imputation Credits*, 29 September 2014.



856. The Authority notes that experts differ in their interpretation of the best approach to estimating gamma in the regulatory setting. This is particularly the case with regard to the value of the utilisation rate. In this context, the Authority noted in the Revised Draft Decision that the ACT in its Energex decision viewed the estimate of gamma as an ‘ongoing intellectual and empirical endeavour’.<sup>303</sup>
857. The Authority has re-visited a range of issues with regard to the position set out in the Revised Draft Decision. These are outlined in what follows.<sup>304</sup>

#### 14.4.1 Definition of the domestic capital market

858. In reconsidering its estimate of gamma, the Authority takes account of the definition of the capital market used for determining the allowed rate of return, which is considered in section 4.4.4.3 above. In particular, as noted there, the Authority has a preference for estimates based on domestic financial data (which will be consistent with a domestic CAPM that allows for the presence of foreign investors).
859. Therefore, to maintain internal consistency, the Authority considers that the estimate of gamma needs to take into account the presence of international investors in the Australian domestic capital market.

#### 14.4.2 Interpretation of gamma

860. The equation set out in paragraph 842 interprets the value of franking credits in the context of the Officer CAPM framework, as extended by Monkhouse to cover a non-perpetuity setting.<sup>305</sup> The Authority concluded in the Revised Draft Decision that the benefit arising from imputation credits can be interpreted as the proportion of franking credits received that are utilised by the representative investor.<sup>306</sup>

<sup>303</sup> Australian Competition Tribunal, *Application by Energex Limited (Gamma) (No 5) [2011] ACompT 9*, 12 May 2011, paragraph 45.

<sup>304</sup> This Final Decision aligns with, and follows closely, the evaluation and conclusions set out in the Authority’s recent Final Decision on the GDS.

<sup>305</sup> Officer assumes all dividends and imputation credits are fully paid out each period. Monkhouse allows some retained earnings and imputation credits (R.R. Officer, *The Cost of Capital of a Company under an Imputation Tax System*, vol.34, no.1, *Accounting and Finance*, May 1994; P.H.L. Monkhouse, *The Valuation of Projects Under the Dividend Imputation Tax System*, *Accounting and Finance*, vol.36, no.2, 1996.) Handley notes that this assumption is unrealistic, such that any estimate of gamma that ignores retained credits will be an underestimate (J.C. Handley, *Advice on the Value of Imputation Credits*, 29 September 2014, p. 13):

It is well understood that the value of a retained imputation credit is less than the value of a distributed imputation credit due to the delay in distribution – but the difficult question is how much less. Unfortunately the answer is we just don’t know as there is currently no empirical evidence on the value of a retained credit. Any value attributable to credits retained in a period would be reflected in the observed capital for that period but there is no known method to identify that component. I continue to find the suggestion that retained imputation credits are worthless to be implausible.

... Estimates of gamma using the traditional approach will therefore be downward biased to the extent that retained imputation credits have value. Although it is not possible to reasonably estimate the magnitude of the bias, its direction is clear.

<sup>306</sup> Economic Regulation Authority, *Draft Decision on Proposed Revisions to the Access Arrangement for the Mid-West and South-West Gas Distribution System*, 14 October 2014, p. 210.

861. The Revised Draft Decision noted that the utilisation rate is a market-level parameter, meaning that the same value applies to all firms.<sup>307</sup> Individual investors have differing utilisation rates; investors who are able to fully use tax credits are assigned a value of one whilst investors who cannot are assigned a value of zero. Individual utilisation rates may be weighted to produce the required market-level utilisation rate. Therefore the utilisation rate 'is a complex weighted average over all investors holding risky assets, where the weights involve each investor's investment in risky assets and their risk aversion'.<sup>308</sup> The utilisation rate is then the value to investors in the market per dollar of imputation credits distributed.<sup>309</sup>
862. ATCO's consultant SFG considers this interpretation to be misplaced. SFG states that the Authority 'has now abandoned its "value" interpretation of gamma in favour of the AER's redemption rate approach'.<sup>310</sup> SFG bases this view on the Authority's definition of the utilisation rate, as being the proportion of imputation credits that are redeemed – the utilisation rate of the representative investor – which the Authority determined was a complex weighted average of the utilisation rates of all investors holding risky assets, where the weights involve each investor's investment in risky assets and their risk aversion utilisation rates.<sup>311</sup>
863. SFG considers that the Authority has committed two errors:
- a) It has misinterpreted the advice provided in the Lally (2013) report to the AER. The ERA interprets that report as supporting its conceptual definition of theta and its use of the equity ownership approach and tax statistic redemption rates to estimate theta. However, as set out in detail in Section 10 below, Lally (2013 AER) provides no such support. That is the ERA has erred in its interpretation of the Lally (2013 AER) report; and
  - b) Irrespective of what might be contained in the Lally (2013) report to the AER, the regulatory task requires theta to be estimated as the value of distributed credits – as explained in Sections 2 and 5 of this report. The ERA now proposes to perform a different task and has erred in that respect.<sup>312</sup>
864. The key challenge to the Authority's estimate set out in the Revised Draft Decision therefore relates to the estimate of the utilisation rate. The Authority deals with this first, in what follows, then discusses the distribution rate, before drawing the material together to provide for an overall estimate of gamma.

<sup>307</sup> See Economic Regulation Authority, *Review of the method for estimating the Weighted Average Cost of Capital for the Regulated Railway Networks: Revised Draft Decision*, 28 November 2014, p. 122. and also M. Lally, *The Estimation of Gamma*, November 2013, p. 11.

<sup>308</sup> See M. Lally, *The Estimation of Gamma*, November 2013, p. 11 and also M. Lally. and T. van Zijl, 'Capital Gains Tax and the Capital Asset Pricing Model', *Accounting and Finance*, vol.43, no.2, 2003, pp. 187-210.

<sup>309</sup> J.C. Handley, *Advice on the Value of Imputation Credits*, 29 September 2014, p. 13.

<sup>310</sup> ATCO Gas Australia, *Response to the ERA's Draft Decision on required amendments to the Access Arrangement for the Mid-West and South-West Gas Distribution System*, 27 November 2014, Appendix 10, p.14.

<sup>311</sup> *Ibid.*, p. 19.

<sup>312</sup> *Ibid.*, p. 16.

### 14.4.3 Utilisation rate

865. As noted, the Authority in its Revised Draft Decision considered that the benefit of imputation credits will rely on the proportion,  $\theta$ , of franking credits received that are utilised by the representative investor.<sup>313</sup>

The utilisation rate is a market-level parameter, meaning that the same value applies to all firms.<sup>314</sup> Individual investors have differing utilisation rates; investors who are able to fully use tax credits are assigned a value of one whilst investors who cannot are assigned a value of zero. These individual utilisation rates may be weighted to produce the required market-level utilisation rate  $\theta$ . Therefore  $\theta$  'is a complex weighted average over all investors holding risky assets, where the weights involve each investor's investment in risky assets and their risk aversion'.<sup>315</sup>

866. To this end, the Authority observed that its previous estimation approach for estimating  $\theta$  – using dividend drop off studies – may not correctly estimate the required utilisation rate required, as, among other things:

- The required utilisation rate is a complex weighted average determined by the value of equity that investors hold and their relative wealth and risk aversion.
- Dividend drop off studies only estimate the value weighted utilisation rate around just two days, the cum-dividend and ex-dividend dates. As a consequence, they provide an estimate of the utilisation rate with a value weighting that reflects the composition of investors around the cum and ex dividend dates, not the weighted average across the entire market over an entire year, as required.
- There are significant econometric challenges in estimating the utilisation rate from dividend drop off studies. Trading around the ex-dividend date reflects a variety of different incentives and price movements. Dividend drop off studies may not accurately separate out the effect of the taxation incentive associated with imputation credits on the share price change.

867. For these reasons, the Authority determined to place limited weight on the dividend drop off estimates, and on the range of applied market value estimates more generally.

868. The Authority instead considered other approaches to estimating the utilisation rate.<sup>316</sup>

869. However, SFG argue that the Authority is in error in interpreting  $\theta$  as the utilisation rate, rather than in terms of the value to the representative investor.

870. First, SFG draws support from the recently revised language of National Gas Rule 87A, which states that 'gamma is the value of imputation credits', rather than the previous term 'utilisation of imputation credits'. SFG acknowledges that the Australian Energy Market Commission did not provide a detailed explanation about the changed language in its Final Determination, but considers that its apparent

<sup>313</sup> Economic Regulation Authority, *Review of the method for estimating the Weighted Average Cost of Capital for the Regulated Railway Networks: Revised Draft Decision*, 28 November 2014, p. 122.

<sup>314</sup> M. Lally, *The Estimation of Gamma*, Report for the AER, November 2013, p. 11.

<sup>315</sup> See M. Lally, *The Estimation of Gamma*, Report for the AER, November 2013, p. 11 and also M. Lally. and T. van Zijl, 'Capital Gains Tax and the Capital Asset Pricing Model', *Accounting and Finance*, vol.43, no.2, 2003, pp. 187-210.

<sup>316</sup> Economic Regulation Authority, *Draft Decision on Proposed Revisions to the Access Arrangement for the Mid-West and South-West Gas Distribution System*, 14 October 2014, Appendix 8.

intention was to be clear that imputation credits did not rely on utilisation.<sup>317</sup> The Authority notes that the AER sought clarification from the AEMC on the reason for the change, which was unable to provide ‘any further insight’.<sup>318</sup>

871. Second, SFG argues that the parameter  $U$  in the following equation – reproduced by the Authority in the Revised Draft Decision – within the term  $IC_1U$ , is defined as the *value* that investors attribute to imputation credits:<sup>319</sup>

$$S_0 = \frac{Y_1 - Tax_1 + IC_1U + S_1}{(1 + E[\hat{R}])} \quad (23)$$

Where

$U$  is the utilisation rate or value that investors attribute to imputation credits;

$Y_1$  is the expected cash flows over the first year to equity holders (net of all deductions except company taxes);

$Tax_1$  is the expected company taxes over the first year;

$S_0$  is the current value of equity;

$S_1$  is the expected value in one year;

$E[\hat{R}]$  is the equilibrium expected rate of return on equity;

$IC_1$  is the distributed imputation credits over the first year.

872. However, the Authority notes that the equation above is drawn from Lally, who quite clearly states in context:<sup>320</sup>

So, relative to the standard form of the CAPM, the Officer CAPM and the associated cash flows requires three additional parameters: the ratio of market-level imputation credits to the value of the market portfolio ( $IC_m/S_m$ ), the ratio of firm-level imputation credits to firm level company tax payments ( $IC/TAX$ ) and the utilisation rate ( $U$ ). The second of these parameters is called the “distribution rate” and the product of the last two is called “gamma”.

The utilisation rate referred to here is a market-level parameter, i.e., the same value applies to each firm. Individual investors also have utilisation rates: one for those who can fully use the credits and zero for those who can’t. Consequently it might be presumed that  $U$  is some type of weighted average over investors. Although Officer (1994) provides no clarification on this matter, because his derivation of the model is intuitive rather than formal, Lally and van Zijl (2003, section 3) provide a formal derivation of a generalisation of Officer’s model (with the Officer model being a special case), in which variation of utilisation rates across investors is recognised. In this

<sup>317</sup> ATCO Gas Australia, *Response to the ERA’s Draft Decision on required amendments to the Access Arrangement for the Mid-West and South-West Gas Distribution System*, 27 November 2014, Appendix 10, pp. 20-21.

<sup>318</sup> Australian Energy Regulator, *Draft Decision on Jemena Gas Network 2015–20 Access Arrangement*, Attachment 4 Value of imputation credits, pp. 4-37.

<sup>319</sup> Economic Regulation Authority, *Review of the method for estimating the Weighted Average Cost of Capital for the Regulated Railway Networks: Revised Draft Decision*, 28 November 2014, p. 148 and also M. Lally, *The Estimation of Gamma*, Report for the AER, November 2013, p. 9.

<sup>320</sup> M. Lally, *The Estimation of Gamma*, Report for the AER, November 2013, p. 10.

derivation, they show that  $U$  is a complex weighted average over all investors holding risky assets, where the weights involve each investor's investment in risky assets and their risk aversion. Individual investors' levels of risk aversion are not observable. Accordingly it is necessary to (reasonably) act as if risk aversion is uncorrelated with utilisation rate at the investor level, in which case the weights reduce to investors' relative investments in risky assets, i.e.,  $U$  is a value-weighted average over the utilisation rates of individual investors.

873. Third, SFG considers that 'there is a material difference between the utilisation rate (the proportion of credits that are redeemed at the tax office) and the value of those credits to shareholders'.<sup>321</sup>
874. In this context, SFG contends that the dividend drop off method is only useful for measuring the *value* of distributed credits, not the value of the utilisation rate, and hence is 'irrelevant' for estimating the proportion of distributed credits that are redeemed.<sup>322</sup>
875. SFG's core argument is that there is a cost for an investor to obtain and redeem a credit.<sup>323</sup> SFG considers that:<sup>324</sup>
- some credits that are distributed are never redeemed, for example because;
    - the investors are non-residents;
    - the 45 day rule precludes it;
  - record keeping creates administrative costs;
  - there is a time delay in obtaining the benefit;
  - imputation credits are taxed at their face value;
  - as resident investors adjust their portfolio to hold domestic shares for imputation, their portfolios will become less diversified, at a cost;
  - a rational investor would increase the concentration of domestic shares in their portfolio until the marginal benefit of imputation is zero.
876. The Authority notes these points, but considers:
- the AER's analysis of tax statistics demonstrates that the amount of credits utilised is very close to the amount of credits that have been received;<sup>325</sup>
  - the effects of the time value of money are likely to be minimal, given the period of delay; and

<sup>321</sup> See ATCO Gas Australia, *Response to the ERA's Draft Decision on required amendments to the Access Arrangement for the Mid-West and South-West Gas Distribution System*, 27 November 2014, Appendix 10, p. 19. SFG consider that it would be a clear error to conclude that  $\theta$  should be interpreted as a redemption rate because of econometric issues involved in estimating the value of distributed credits (ATCO Gas Australia, *Response to the ERA's Draft Decision on required amendments to the Access Arrangement for the Mid-West and South-West Gas Distribution System*, 27 November 2014, Appendix 10, p. 17). The Authority notes that its interpretation does not turn on issues associated with dividend drop off studies.

<sup>322</sup> ATCO Gas Australia, *Response to the ERA's Draft Decision on required amendments to the Access Arrangement for the Mid-West and South-West Gas Distribution System*, 27 November 2014, Appendix 10, p. 17.

<sup>323</sup> *Ibid.*, p. 21.

<sup>324</sup> *Ibid.*, p. 22.

<sup>325</sup> Australian Energy Regulator, *Draft Decision on Jemena Gas Network's 2015-20 Access Arrangement*, November 2014, pp. 4-46.



- there is no empirical evidence on the diversification effect of imputation credits, and no clear theoretical position for the effect either.<sup>326</sup>
877. In addition, transactions and other costs are unlikely to materially affect redemption of imputation credits, as investors are required to report franked dividends and eligible imputation credits, such that the incremental cost of redemption to that of shareholding is likely to be small. Most importantly, the Authority notes in this context Handley's view that the correct estimate of an after-company-before-personal-tax value of a distributed imputation credit should value credits before administrative costs, personal taxes and diversification costs.<sup>327</sup>
878. The Authority's view then is that these points do not detract from the fact that some investors will redeem credits, and thus have a utilisation rate of 1, and other investors in the Australian share market will not redeem credits, and will thus have a utilisation rate of 0. In the Authority's view, there is no case here that the utilisation rate is not a complex weighted average across all investors, both domestic and international. That complex weighted average depends on risk aversion, wealth, and given the foregoing, the cost of redeeming credits. Therefore the Authority remains of the view that approaches that directly inform the degree of utilisation of imputation credits will provide relevant information. Those approaches include the domestic ownership share of equity and taxation statistics on the proportion of redeemed imputation credits.
879. SFG's further argument is that the complex weighted average interpretation can only be consistent with perfectly segmented or perfectly integrated capital markets – and that this is not consistent with the Authority's definition of a domestic capital market with the presence of foreign investors:<sup>328</sup>
- However, the ERA's definition of theta in terms of the proportion of credits that are redeemed is not consistent with any theoretical model. The theoretical models that involve "a complex weighted average over all investors" only apply to two special cases:
- a) The case where Australia is perfectly segmented from world capital markets; and
  - b) The case where Australia is perfectly integrated into world capital markets.
880. SFG argues that there is no theoretical model that is consistent with the Authority's definition of the boundaries of the domestic market for estimation purposes, which include the presence of foreign investors to the extent that they invest domestically. In this context, SFG considers that the Authority's definition of the market is not a 'closed system', citing Lally in support:
- Lally (2013 AER) notes that there is a special case in which the proportion of imputation credits that are redeemed would be an appropriate estimate of the value of imputation credits that is reflected in the share price. He considers a class of models that includes Monkhouse (1993) and Lally and van Zijl (2003). These models all consider a setting in which there is a single market in which the m investors jointly own

<sup>326</sup> The Authority notes that diversification will depend on investor's wealth and risk preferences. It may be that investors respond to the presence of imputation by holding more, less or the same value of Australian equities, depending on preferences.

<sup>327</sup> J.C. Handley, *Advice on the Value of Imputation Credits*, 29 September 2014, p. 46.

<sup>328</sup> See ATCO Gas Australia, *Response to the ERA's Draft Decision on required amendments to the Access Arrangement for the Mid-West and South-West Gas Distribution System*, 27 November 2014, Appendix 10, p. 26. The Rate of Return Guidelines stated that 'the Authority's position is that the boundary should account for the full domestic data set, including any direct influences on the cost of capital for Australian domiciled firms. This may include the influence of international investors in Australian markets for equity...' (Economic Regulation Authority, *Explanatory Statement for the Rate of Return Guidelines*, 16 December 2013, p. 30).

all of the  $n$  assets. In these models there is a closed system – there are no assets outside the market that are available to the  $m$  investors inside the market and there are no investors outside the market who can buy any of the  $n$  assets inside the market. That is, these models only apply in a closed system where the  $m$  investors collectively own all of the  $n$  assets and nothing else.

The models then derive an equilibrium by solving a market clearing condition. This involves noting that: a) All of the  $m$  investors must invest all of their wealth across the  $n$  assets and nothing else; and b) All of the  $n$  assets must be owned entirely by the  $m$  investors and no one else.

Each of the  $m$  investors will hold a different amount of each of the  $n$  assets according to their wealth, their risk aversion and their tax status. Other things equal, wealthy investors will hold more of each asset than poor investors, highly risk averse investors will tend to hold safer portfolios, and investors who are eligible to redeem imputation credits will hold relatively more of the stocks that distribute larger amounts of those credits.

Because there is a closed system in which the  $m$  investors collectively own all of the  $n$  assets and nothing else, it is possible to derive the relative amount of each asset that each investor will want to hold. This will be a function of the investor's relative wealth, risk aversion and tax status. The relative demand for each asset will determine its equilibrium price and the equilibrium return that investors will require for holding it. Again, it is very important to emphasise that none of these equilibrium calculations can be performed unless the system is closed such that the  $m$  investors collectively own all of the  $n$  assets and nothing else.<sup>329</sup>

881. This is a pivotal issue, as evinced by the last paragraph above. SFG acknowledges that:

In this [closed system] case, there is equality between:

- a) The extent to which imputation credits are capitalised into stock prices; and
- b) The weighted-average redemption rate.

That is, there are two equivalent ways of determining the value of imputation credits, but only if the pre-requisite conditions and assumptions of the model hold. Importantly, under these special assumptions value and redemption will be equal. That is, redemption rates can be used to estimate value under these special assumptions. That is, these models do not say that redemption is the right interpretation and value is the wrong interpretation – the value interpretation is always the correct one. The only contribution of these models is to identify the special cases in which the redemption rate would provide an estimate of value.<sup>330</sup>

882. Contrary to SFG's position, the Authority considers that there is no ambiguity regarding the presence of foreign investors, or that the Australian market is anything other than a system of  $n$  assets with  $m$  investors. The interpretation is that some of the  $m$  investors in that system are foreigners. To assume somehow that we cannot draw a boundary around the full Australian capital market, reflecting the actual situation with regard to the  $n$  assets and  $m$  investors in that market, and then derive a wealth and risk weighted average of those investors' redemption of credits, seems odd. SFG appears to be saying that the Australian capital market will not be able to find equilibrium prices because foreign investors are present in that market.

<sup>329</sup> ATCO Gas Australia, *Response to the ERA's Draft Decision on required amendments to the Access Arrangement for the Mid-West and South-West Gas Distribution System*, 27 November 2014, Appendix 10, p. 27.

<sup>330</sup> *Ibid.*, p. 28.



883. Handley concurs with this view. Importantly, he rejects the idea that the CAPM requires that the  $m$  investors hold no other assets in any other market, only that they price domestic assets in isolation of other assets. He puts it thus:<sup>331</sup>

The starting point for a CAPM is a given set of  $n$  assets and a given set of  $m$  investors who hold them. It is then assumed that this set of investors will trade this set of assets among themselves in order to form their optimal portfolios – with the decision criteria of each investor being to maximize his utility of end-of-period wealth, which in turn is defined over the set of  $n$  assets. The CAPM makes no explicit assumption about any other assets or any other investors but if there are other assets or investors then it is implicitly assumed that these do not matter for the purposes of determining the prices of the  $n$  assets under consideration (otherwise they should be in the model). This means that other assets held by other investors do not matter. It also means that other assets held by the  $m$  investors do not matter. This is just a form of market segmentation. By definition the system is closed because what matters for pricing purposes – the  $n$  assets and  $m$  investors – are in the model and any other assets or investors being outside the model are ignored.

This is precisely the assumption that one implicitly makes when using the CAPM in practice. Once you choose a benchmark market then you define the set of assets and investors that are relevant for pricing purposes – in other words, by choosing a particular proxy for the market, one is saying that this is the best model for estimating expected returns on assets within this market. The model is closed in the sense that it is implicitly assumed to be segmented. If one disagrees with this assumption then the solution is to bring the other assets and investors into the model.

... SFG's comments are based on a faulty premise – that the  $m$  investors can own no other assets. This is an assumption of SFG but is not an assumption of the CAPM. In the current context, it is not assumed that investors in the domestic market hold no other assets but rather it is assumed that investors in the domestic market price domestic assets in isolation of any other assets they may or may not hold. For this purpose, investors in the domestic market consist of domestic investors to the extent that they hold domestic assets and foreign investors to the extent that they hold domestic assets – this is the set of  $n$  assets and the set of  $m$  investors who hold those  $n$  assets. Foreign assets held by these domestic investors, foreign assets held by these foreign investors and foreign assets held by other foreign investors are outside the model.<sup>332</sup>

884. This position is opposed by Lally, in the context of the Officer model, who notes that regulators account for foreign investors, to the extent that they invest in the Australian market, to reflect the empirical reality of their existence, but that:

...this involves use of a model (the Officer CAPM) that assumes that national markets for risky assets are segmented along with the definition for a parameter ( $U$ ) that is inconsistent with this model. Expressed more technically, the Officer model arises from the portfolio choices of a group of investors whose portfolio choices are limited to the Australian risk free asset (whose rate is determined exogenously) and Australian risky assets, and their portfolio choices determine the prices and hence the expected rates of return on these risky assets. Thus foreign investors, who by definition can hold both Australian and foreign risky assets, have no place in such a model. In addition, if Australian investors have access to foreign assets, the appropriate CAPM will reflect that fact and the equilibrium prices of Australian assets will differ.<sup>333</sup>

885. But Handley points out:

Lally (2013) adopts an unnecessarily narrow interpretation of segmentation in suggesting that foreign investors should be excluded completely. But once you

<sup>331</sup> J.C. Handley, *Advice on the Value of Imputation Credits*, 29 September 2014, p. 22.

<sup>332</sup> *Ibid.*, pp. 22-23.

<sup>333</sup> M. Lally, *The Estimation of Gamma*, Report for the AER, November 2013, p. 14.

choose a proxy for the market portfolio you define not only the set of assets that are relevant for pricing purposes but you also define the set of investors that are relevant for pricing purposes – in other words, it is a joint assumption. Lally's suggestion that we include the full set of  $n$  assets but only a subset of the of  $m$  investors not only contradicts the starting point of the CAPM but also does not accord with the reality that foreign investors are present in and influence the pricing of assets in the domestic market. This notion of (complete) segmentation – that only domestic assets are held by domestic investors – is an assumption of Lally but is not an assumption of the CAPM.<sup>334</sup>

886. The Authority considers that Handley's views relating to segmentation in the CAPM model are sensible. While it is reasonable to consider that Australian and foreign investors' holdings of Australian assets may be influenced by the prices of assets in overseas markets, a globally integrated market is not used for estimating the rate of return in this Final Decision.<sup>335</sup> The Authority has explicitly rejected such an approach. While utilisation rates may change as investors in Australian capital markets change their portfolio holdings and the proportion of foreign investors changes, *at any given point in time* the utilisation rate will be a complex weighted average of the  $m$  investors' utilisation rates.<sup>336</sup>
887. It becomes clear then – consistent with SFG's view noted in paragraph 881 – that the term '*value of franking credits*' and '*proportion of the tax paid at the company level [which] is really a withholding of personal tax*' are interchangeable terms for gamma.<sup>337</sup> From the shareholders' point of view '*distributed imputation credits are valuable to the extent that they can be used (or utilised or redeemed) to reduce personal taxes and/or have credits refunded*'. Officer described gamma in both ways. Handley considers that Officer's central idea is the identification of personal tax component of the company tax paid.<sup>338</sup> The relevant value of an imputation credit is the after-company-before-personal-tax value.<sup>339</sup>
888. Handley notes that the debate about value and utilisation is a largely sterile one:
- ...the relevant measure of utilisation value is that value as determined by the market – in other words it is not the utilisation value of a credit to any single investor or the utilisation value to any single class of investors that we want but rather the utilisation value to the market as a whole. In contrast, much of the current debate appears to incorrectly suggest that market value and utilisation value are alternative concepts for this purpose.

<sup>334</sup> J.C. Handley, *Advice on the Value of Imputation Credits*, 29 September 2014, p. 22.

<sup>335</sup> The Authority notes that the observed rate of return in a globally integrated capital market is lower than that of the partially segmented domestic capital market – indeed this is a key point of Lally's analysis for the 'conceptual goal posts'. In a fully integrated global market, the value of imputation credits would continue to be a complex weighted average over all investors, but clearly very close to zero. For a detailed discussion of this issue, and Lally's analysis with regard to the relationship between observed rates of return and the value of imputation credits, see Economic Regulation Authority, *Draft Decision on Proposed Revisions to the Access Arrangement for the Mid-West and South-West Gas Distribution System*, 14 October 2014, p. 448.

<sup>336</sup> Handley further notes in this context that (J.C. Handley, *Advice on the Value of Imputation Credits*, 29 September 2014, p. 8):

An implication of SFG's assertion is that one could validly use a "domestic" version of the CAPM say to price U.S. stocks only if you assume that investors in the U.S. stock market hold no other assets except U.S. stocks. Such an assumption would be clearly implausible.

<sup>337</sup> J.C. Handley, *Advice on the Value of Imputation Credits*, 29 September 2014, p. 9.

<sup>338</sup> *Ibid.*, p. 9.

<sup>339</sup> *Ibid.*, p. 7.

889. Handley observes that Officer concluded that the grossed up return to a company would include returns for capital accumulation, dividends and imputation. The returns to imputation may be expressed as  $\frac{\gamma C_t}{P_{t-1}}$  where  $C_t$  is imputation credits distributed during the period and the share price  $P_{t-1}$  is the price at the start of the period. Handley quotes Officer as defining this component as the ‘value of tax credits expressed as a rate or proportion of the initial value of the share’.<sup>340</sup> With Monkhouse’s extension to a non-perpetuity setting, then ‘ $\gamma$  continues to be used to refer to the personal tax proportion of company tax paid – equivalently the utilisation value of generated imputation credits while theta, is used to refer to the utilisation value of distributed imputation credits and is commonly called the utilisation rate’.<sup>341</sup>
890. Handley notes that the utilisation rate will reflect the value of imputation credits to the market as a whole, which may be difficult to observe. In this context, Handley reiterates the key messages made by Lally, discussed at length in the Revised Draft Decision, that:<sup>342</sup>
- the per dollar utilisation value of imputation credits embedded in equilibrium asset prices, theta, is common across all assets in the market; and
  - theta may be interpreted as a complex weighted average of investor utilisation rates.
891. The Authority endorses Handley’s view that use of the CAPM and interpretation of theta as the utilisation rate (equivalent to the value of imputation credits) is entirely consistent with its definition of the domestic capital market.
892. The Authority considers that, consistent with this interpretation, the ‘most important approaches to estimation in order of importance to be the equity ownership approach, the historic credit utilisation rate approach and dividend drop-off studies (being the most relevant within the class of implied market value studies)’.<sup>343</sup> However, the Authority agrees that ‘all approaches are subject to substantial uncertainty and so the estimate of theta is imprecise’.<sup>344</sup>
893. The Authority also agrees that there is considerable uncertainty surrounding the estimation of the utilisation rate. The Authority therefore considers that a range of approaches is desirable to determine the estimate.
894. Finally, the Authority agrees with Handley that the equity ownership and tax statistics on utilisation of imputation credits provide key evidence for the utilisation rate. The Authority also considered dividend drop off estimates and the ‘conceptual goal posts’ of Lally in the Revised Draft Decision. In what follows, these approaches for estimating the utilisation rate are revisited for this Final Decision.

#### 14.4.3.1 *Equity share ownership*

895. In the Revised Draft Decision, the Authority placed most weight on the equity ownership approach for estimating the value of the utilisation rate.

<sup>340</sup> Ibid., p. 10.

<sup>341</sup> Ibid., p. 11.

<sup>342</sup> Ibid., p. 20.

<sup>343</sup> Ibid., p. 31.

<sup>344</sup> Ibid., p. 32.

896. The Authority noted that the equity ownership approach can provide for an estimate of the utilisation rate that is consistent with Officer CAPM. This is because the majority of domestic investors will be eligible to redeem imputation credits (and therefore have an implied utilisation rate of 1), while foreign investors will not be eligible (with an implied utilisation rate of 0). The proportion of domestic ownership of capital investments therefore provides a simple and transparent estimate of the utilisation rate.
897. The Authority noted that the resulting estimate does not account for the required risk weighting of utilisation rates. However, the Authority is not aware of any means to incorporate such a consideration.<sup>345</sup> Therefore, the Authority accepted that current estimates of domestic investors' equity ownership share provide relevant information for determining the value of the utilisation rate.<sup>346</sup>
898. In the Revised Draft Decision, the Authority adopted a domestic equity share ownership proportion that was based on 'all equity' – both listed and unlisted – as it was consistent with its approach used to estimate the distribution rate.<sup>347</sup>
899. The Authority in the Revised Draft Decision rejected using an estimation approach based on listed equity ownership only, as it considered that the resulting estimate was not consistent with its preferred approach to estimating the distribution rate, which is based on all equity.

#### All equity – listed and unlisted

900. The Authority estimated the domestic equity share ownership proportion of listed and unlisted equity at 0.7 in the Revised Draft Decision. That estimate was based on:
- evidence from the AER, based on 2007 evidence from the Australian Bureau of Statistics (**ABS**), that 71 per cent of Australian equity is held by domestic investors,<sup>348</sup> and
  - updated ABS evidence from the QCA support a foreign ownership share (listed and unlisted) of around 30 per cent, depending on the period chosen.<sup>349</sup>

<sup>345</sup> Lally observes that ignoring risk weighting may be reasonable if it is assumed that individual investors' risk aversion is uncorrelated with their utilisation rate (see M. Lally, *The Estimation of Gamma*, Report for the AER, 23 November 2013, p. 11).

<sup>346</sup> Queensland Competition Authority, *Final Decision: cost of capital: market parameters*, August 2014, p. 98. The Authority notes that Hathaway has recently examined this data, finding figures closer to 0.8. However, as noted by the AER: 'Given they are the primary authors of this data, the ABS reported figures might be considered more reliable.' (Australian Energy Regulator, *Explanatory Statement – Rate of Return Guideline*, December 2013, p. 172).

<sup>347</sup> Economic Regulation Authority, *Review of the method for estimating the Weighted Average Cost of Capital for the Regulated Railway Networks: Revised Draft Decision*, 28 November 2014, p. 125.

<sup>348</sup> Australian Bureau of Statistics, *Feature article: Foreign ownership of equity*, Available at: <http://www.abs.gov.au/ausstats/abs@.nsf/featurearticlesbytitle/EDEB646A92BF2BFBCA2579B8000DF20B?OpenDocument>

<sup>349</sup> Queensland Competition Authority, *Final Decision: cost of capital: market parameters*, August 2014, p. 98.

901. SFG cautions that the estimates in unlisted equity may be unreliable, quoting the original ABS feature article from June 1992 to this effect.<sup>350</sup> However, the Authority notes that:
- SFG omitted to include a sentence in the ABS quote that 'Alternative information sources and methodologies for deriving these estimates are being investigated.'<sup>351</sup> The feature article is more than 20 years old, and the ABS has continued to refine the data in the relevant catalogue over the years;
  - the ABS has continued to publish the data, so it is reasonable to consider it relevant; and
  - the data quality warning was not repeated in the ABS feature article from 2007.
902. The Authority is therefore not persuaded that the equity ownership estimates are undermined by data quality issues.
903. ATCO's consultant SFG also noted the use of 2007 ABS data, suggesting that updated estimates based on current ABS data should be used. SFG also suggests that any equity share ownership estimate should be restricted to privately owned equity or else the inclusion of government owned equity will cause a systematic bias in the estimate of foreign ownership.<sup>352</sup> The Authority has noted these points and derived an updated series of equity share ownership that excludes government entities.
904. The Authority has also refined the equity share ownership estimates consistent with the method set out by the AER (Figure 27). The method:
- excludes from the calculation entities that are wholly owned by the public sector – including equity issued by the 'central bank', 'central borrowing authorities', 'national public non-financial corporations' and 'state and local public non-financial corporations';
  - sums the equity held by those classes of domestic investor that are eligible to utilise imputation credits – 'households', 'pension funds' and 'life insurance corporations';
  - sums the equity held by those classes of domestic investor that are not eligible to utilise imputation credits – 'state and local general government', 'national general government' and the rest of the world'; and
  - determines the share of equity held by domestic investors eligible to utilise imputation credits as a proportion of the equity held by domestic investors that either use or waste imputation credits.<sup>353</sup>

<sup>350</sup> ATCO Gas Australia, *Response to the ERA's Draft Decision on required amendments to the Access Arrangement for the Mid-West and South-West Gas Distribution System*, 27 November 2014, Appendix 10, p. 33.

<sup>351</sup> Australian Bureau of Statistics, *International Investment Position Australia*, June 1992, Section 4.

<sup>352</sup> ATCO Gas Australia, *Response to the ERA's Draft Decision on required amendments to the Access Arrangement for the Mid-West and South-West Gas Distribution System*, 27 November 2014, Appendix 10, p. 53.

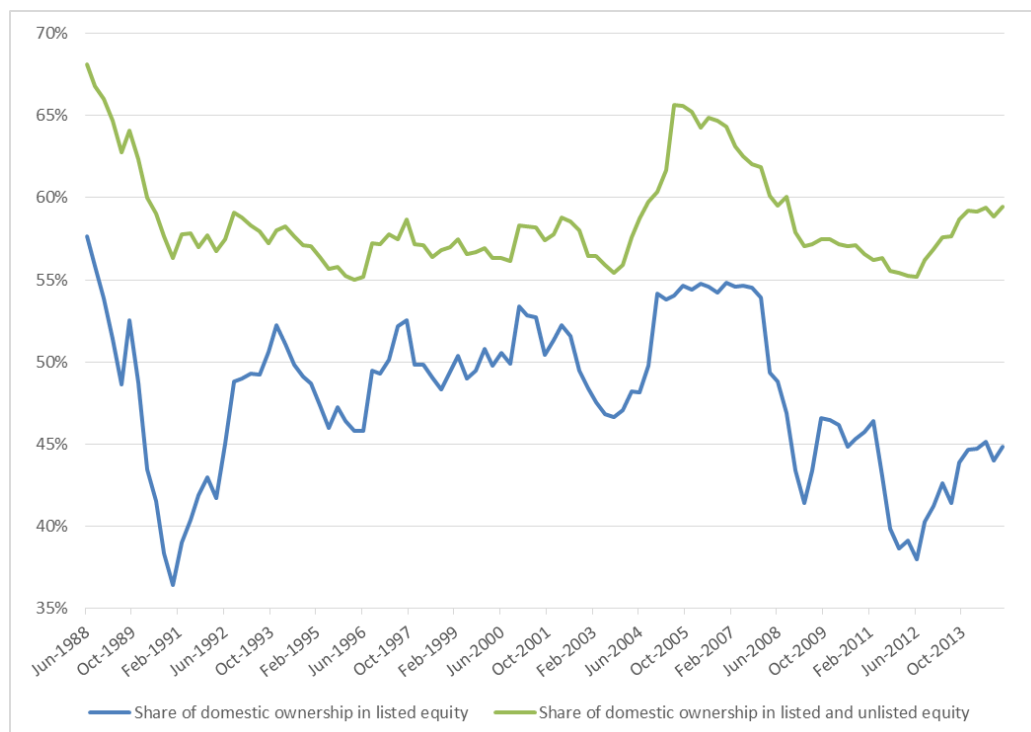
<sup>353</sup> Australian Energy Regulator, *Draft Decision, Jemena Gas Network's 2015–20 Access Arrangement*, Attachment 4 Value of imputation credits, p. 4-55. The AER observes that the case for assuming that governments 'waste' the imputation credits they receive is not clear, but that the effect of the exclusion is immaterial on the final result.

905. The resulting domestic ownership for listed and unlisted equity has tended to lie in the range between 55 and 65 per cent much of the time (Figure 27). The most recent share in December 2014 was 59 per cent.
906. The Authority considers that the most relevant period for making an estimate is that since July 2000, when the current regime allowing refunds of excess credits for eligible investors came into effect. Over that period the share of domestic ownership in all equity has averaged 59 per cent.
907. The Authority notes that the estimate has fluctuated over time. The Authority therefore is of the view that it is reasonable to infer an estimate around 59 per cent for domestic ownership of listed and unlisted equity, based on the average since 2000. That estimate also happens to coincide with the most recent observation.

### Listed equity

908. The listed equity share has fluctuated around 50 per cent much of the time, moving in a range between 37 per cent and 54 per cent in the observed data. The listed equity share is currently 45 per cent (based on the most recent ABS data for December 2014), and the average value since June 2000 has been 48 per cent (Figure 27).
909. The Authority therefore is of the view that it is reasonable to infer an estimate of around 48 per cent for domestic ownership of listed equity, based on the average since June 2000.

**Figure 27 Share of domestic ownership in listed and unlisted equities – excluding government ownership and refined to account for use of imputation credits**



Source: Australian Bureau of Statistics, *Australian National Accounts: Finance and Wealth*, Catalogue 5232.0, Tables 47 and 48, December 2014; ERA analysis.



### Equity share ownership estimate of the utilisation rate

910. The Authority estimates the utilisation rate of imputation credits as being in the range of 0.48 to 0.59 at the current time (based on the most recent ABS data for December 2014, and using the ‘refined’ approach), depending on whether the estimate is based on listed or all equity respectively.
911. The Authority notes that this is somewhat lower than Handley’s estimate, which is that the corresponding range is 0.5 to 0.7, depending on whether listed or all equity is used.<sup>354</sup> The Authority notes that Handley’s estimate is based on earlier ABS data (March 2014), and also took account of the estimate of Hathaway, that ‘domestic investors held between 75 per cent and 81 per cent of Australian equity between 1988 and 2012’.<sup>355</sup> The Authority has not accounted for Hathaway’s data, given its preference to focus on the estimates for the post-2000 period.

#### 14.4.3.2 Taxation statistics

912. Taxation statistics estimate the utilisation of imputation credits, which is a measure of the imputation credits redeemed by shareholders. The method uses Australian Taxation Office (**ATO**) statistics to observe the proportion of distributed imputation credits that have been used by investors to reduce their personal taxation liabilities. The approach implicitly assumes that the value of a redeemed franking credit is equal to its face value, whilst an unredeemed franking credit has no value. It follows that the average value of a franking credit is equal to the proportion of franking credits redeemed.<sup>356</sup>
913. The Authority noted in its gas Rate of Return Guidelines that two studies – performed by Hathaway and Officer (2004) and Handley and Maheswaran (2008) – have been considered by regulators in the past to estimate the required utilisation rate.<sup>357</sup>
914. Hathaway and Officer (2004) examined national tax statistics in order to estimate the average value of redeemed imputation credits from 1988 to 2002.<sup>358</sup> They calculated that 71 per cent of company tax payments had been distributed as imputation credits on average and estimated that 40 per cent to 50 per cent of the distributed credits were redeemed by taxable investors. Taking these two factors into account indicated to the authors that the statutory company tax rate is reduced by a proportion of 28 per cent to 36 per cent. This suggested that the effective rate of company taxation is around 19 to 21 per cent. They estimated a value of gamma within a range of 0.38 to 0.44. However, they noted that some of their data is not reliable.<sup>359</sup>
915. Handley and Maheswaran (2008) examined the reduction in individual tax liabilities due to imputation credits from 1988 to 2004.<sup>360</sup> Their study found that 67 per cent of

<sup>354</sup> J.C. Handley, *Advice on the Value of Imputation Credits*, 29 September 2014, p. 36.

<sup>355</sup> *Ibid.*, p. 35.

<sup>356</sup> NERA Economic Consulting, *The Value of Imputation Credits*, A report for the ENA, Grid Australia and APIA, 11 September 2008, p. 23.

<sup>357</sup> Economic Regulation Authority, *Explanatory Statement for the Rate of Return Guidelines: Meeting the Requirements of the National Gas Rules*, 16 December 2013, p. 212.

<sup>358</sup> N.J. Hathaway & R.R. Officer, *The Value of Imputation Tax Credits*, working paper, Melbourne Business School, 2004, p. 14.

<sup>359</sup> *Ibid.*, p. 14.

<sup>360</sup> J. Handley and K. Maheswaran, “A Measure of the Efficacy of the Australian Imputation Tax System”, *The Economic Record*, Vol. 84, No. 264, 2008, pp. 82-94.



distributed imputation credits were used to reduce personal taxes between 1990 and 2000, and that this distribution increased to 81 per cent over 2001-2004.

916. In his advice to the AER, Lally observed that SFG Consulting has previously argued that taxation statistics can only provide an upper bound on the utilisation rate, as opposed to a point estimate.<sup>361</sup> This argument was also previously accepted by the Authority as a consequence of the ACT decision.<sup>362</sup> Lally notes that as investors who receive franking credits utilise them fully, this is incorrect and redemption rates can be used to provide a point estimate of the utilisation rate (which Lally refers to as  $U$ ). Lally demonstrates this by defining  $u_i$  as the utilisation rate of investor  $i$ , and  $t_i$  to denote their marginal taxation rate.
917. Lally identifies that the personal tax obligation of that investor due to dividends paid, after the taxes already paid by the company is as follows:<sup>363</sup>

$$Tax_i = (DIV + u_i IC)t_i - u_i IC \quad (24)$$

Where

$DIV$  is the value of the dividend; and

$IC$  is the imputation credits for that company in the relevant period.

918. Lally notes that Australian investors can be assigned to two groups, those who can and cannot utilise franking credits. Given that the taxation for those who can utilise franking credits is as follows:

$$Tax_i = (DIV + IC)t_i - IC \quad (25)$$

919. It follows that  $u_i = 1$  for these investors.
920. Therefore, as the utilisation rate is not less than 1 for these investors, taxation statistics can provide an accurate point estimate of  $U$ . Implicit in this analysis is the assumption that franking credits cannot be transferred between investors. Lally continues by observing the evidence presented by McKenzie and Partington, which indicates that even though legislation exists to prevent this, it can be overcome in some cases.<sup>364</sup> Lally further notes that if this practice is extensive, it may result in tax statistics overestimating the utilisation rate. The Authority considers that as the legislation to transfer the credits exists to prevent this, it is likely to considerably constrain this activity and as a consequence this is not considered a significant issue.

<sup>361</sup> See SFG Consulting, *Estimating Gamma*, Report prepared for QR National, 2012, p. 7 and also M. Lally, *The Estimation of Gamma*, Report for the AER, November 2013, p. 18.

<sup>362</sup> Economic Regulation Authority, *Explanatory Statement for the Rate of Return Guidelines: Meeting the Requirements of the National Gas Rules*, 16 December 2013, p. 212.

<sup>363</sup> M. Lally, *The estimation of gamma*, 23 November 2013, p. 18.

<sup>364</sup> M. McKenzie, and G. Partington, *Evidence and Submissions on Gamma*, report prepared for the AER, 2010.

921. Lally considered that the tax statistics approach lacks precision, but still preferred it as an estimate over implied market value studies.<sup>365</sup>
922. The Authority notes that Hathaway has observed that large discrepancies exist in relation to franking credits when comparing ATO taxation data to that of ATO company financial data.<sup>366</sup> Hathaway urges caution in using ATO statistics for any estimates of parameters concerned with franking credits, until a reconciliation related to the actions of state owned enterprises is conducted, which may provide an explanation.
923. Both the AER, and Lally observe that using taxation statistics may be inconsistent with the interpretation of gamma under the Officer framework, where the utilisation rate is required to satisfy the complex weighted average.<sup>367</sup> Taxation statistics produce an estimate of the utilisation rate that is weighted by the amount of imputation credits received, not by equity ownership or risk aversion. On balance, the AER noted that it considers taxation statistics have merit in informing the required utilisation rate, but given these criticisms, it does not propose relying solely on this in informing its judgement. The Authority agrees with these conclusions.
924. The Authority considered in the Revised Draft Decision that taxation statistics can be used to empirically estimate the utilisation rate, concluding that tax statistics provide an estimate for the utilisation rate of 0.4 to 0.8.
925. However, given the concerns of Hathaway, Lally and the AER, the Authority did not consider that this methodology can be given much weight in determining the utilisation rate.<sup>368</sup>
926. ATCO in its response to the Draft Decision did not question the accuracy of the tax statistics estimate, but rather the relevance of the resulting estimate for the utilisation rate, based on the views of its consultant SFG, as discussed above.
927. The Authority notes that the AER has set out a further review the evidence for the estimate based on tax statistics, drawing on and further considering views from the experts, noting that:<sup>369</sup>
- evidence assembled by Hathaway points to a range of 0.4 to 0.6 for the utilisation rate;
    - based on the observation that the post-2004 taxation statistics data is more reliable than prior to that date:

In this current work I only consider franking credit flows for the period for 2004 onwards and can provide a much more detailed insight into the flows and utilisations of franking credits for that period

I would caution anyone, including the AER, against relying on those parts of my earlier reports which focussed on ATO statistics [up to 2004]. The

<sup>365</sup> M. Lally, *The estimation of gamma*, 23 November 2013, p. 4.

<sup>366</sup> N. Hathaway, *Imputation credit redemption ATO data 1988-2011, Where have all the credits gone?*, September 2013, p. 5.

<sup>367</sup> Australian Energy Regulator, *Better Regulation Explanatory Statement for the Rate of Return Guidelines*, [www.aer.gov.au](http://www.aer.gov.au), December 2013, p. 175.

<sup>368</sup> Economic Regulation Authority, *Draft Decision on Proposed Revisions to the Access Arrangement for the Mid-West and South-West Gas Distribution System*, 14 October 2014, p. 441.

<sup>369</sup> Australian Energy Regulator, *Draft Decision, Jemena Gas Network's 2015–20 Access Arrangement*, Attachment 4 Value of imputation credits, 17 November 2015, pp. 4-58 to 4-59.

data was then not as clear as it is today. I had to rely on separate analyses of ATO tax data and the ATO financial data. As I am now aware with the new data, there is an extremely large discrepancy between these two subsets of data. The missing link was the data on the flows of credits between companies which is now visible after the changes of 1 July 2002. I would recommend that the AER do not rely on that earlier report.<sup>370</sup>

- informed by two estimates for the period 2004 to 2011: 0.43 and 0.61, which reflect two alternative measures of the value of credits distributed, and two alternative estimates of the distribution rate;
- the 0.43 estimate of the utilisation rate corresponds to estimates of the distribution rate of around 0.7;
- the 0.61 estimate of the utilisation rate corresponds to estimates of the distribution rate of around 0.5 respectively;
- with Hathaway’s estimate of 0.43 based on post-2004 data being preferred as reasonable as it is consistent with an estimate of the distribution rate for ‘all equity’ of 0.7;<sup>371</sup>
- Handley considered that tax statistics provide a relevant estimate for the utilisation rate, concluding that a range of 0.4 to 0.6 is appropriate, based on the Hathaway material.<sup>372</sup>

928. The Authority has reviewed this evidence and considers that the Hathaway study provides the best estimate of the utilisation rate derived from taxation statistics. On that basis, the Authority considers that a revised range of 0.4 to 0.6 is appropriate, and that a point estimate of 0.43 should be applied given the Authority’s preference to base its estimates on ‘all equity’, with a distribution rate of 0.7.

929. However, the Authority remains mindful of Hathaway’s concerns with the ATO data, and the pointed caution about relying on it for estimating utilisation rates:

Unfortunately, there are too many unreconciled problems with the ATO data for reliable estimates to be made about the utilisation of franking credits. The utilisation rate of franking credits is based on dividend data (from the tax office) and I have demonstrated that this data is questionable.<sup>373</sup>

#### 14.4.3.3 *Implied market value studies*

930. Implied market value studies include:

- simultaneous price studies; and
- dividend drop off studies.

<sup>370</sup> N. Hathaway, *Imputation credit redemption ATO data 1988–2011: Where have all the credits gone?*, September 2013, p. 6.

<sup>371</sup> Australian Energy Regulator, *Jemena Gas Network’s 2015-20 Access Arrangement Draft Decision*, Attachment 4, pp. 4-20.

<sup>372</sup> J. Handley, *Advice on the value of imputation credits*, 29 September 2014, p. 31.

<sup>373</sup> N. Hathaway, *Imputation credit redemption ATO data 1988–2011: Where have all the credits gone?*, September 2013, p. 39.

931. In the gas Rate of Return Guidelines and the rail WACC method Draft Decision, the Authority concluded that simultaneous price studies cannot be used to estimate the utilisation rate.<sup>374</sup>
932. On the other hand, the range of dividend drop off studies were considered at length in the gas Rate of Return Guidelines. The Authority considered the set of existing dividend drop off studies. The Authority in the gas Rate of Return Guidelines and the rail WACC method Draft Decision adopted a range for the utilisation rate of 0.35 to 0.55, based on the results of studies by SFG and by the Economic Regulation Authority Secretariat.
933. The Authority in the Revised Draft Decision retained the range for the outcomes of the econometric estimates adopted in the Rate of Return Guidelines – of 0.35 to 0.55 – but determined to adjust the estimates to reflect Lally’s advice that the regression coefficient on franking credits estimated in dividend drop off studies may not necessarily equate to the utilisation rate,  $\theta$ , given that the tax rate on gross dividends diverges from capital gains. Rather, Lally argues that the regression coefficient on franking credits may be constituted as a product of, first, the utilisation rate  $\theta$  and, second, the regression coefficient on the value of the dividend which contributes the resulting share price drop off.<sup>375</sup>
934. Adjusting the estimates utilised for the gas Rate of Return Guidelines and rail WACC method Draft Decision to account for this issue – by dividing the estimated regression coefficient on the franking credit by the estimated regression coefficient of the cash dividend – results in an estimate of  $\theta$  of 0.4 from the SFG analysis, and a range of 0.38 – 0.69 from the results of the Authority’s own analysis.<sup>376</sup>
935. The Authority’s resulting range in the Revised Draft Decision for  $\theta$  derived from dividend drop off studies was 0.3 to 0.7. The broad range reflected the Authority’s concern with the quality of dividend drop off estimates, and encompassed both the rounded adjusted and unadjusted estimates.
936. The Authority in the Revised Draft Decision determined to place limited weight on the dividend drop off estimates, due to issues associated with the econometric estimation, and also its concern that the studies do not estimate the complex weighted average utilisation rate over all equities.<sup>377</sup> The Authority considered that dividend drop off studies are only useful to the extent that they confirm that investors place value on franking credits, however, due to the econometric issues associated with them, their exact market value cannot precisely be determined.<sup>378</sup>

<sup>374</sup> Economic Regulation Authority, *Draft Decision on Proposed Revisions to the Access Arrangement for the Mid-West and South-West Gas Distribution System*, 14 October 2014, p. 448.

<sup>375</sup> Note that Lally refers to  $\theta$  by the equivalent symbol  $U$  (see M. Lally, *Estimating Gamma*, Report for the QCA, 25 November 2013, p. 21).

<sup>376</sup> SFG Consulting, *Dividend drop-off estimate of  $\theta$* , Final Report, 21 March 2011. The upper bound of 0.69 is the division of the upper bound utilisation estimate of 0.53 (which was rounded up to 0.55) by the coefficient on the corresponding estimate of the cash dividend of 0.77 (see Table 5 in D. Vo, B. Gellard, S. Mero. *Estimating the Market Value of Franking Credits, Empirical Evidence from Australia*, Conference Paper, Australian Conference of Economists 2013).

<sup>377</sup> Economic Regulation Authority, *Review of the method for estimating the Weighted Average Cost of Capital for the Regulated Railway Networks: Revised Draft Decision*, 28 November 2014, p. 126.

<sup>378</sup> Economic Regulation Authority, *Draft Decision on Proposed Revisions to the Access Arrangement for the Mid-West and South-West Gas Distribution System*, 14 October 2014, p. 212.

937. SFG Consulting gave the following response to the Authority's views on the dividend drop off estimates which were set out in the Revised Draft Decision:<sup>379</sup>
- econometric issues are not significant as to preclude use of dividend drop off studies;
  - dividend drop off estimates measure the utilisation rate directly; no adjustment is required for the coefficient on dividends;
  - the composition of investors around ex-dividend dates is representative of the long term providers of equity capital; and
  - greater reliance should be placed on the SFG dividend drop off studies.

### Econometric issues

938. SFG notes that:

The [Authority] raises a number of general econometric issues in relation to dividend drop-off analysis. Most of these issues have previously been considered by the ERA, with the ERA determining that they are not so severe as to impact on its total reliance on drop-off analysis for estimating theta.<sup>380</sup>

939. The Authority agrees that econometric issues did not preclude it giving limited weight to the dividend drop off studies. However, the Authority remains of the view that:
- The required utilisation rate under the Officer framework is a complex weighted average determined by the value of equity that investor's hold and their relative risk aversion. Dividend drop off studies, however, only estimate the value weighted utilisation rate around just two days, the cum-dividend and ex dividend dates. As a consequence, they provide an estimate of the utilisation rate with a value weighting that reflects the composition of investors around the cum and ex dividend dates, not the weighted average across the entire market, as required.
  - There are significant econometric challenges in estimating the utilisation rate from dividend drop off studies. Trading around the ex-dividend date reflects a variety of different incentives and price movements. Dividend drop off studies may not accurately separate out the effect of the taxation incentive associated with imputation credits on the share price change.
940. The Authority notes that both Handley and Lally agree that the composition of investors around ex-dividend dates may not be representative of long term investors.<sup>381</sup> Lally also points out that ex-dividend movements can reflect a range of factors, including tax, transactions costs and preferences, such that it is not clear that tax arbitrage would necessarily exacerbate share price differentials around ex-dividend dates. The corollary is that it is not clear that dividend drop off studies necessarily over-estimate the utilisation rate. For the same reasons, there remain valid concerns as to what exactly dividend drop off studies are measuring.

<sup>379</sup> ATCO, *Response to the ERA's Draft Decision on required amendments to the Access Arrangement for the Mid-West and South-West Gas Distribution System*, 27 November 2014, Appendix 10, p. 34.

<sup>380</sup> ATCO, *Response to the ERA's Draft Decision on required amendments to the Access Arrangement for the Mid-West and South-West Gas Distribution System*, 27 November 2014, Appendix 10, p. 35.

<sup>381</sup> See M. Lally, *The estimation of gamma*, 23 November 2013, p. 29 and also J. Handley, *Advice on the value of imputation credits*, 29 September 2014, p. 15.

941. The Authority therefore considers that this is a contentious area. It adds to the caution the Authority has in relying too much on dividend drop off studies for estimating the utilisation rate.

#### **Dividend drop off coefficient adjustment**

942. The Revised Draft Decision set out that the estimate of the utilisation rate is defined relative to a representative investor's ability to use each franking credit to reduce personal tax. However, as trading around the ex-dividend date represents a variety of different incentives, it may not accurately reflect the taxation incentive.<sup>382</sup>

943. Econometric problems that exist with dividend drop off studies have been well explored by the Authority, which has previously noted that this is the reason for the large divergence in empirical estimates of the utilisation rate using dividend drop off studies.<sup>383</sup> The Authority noted that any estimate of theta is essentially a function of the most influential observations, due to the extreme multicollinearity present in the data.

944. This conclusion is supported by the AER, which has noted:

Further, even if implied market value estimates were conceptually appropriate, there are significant limitations with the accuracy and robustness of such studies.<sup>384</sup>

945. Lally further notes:

The AER does not consider that these estimates are useful for a number of reasons. In respect of dividend drop off studies, these include evidence that trading activity around dividend ex-days is abnormal, that correction is required for market movements, and the sensitivity of results to data, outliers and model choices. More generally these problems include the difficulties in separating the values of franking credits and dividends in these studies, the wide range of empirical results from such studies, the possibility of bias from 'bid-ask bound', and the exposure of such estimates to the tax circumstance and transaction costs of tax arbitrageurs. Many of these problems are manifest in high standard errors in the estimates of the coefficients. I concur with all of these concerns, and I have additional concerns about these studies or their interpretation.<sup>385</sup>

946. Lally also provides evidence that Australian regulators (including the Authority) and the Australian Competition Tribunal have consistently misinterpreted the results of dividend drop off studies for estimating the required utilisation rate. Lally observes that the coefficient of the regression equation in dividend drop off studies is generally

<sup>382</sup> Influences on investors' incentives include their transaction costs, tax situation and trading strategies. See Economic Regulation Authority, Draft Decision on Proposed Revisions to the Access Arrangement for the Mid-West and South-West Gas Distribution System, 14 October 2014, p. 443.

<sup>383</sup> See D. Vo, B. Gellard, S. Mero. 'Estimating the Market Value of Franking Credits, Empirical Evidence from Australia', Conference Paper, Australian Conference of Economists 2013. And also The Authority explored in the explanatory statement of the Rate of Return Guidelines the econometric issues encountered in dividend drop off studies, for a detailed discussion see: Economic Regulation Authority, *Explanatory Statement for the Rate of Return Guidelines: Meeting the Requirements of the National Gas Rules*, Dec 2013, p. 216 and Economic Regulation Authority, *Appendices to the Explanatory Statement for the Rate of Return Guidelines* Dec 2013, Appendix 28.

<sup>384</sup> Australian Energy Regulator, *Better Regulation Explanatory Statement for the Rate of Return Guidelines*, Dec 2013, p. 177.

<sup>385</sup> M. Lally, 'The Estimation of Gamma, Report for the AER', November 2013, p. 20.



assumed to be the utilisation rate, which Lally suggests is incorrect. Lally demonstrates this by first outlining the dividend drop off equation as follows:

$$P_{i,t-1} - P_{i,t}^* = \delta D_i + \theta FC_i + u_i \quad (26)$$

Where

$P_{i,t-1}$  is the cum-dividend price;

$P_{i,t}^*$  is the ex-dividend price corrected for the market movement;

$D_i$  is the cash dividend;

$FC_i$  is the franking credit; and

$u_i$  is the regression residual.

947. Lally begins by noting that no distinction should be made regarding the cash dividend and franking credit if the franking credit can be fully utilised, e.g. a cash dividend of \$10 and a franking credit of \$2 is equivalent to a cash dividend of \$12. That is, an investor should be indifferent between the decomposition of any gross dividend received to the extent the franking credit can be utilised.<sup>386</sup> Lally further observes that if all investors can utilise imputation credits, the required regression equation would be as follows:

$$P_{i,t-1} - P_{i,t}^* = \delta [D_i + FC_i] + u_i \quad (27)$$

948. In this circumstance,  $\delta$ , recognises that the expected price change can differ from the paid out gross dividend, as in reality, the tax rate applicable on the gross dividend can diverge from that of capital gains.<sup>387</sup> In order to incorporate the empirical reality of not all investors being able to utilise franking credits, Lally notes that the franking

<sup>386</sup> Gross dividend refers to the sum of the cash dividend and the franking credit,  $G_i = D_i + FC_i$

<sup>387</sup> The coefficient  $\delta$ , is the gross drop-off ratio, see: Beggs D., and Skeels, C., 2006, 'Market Arbitrage of Cash Dividends and Franking Credits', *Australian Economic Papers*, vol 82, no.285, pp. 239-252. The estimated coefficient,  $\hat{\delta}$ , therefore measures the average change in stock price that occurs due to payment of \$1 of gross dividend. The Authority notes that the theoretical model underlying dividend drop off studies is based on Elton, E.J and Gruber, M.J (1970), 'Marginal Stock Holder Tax Rates and the Clientele Effect', *Review of Economics and Statistics*, 52, 68-74. Under the assumptions of no stochastic uncertainty, no time value of money and no transaction costs, it can be shown that  $\delta = \frac{(1-T_d)}{(1-T_g)}$  where  $T_d$

is the tax rate applicable to the gross dividend, whilst  $T_g$  is the tax rate applicable on capital gains. It follows that  $\hat{\delta}$  measures the divergence in tax rates applicable to the gross dividend and capital gains of the representative investor.



credit covariate should be multiplied by the coefficient U, to represent the average utilisation rate. The required equation is then as follows:

$$\begin{aligned} P_{i,t-1} - P_{i,t}^* &= \delta[D_i + U.FC_i] + u_i \\ &= \delta D_i + U.\delta FC_i + u_i \end{aligned} \quad (28)$$

949. Based on this analysis, it is apparent that  $\theta = U.\delta$ . Therefore, in order to derive the required utilisation rate, U, from dividend drop off studies, the estimated coefficient of the franking credit,  $\theta$ , must be divided by the estimated coefficient of the cash dividend,  $\delta$ , as follows,  $U = \frac{\theta}{\delta}$ .
950. The Authority in the Revised Draft Decision accepted the criticism that it had misinterpreted the required utilisation rate in previous regulatory decisions, in addition to the gas Rate of Return Guidelines. Re-interpreting the required utilisation rate from the previously considered relevant dividend drop off studies results in a utilisation rate of 0.4 from the SFG analysis, and an upper bound of 0.69 from the Authority's own analysis.<sup>388</sup>
951. However, SFG considers that the dividend drop off coefficient does not need to be adjusted:

In our view, this adjustment is not appropriate when estimating theta as the value of distributed imputation credits. When theta takes a value interpretation within the regulatory framework, what is required is an estimate of the price that investors would be prepared to pay for an imputation credit. This is because the allowed return for an investor will be reduced by theta for every dollar of imputation credits that is distributed to them. To preserve the appropriate return to investors, the regulatory framework must reduce the return to investors by an amount that is equivalent to the price investors would be prepared to pay for the credit. Dividend drop-off analysis is specifically designed to estimate the price that investors would be prepared to pay for imputation credits. It directly estimates the extent to which imputation credits are capitalised into the stock price. This is an estimate of how much the stock price has been bid up in relation to the imputation credit that is to be received. The standard dividend drop-off estimate of theta provides a direct estimate of the value of distributed credits.<sup>389</sup>

952. SFG considers that the proposed adjustment leads to perverse outcomes. To illustrate, SFG sets up a hypothetical example comparing two different outcomes with  $\delta = 1$  and  $\delta < 1$ , while requiring shareholders to be equally well off. Where  $\delta < 1$ , investors do not value dividends as highly as  $\delta = 1$ . SFG argues that to be equally

<sup>388</sup> SFG Consulting, *Dividend drop-off estimate of theta, Final Report*, 21 March 2011, p. 32. SFG's estimate is 0.35, which is 'paired with an estimate of the value of cash dividends in the range of 0.85 to 0.90'. Dividing 0.35 by 0.875 gives 0.4. Based on adjusting the range of 0.35 to 0.55 (using robust techniques) set out in D. Vo, B. Gellard, S. Mero. 'Estimating the Market Value of Franking Credits, Empirical Evidence from Australia' Conference Paper, Australian Conference of Economists 2013, final paragraph. The corresponding value of  $\delta$  in that study for the upper bound (unrounded) value with no market correction of 0.53 was 0.77 (Table 5). Dividing 0.53 by 0.77 gives 0.69.

<sup>389</sup> ATCO Gas Australia, *Response to the ERA's Draft Decision on required amendments to the Access Arrangement for the Mid-West and South-West Gas Distribution System*, 27 November 2014, Appendix 10, p. 36.

well off with  $\delta < 1$ , the value for theta would have to fall, but that this would not be the outcome dividing through by a lower  $\delta < 1$ .<sup>390</sup>

953. However, the Authority is not convinced by this argument, as it sets up a ‘straw man’. It is not clear to the Authority why, if investors do not value dividends as highly, they would necessarily have exactly the same preferences and requirements of utility. It may be that they do not require to be as well off if  $\delta < 1$ , given that they do not value dividends as highly.
954. SFG also considers that such an adjustment would be required throughout the regulatory process, as it is implicit in the Sharpe-Lintner CAPM that  $\delta = 1$ . SFG notes that Lally and van Zijl develop a more complex version of the CAPM with  $\delta < 1$ .
955. On this point, the Authority notes that both Handley and Lally have recommended such an adjustment. Handley for example observes:
- The key message here is that other stuff (such as taxes and risk) may need to be taken into account in interpreting dividend drop-off studies...
- Importantly, the regression coefficients  $\delta$  and  $\theta$  can be interpreted in this way only if there are no other factors such as differential personal taxes and risk reflected in the estimates. But the results of SFG clearly tell us that this is not the case. SFG estimate the value of cash dividends  $\delta$  to be in the range of 0.85 to 0.90 but one would expect a coefficient of  $\delta = 1$  in the absence of differential personal taxes and risk, since by definition the (after-company-before-personal-tax) value of one dollar of dividends is one dollar. This means that the coefficient of  $\theta = 0.35$  does not represent the (after-company-before-personal-tax) value of one dollar of imputation credits but rather it represents the (after-company-before-personal-tax) value of one dollar of imputation credits and the impact of other factors, such as differential personal taxes and risk. We don’t really need to concern ourselves with precisely identifying what these other factors are – it is sufficient to know that collectively they have reduced the estimates of the (after-company-before-personal-tax) values of one dollar of dividends and one dollar of imputation credits by 10 – 15% . Accordingly, we need to gross-up the SFG estimates of  $\theta$  by 10 – 15% to correctly interpret the results of the study. In other words, the SFG studies suggest a utilisation rate of 0.39 – 0.41 rather than the 0.35 as claimed. This approach is equivalent to the “Lally Adjustment”...<sup>391</sup>
956. The Authority therefore considers that it is appropriate to retain the *adjusted upper bound* for the estimate of the utilisation rate, based on applying the Lally adjustment to the upper bound of its own study, but no longer rounded to one significant figure. That gives an upper bound of 0.69. The Authority will also adopt the unrounded lower bound of 0.35, which reflects the results from the Authority’s unadjusted estimates and also SFG’s unadjusted finding.<sup>392</sup>
957. The resulting range is 0.35 to 0.69. This range is reasonably wide, reflecting the uncertainty surrounding the estimates, and the conflicting views of the experts.

<sup>390</sup> Ibid., p. 36.

<sup>391</sup> J. Handley, *Advice on the value of imputation credits*, 29 September 2014, p. 43.

<sup>392</sup> The Authority has adopted the unrounded range as it will apply the distribution rate for listed equity, of 0.8 (see paragraph 983 below).

## Composition of investors

958. SFG questions the Authority's concern with regard to the composition of investors around ex-dividend days. SFG considers that the Energy Networks Association:<sup>393</sup>

...demonstrated that the empirical evidence shows that the increase in trading volume around ex-dividend dates is driven by a subset of investors who value imputation credits highly. These investors purchase shares to capture the dividend and imputation credit, causing a run-up in the cum-dividend price.<sup>394</sup>

To the extent that this effect is material, it results in the dividend drop-off being higher than it would otherwise be, which in turn results in the estimate of theta being higher than it would otherwise be. That is, to the extent that the increase in trading volume around the ex-dividend date has an effect, it is likely to result in an over-estimate of theta.

959. This point is addressed in paragraph 940 above. The Authority considers that there remain valid concerns as to what exactly dividend drop off studies are measuring, and that this is a contentious area. It adds to the caution the Authority has in relying too much on dividend drop off studies for estimating the utilisation rate.

960. In addition, SFG suggests that the Authority implied in the Revised Draft Decision that a partially segmented domestic capital market, which includes the presence of foreign investors, means that any estimate of the utilisation rate using the dividend drop off method is incompatible with the Officer CAPM framework and by extension the NGR. However, the Authority considers that this suggestion is incorrect, as it is taken out of context. SFG omits the full quote, which is:

A key assumption of the Officer CAPM framework employed by Australian regulators is that it assumes a segmented domestic capital market in addition to tax invariance between capital gains and dividends. Dividend drop off studies, however, reflect the empirical reality of foreign investors and differential taxation rates between capital gains and dividends. Therefore, any estimate of the utilisation rate using the dividend drop off method is incompatible with the Officer CAPM framework and by extension the NGR.<sup>395</sup>

961. The Authority was reporting Lally's views.<sup>396</sup> However, as noted above at paragraph 886, the Authority does not agree with Lally's view that only a fully segmented market is consistent with the CAPM. In line with Handley's view, a partially segmented market may be defined for the purpose of the CAPM. It remains relevant, however, that the results of dividend drop off studies may incorrectly estimate the value of the utilisation rate, given the potential influence on the estimates of other factors such as differential personal taxes and risk.

<sup>393</sup> ATCO Gas Australia, *Response to the ERA's Draft Decision on required amendments to the Access Arrangement for the Mid-West and South-West Gas Distribution System*, 27 November 2014, Appendix 10, p. 37.

<sup>394</sup> The same point is made by M. McKenzie and G. Partington, *Response to questions related to the estimation and theory of theta*, Report for the AER, 7 March 2011.

<sup>395</sup> Economic Regulation Authority, *Draft Decision on Proposed Revisions to the Access Arrangement for the Mid-West and South-West Gas Distribution System*, 14 October 2014, p. 442.

<sup>396</sup> Paragraphs 89 – 91 of Appendix 8 are attributed to the AER (see the statement to this effect at paragraph 90), but should have been attributed to Lally.

## Relevance of the Authority's study

962. SFG considers that the SFG dividend drop off estimates are superior to the Authority's estimates, on the grounds that:<sup>397</sup>
- The Authority's estimates do not apply the 'standard market adjustment' to account for the overall movement of the market on the ex-dividend day. When the market correction is applied to the Authority's results, the outcome is very close to the SFG estimate of 0.35 for the market value of imputation credits.
  - The mid-point of the Authority's range of 0.35 to 0.55 does not represent the best estimate, as the majority of estimates are below 0.45 – SFG considers that 0.4 is a better representation of the Authority's results.
  - The SFG studies have been subject to intense scrutiny, including by the Australian Competition Tribunal, whereas the Authority's study has not.
  - The SFG theta estimates 'have been shown to be stable and reliable in the face of a battery of stability and robustness checks, whereas the ERA expresses concerns about the stability and reliability of its own results'.
963. The Authority considers that its studies have been subject to extensive scrutiny, including by regulators, experts, and ATCO and SFG itself.<sup>398</sup>
964. SFG considers that the Authority's study produces a theta estimate of 0.34 – when the same 'ex-day market correction is applied' as is undertaken by SFG in its study.<sup>399</sup> ATCO considers that this 'supports the SFG estimate'.<sup>400</sup>
965. SFG also disagrees with the Authority's contention that dividend drop off studies have resulted in a wide range of estimates, and are sensitive to particular data observations.
966. However, Lally has considered both studies in depth, noting:
- ...despite using the same methodology and data filtering rules to data from an almost identical period (July 2001 to July 2012 versus July 2001 to October 2012), Vo et al (2013) and SFG (2013a) generate some quite dramatic differences in results. In particular, for models 3 and 4 with OLS, SFG estimate U at 0.15 and 0.33 respectively whilst Vo et al estimates it at 0.60 and -0.08 respectively. In addition Vo et al's standard errors on the franking credit coefficient are on average 50% larger than SFG's. In addition, using different (but reasonable) approaches to investigating the effect of removing outliers, the effect on the parameter estimates is quite different. For example, in respect of SFG's preferred approach involving model 4 and "robust regression", the effect on Vo et al's estimate of the franking credit coefficient from progressively removing the 30 most extreme observations (in absolute terms), and rerunning the model after each deletion, is to generate estimates of this coefficient that (largely) progressively increase from 0.32 to 0.53 (ibid, Table 8 and Figure 15). The associated coefficients on cash dividends are not given but it could be presumed that the range in estimates for U would be at least as great as that for the coefficient on franking credits. Importantly, these 30 observations represent less than 1% of the total set of observations. By contrast, SFG progressively remove the 20 most extreme pairs

<sup>397</sup> ATCO Gas Australia, *Response to the ERA's Draft Decision on required amendments to the Access Arrangement for the Mid-West and South-West Gas Distribution System*, 27 November 2014, Appendix 10, pp. 40-41.

<sup>398</sup> See for example, Australian Energy Regulator, *Draft Decision: Jemena Gas Networks 2015-20*, November 2014, Attachment 4, p.4-23.

<sup>399</sup> ATCO Gas Australia, *Response to the ERA's Draft Decision on required amendments to the Access Arrangement for the Mid-West and South-West Gas Distribution System*, 27 November 2014, p. 41.

<sup>400</sup> Ibid., p. 219.

of observations (the one that exerts the most upward effect on the franking credit coefficient and the one exerting the most downward effect) and find only trivial effect on the coefficient (SFG, 2013a, Figure 4).

...in respect of the robust regression models used by both SFG and Vo et al, the latter authors rerun the models with various values of the “tuning constant” in the model, and obtain significantly different estimates of the coefficient on franking credits across the range of values for the tuning coefficient, for each of SFG’s four models. For example, in respect of SFG’s model 4, the estimated coefficient varies from 0.32 to 0.64 (Vo et al, 2013, Table 11 and Figure 19). Again, the associated coefficients on cash dividends are not given but it could be presumed that the range in estimates for U would be at least as great as that for the coefficient on franking credits.<sup>401</sup>

967. The Authority has also been concerned about such differences, and agrees with Lally when he states that ‘these differences undermine the credibility of results from all such studies’.<sup>402</sup> This is an important further reason why the Authority concluded that dividend drop off studies of the utilisation rate are vulnerable to the dividend sample, parametric form of the regression equation and regression technique used, and is a further reason why the Authority places only limited weight on the estimated range.<sup>403</sup>

#### 14.4.3.4 The Lally conceptual test

968. A summary of the Authority’s consideration of this approach may be found in Appendix 5 of the Revised Draft Decision.<sup>404</sup> The Authority in the Draft Decision concluded that Lally’s conceptual test indicated that the utilisation rate should lie in the range of 0.6 to 1.

969. The Authority’s range is broader than that of Lally, who considered that the test should lie in the range of 0.8 to 1. Lally’s key point is that moving from complete domestic market segmentation to incorporate the presence of foreign investors requires an internally consistent change in the parameters employed in the CAPM:

...as one moves from a world of complete segmentation to complete integration, the model used should also change and this is not done. Instead regulators are using a model that presumes complete segmentation and populating it with an estimate for U that reflects partial segmentation. The result is regulatory estimates of the cost of equity that lie outside the bounds of complete segmentation and complete integration. Given the use of the Officer model by regulators, and an MRP estimate that can reasonably be presumed to lie between the two extreme cases, the only values for U that produce sensible estimates for the cost of equity are those from 0.80 to 1.<sup>405</sup>

970. The Authority noted in the Draft Decision that the lower bound of Lally’s estimated range of 0.8 depends on the assumptions used for the fully integrated (Solnik) model. The estimate of what is ‘sensible’ also depends on the assumptions used for the regulator’s estimate of the partially segmented domestic MRP.

971. It is possible that varying these assumptions would broaden the permissible range of what is potentially ‘sensible’. Lally conducts sensitivity analyses, demonstrating that

<sup>401</sup> M. Lally, ‘*The Estimation of Gamma*, Report for the AER’, November 2013, p. 25.

<sup>402</sup> M. Lally, ‘*The Estimation of Gamma*, Report for the AER’, November 2013, p. 25.

<sup>403</sup> D. Vo, B. Gellard, S. Mero. ‘Estimating the Market Value of Franking Credits, Empirical Evidence from Australia’ Conference Paper, Australian Conference of Economists 2013.

<sup>404</sup> Economic Regulation Authority, *Review of the method for estimating the Weighted Average Cost of Capital for the Regulated Railway Networks: Revised Draft Decision*, 28 November 2014, Appendix 5, p. 165.

<sup>405</sup> M. Lally, *The Estimation of Gamma*, Report for the AER, November 2013, p. 44.



some combinations of the parameters provide sensible estimates for a value for U as low as 0.625.<sup>406</sup>

972. Accordingly, the Authority considered it reasonable to infer a range for the utilisation rate of 0.6 to 1, as conceptual goal posts. The Authority recognised that there is uncertainty as to the exact lower bound, and that values approaching 0.6 require combinations of less likely parameter values.
973. However, the conceptual goal posts approach has not found much support:
- SFG considers that the conceptual text is based on ‘an implausible and inherently contradictory foundation’ such that it should be afforded no weight.<sup>407</sup>
  - Handley does ‘not consider the conceptual goalpost approach to be a reasonable approach to estimation as first, it is motivated by a faulty premise – that the CAPM suggested by Officer implicitly assumes that national markets for risky assets are completely segmented in the sense that all domestic assets are held by domestic investors only and all foreign assets are held by foreign investors only – and second, that it seeks to sure up one uncertain estimate by reference to two other estimates (the “goalposts”) which themselves are subject to substantial uncertainty.<sup>408</sup>
  - The AER, which placed a degree of reliance on the approach in its Guidelines, no longer relies on it, ‘mainly to be consistent with Handley’s advice on the conceptual framework’.<sup>409</sup>
974. The Authority considers that, in line with Handley’s advice, it is reasonable to adopt a partially segmented capital market for the application of the CAPM. The Authority also considers that Lally makes a case as to the potential for internally inconsistent estimates to arise when moving away from the assumption of a completely segmented market, towards a more globally integrated market. The Authority considers that this provides a caution against adopting estimates of gamma that are at the lower end of estimated ranges.
975. That said, the Authority accepts that there is a general concern about the validity of the range implied by the conceptual goal posts approach. Given the broad acceptance by the Authority of Handley’s interpretation of gamma, and his concern over the uncertainty of the estimates for the range of the conceptual goal posts approach, noted above, the Authority will no longer place any weight on estimates from the method in determining the value of the utilisation rate.
976. For these reasons, the Authority does not rely on the conceptual goal post approach estimates for this Final Decision.

#### 14.4.4 Distribution rate

977. The gas Rate of Return Guidelines and the rail WACC method Draft Decision adopted an estimate for the distribution rate, F, of 0.7. The estimate was based on

<sup>406</sup> Ibid., p. 45.

<sup>407</sup> ATCO Gas Australia, *Response to the ERA’s Draft Decision on required amendments to the Access Arrangement for the Mid-West and South-West Gas Distribution System*, 27 November 2014, Appendix 10, p. 45.

<sup>408</sup> J. Handley, *Advice on the value of imputation credits*, 29 September 2014, p. 31.

<sup>409</sup> Australian Energy Regulator, *Jemena Gas Network’s 2015-20 Access Arrangement Draft Decision*, Attachment 4, p. 4-69.

data for the cumulative payout ratio from Australian Tax Office (**ATO**) franking account balances, and related to listed and unlisted equity. The estimate has been widely accepted in recent times; the Australian Competition Tribunal (**ACT**) for example concluded that a distribution ratio of 0.7 was supported by a range of evidence and submissions.<sup>410</sup>

#### 14.4.4.1 Listed and unlisted equity

978. In its Revised Draft Decision, the Authority noted that there is considerable variation in estimates based on diverse ATO data.
979. For example, estimates of the cumulative distribution rate from *franking account balances* in the tax statistics – from 1987 to 2011 – is 0.7.<sup>411</sup> However, a five year average of recent annual estimates constructed from net tax and *franked dividends distributed* is estimated by NERA to be 0.53.
980. Hathaway finds similar variation in results. Hathaway identifies a large discrepancy between the franking account balance and the franked dividends data as a potential contributor.<sup>412</sup>
981. However, it is generally accepted that the cumulative distribution rate provides a reasonable estimate. Handley summarises the position with regard to these studies as follows:
- ...the cumulative payout approach... has been used by NERA (2013) and Hathaway (2013) and is reasonably uncontroversial. SFG (2014 p.57) also supports this estimation methodology. Using data from the start of the imputation tax system on 1 July 1987 and covering the twenty-four tax years from 1988 to 2011, NERA estimates the cumulative payout ratio to be 0.69. Hathaway (2013) provides an estimate of 0.71 based on the eight year period from 2004 to 2011.<sup>413</sup>
982. On this basis, the Authority considers it reasonable to conclude that the ATO data supports an estimate for the distribution rate across all equity, listed and unlisted, of around 0.7.

#### 14.4.4.2 Listed equity

983. Following the same cumulative payout ratio approach used by Hathaway and NERA for all equity, Handley developed an estimate for only listed equity, based on ATO tax data, of 0.8.<sup>414</sup>
984. The Revised Draft Decision also noted that Lally has developed an alternative estimate of the distribution rate, based on the financial reports of the top 20 ASX

<sup>410</sup> Australian Competition Tribunal, *Application by Energex Limited (Distribution Ratio (Gamma)) (No 3) [2010] ACompT9*, October 2010.

<sup>411</sup> Based on tax statistics estimates updated by NERA in 2013 and submitted by the Energy Networks Association as part of the Rate of Return Guidelines process (see NERA, *The Payout Ratio*, June 2013). In addition, a five year average of the most recent annual estimates, constructed by NERA from net tax and the change in the *franking account balance*, is 0.7.

<sup>412</sup> N. Hathaway, *Imputation Credit Redemption: ATO data 1988-2011: Where have all the credits gone?*, September 2013, pp. 38-39.

<sup>413</sup> J. Handley, *Advice on the value of imputation credits*, 29 September 2014, p. 27.

<sup>414</sup> *Ibid.*, p. 28.



firms, of 0.84.<sup>415</sup> SFG, however, is critical of this estimate, suggesting that it does not measure the distribution rate appropriately.

985. In particular, SFG considers that:

- the regulatory framework and the Post Tax Revenue Model requires a distribution rate that is defined as the ratio of distributed credits to *corporate tax paid*; but that
- Lally has estimated the ratio of distributed credits to *imputation credits created*.<sup>416</sup>

986. SFG suggests that large ASX firms pay a considerable amount of corporate tax overseas, which sets up a significant difference between the denominators of the two ratios.

987. The Authority notes SFG's concerns. For that reason, the Authority has determined to rely on the Handley estimate alone, concluding that a reasonable estimate of the distribution rate for listed equity is 0.8.

#### 14.4.4.3 Conclusions with regard to the distribution rate

988. It is desirable to have an estimate of gamma that is internally consistent. The Authority notes that its preferred measures of the utilisation rate (refer below), are based on estimates derived using both listed equity and all (listed and unlisted) equity.

989. Therefore, the Authority will adopt a distribution rate of 0.7, as being consistent with the broad definition of all equity. On the other hand, where it is required to adopt a distribution rate for listed equity, so as to ensure consistency, the Authority will adopt a distribution rate of 0.8.

## 14.5 Final Decision

### 14.5.1 Approach

990. The Authority considers that three different approaches to estimating gamma are appropriate, based on the following methods for estimating the utilisation rate:

- the equity share approach;
- the taxation statistics approach; and
- the dividend drop off method.

991. As noted above, the Authority will no longer take into account the conceptual goal posts for determining the estimate of gamma.

<sup>415</sup> M. Lally, *Estimating Gamma*, Report for the QCA, 25 November 2013.

<sup>416</sup> ATCO Gas Australia, *Response to the ERA's Draft Decision on required amendments to the Access Arrangement for the Mid-West and South-West Gas Distribution System*, 27 November 2014, Appendix 10, p. 9.

### The equity share ownership estimate

992. The Authority's estimate of the utilisation rate based on the equity share ownership approach is either 0.48 (listed equity) or 0.59 (all equity – both listed and unlisted).
993. Combining the utilisation rate estimate for listed equity, of 0.48, with the estimate of the distribution rate for listed equity, of 0.8, gives an estimate of gamma of 0.38.
994. Combining the utilisation rate estimate for all equity, of 0.59, with the estimate of the distribution rate of all equity, of 0.7, gives an estimate of gamma of 0.41.
995. The resulting range for gamma from the equity share ownership approach is 0.38 to 0.41.
996. Rounding that range to one significant figure gives a point estimate of 0.4 for gamma – with both listed and all equity supporting the point estimate.

### The taxation statistics estimate

997. The Authority's estimate of the utilisation rate based on the taxation statistics approach is 0.43. Combining that estimate with the relevant estimate of the distribution rate of 0.7 (all equity) gives a point estimate of gamma of 0.3, at one significant figure.

### The dividend drop off estimate

998. As discussed above, the Authority's estimate of the utilisation rate from dividend drop off studies is fairly broad, at 0.35 to 0.69, reflecting concerns with the robustness of the method.
999. That range for the utilisation rate combines with an estimate of the distribution rate for listed equity of 0.8.<sup>417</sup> The resulting range for gamma is 0.3 to 0.5, rounded to one significant figure.

## 14.5.2 Estimate of gamma

1000. The Authority bases its estimate of gamma on the following, with estimates given most weight ranked first:
- the equity share ownership approach gives an estimate of gamma of 0.4;
  - the taxation statistics approach gives an estimate of gamma of 0.3; and
  - the dividend drop off approach gives a range for the estimate of gamma of 0.3 to 0.5.
1001. The resulting range for the Authority's estimate of gamma is 0.3 to 0.5.
1002. The Authority places most reliance on the equity share ownership approach. It suggests a point estimate for gamma of 0.4.
1003. Taxation statistics suggest that the estimate of gamma could be lower, at 0.3. However, the Authority does not place much weight on the estimate, or on its ability

<sup>417</sup> The Authority considers that it was in error in the Guidelines and Draft Decision in applying an estimate of the distribution rate that was based on all equity. As the dividend drop off estimates are (listed) market based estimates, they should be paired with an estimate of the distribution rate that is based on listed equity.

to inform a point estimate of the utilisation rate, given concerns about the robustness of the taxation data used for estimating the utilisation rate.

1004. Similarly, the dividend drop off estimate suggests that the estimate of gamma could be higher or lower than 0.4, although the mid-point of the estimate range supports an estimate of 0.4. The Authority gives only limited weight to the estimated range, and to the point estimate, given its concerns with regard to the sensitivity of the estimates to the dividend sample, parametric form of the regression equation and regression technique used.
1005. Based on the foregoing, the Authority considers that the evidence supports a point estimate of the value of imputation credits of 0.4.
1006. The Authority considers that the resulting estimate of 0.4 is consistent with its approach used elsewhere in this Final Decision, and in particular the definition of the domestic market for equities. The estimate is supported by a range of evidence, including relevant academic literature, and also the views of academic experts:
- the estimate is within the range set out by Handley for his preferred estimate of gamma, of 0.4 to 0.5;<sup>418</sup>
  - the estimate is primarily based on the equity share ownership approach, which is Lally's second preference as a method for estimating gamma (after a strict Officer CAPM approach, which gives a value of 0.7 based on a utilisation rate of 1).<sup>419</sup>
1007. The Authority therefore considers that its estimate is fit for purpose, notwithstanding concerns with the data and the resulting robustness of the estimates. Importantly, the use of a range of approaches for estimating gamma assists in overcoming limitations associated with any particular study. This helps to ensure that the estimation method is consistent with accepted economic and financial principles, informed by sound empirical analysis.
1008. The Authority therefore adopts a value for imputation credits of 0.4 for this Final Decision. This value will remain fixed until the next rail WACC method review – the annual updates of the rail WACC will adopt the value for gamma of 0.4.

---

<sup>418</sup> J. Handley, *Advice on the value of imputation credits*, 29 September 2014, p. 3.

<sup>419</sup> M. Lally, *The Estimation of Gamma*, Report for the AER, 23 November 2013, p. 5.

## 15 Inflation

1009. Inflation is defined as the rate of change in the general level of prices of goods and services. A nominal WACC incorporates the 'real' rate of return, as well as a component rate that reflects expectations of inflation.
1010. An estimate of the forecast rate of inflation is important for the rail WACC, as it allows conversion of nominal observed values to real values for input to the real pre-tax WACC calculation.

### 15.1 Current approach

1011. Australian regulators have typically derived values of real and nominal risk free rates from capital-market observations of implied yields on long-term inflation-indexed Treasury bonds (real) and non-indexed (nominal) Commonwealth Government Securities. A forecast of inflation has then been derived from the difference in implied yields of the two types of bonds.
1012. The Rail Access Regulator and the Authority adopted this so-called 'Treasury bond approach' for WACC determinations up to 2008. Inflation forecasts were updated annually for each rail WACC determination using this method.

### 15.2 Revised Draft Decision

1013. In its Revised Draft Decision, the Authority was of the view that a forward looking estimate of inflation of 2.5 per cent is appropriate, given the long term of the rail WACC estimates. The Authority considered that the estimate of 2.5 per cent for inflation is consistent with the mid-point of the Reserve Bank of Australia's inflation target, which is 2 to 3 per cent.

### 15.3 Submissions

1014. The Authority did not receive any submissions in relation to the estimate of the forward looking inflation.

### 15.4 Considerations of the Authority

1015. The Authority notes that nominal estimates for the return on debt and the return on equity need to be converted from nominal back to real estimates, for the purpose of developing the real pre-tax WACC.
1016. Given the long term of the asset classes to which the rail WACC estimates apply – approaching 50 years – the Authority considers that the appropriate estimate for inflation going forward is the mid-point of the Reserve Bank of Australia's inflation target, which is 2 to 3 per cent.
1017. The resulting forward looking estimate for inflation is therefore 2.5 per cent.

## 15.5 Final Decision

1018. Given the long term of asset classes to which the rail WACC estimates apply, the Authority will adopt a forward looking estimate of inflation of 2.5 per cent. This is consistent with the mid-point of the Reserve Bank of Australia's inflation target, which is 2 to 3 per cent. This estimate will remain fixed until the next rail WACC method review – the annual updates of the rail WACC will utilise the value for inflation of 2.5 per cent.

## Appendices

<b>Appendix 1</b>	<b>Econometric estimation of the equity beta</b>	<b>212</b>
<b>Appendix 2</b>	<b>Adjustments to Bloomberg’s reporting of data</b>	<b>217</b>
<b>Appendix 3</b>	<b>The bond yield approach’s extended benchmark sample</b>	<b>218</b>
<b>Appendix 4</b>	<b>Converting Foreign Currency Yields into Australian Dollar Equivalents</b>	<b>220</b>
<b>Appendix 5</b>	<b>The 2015 WACC for the regulated rail businesses</b>	<b>222</b>



## Appendix 1 Econometric estimation of the equity beta

1. In his advice to the AER, Henry outlined that beta is best estimated by applying regression analysis to the following equation:<sup>420</sup>

$$r_{i,t} = \alpha_i + \beta_i r_{m,t} + \varepsilon_{i,t} \quad (29)$$

where

$\beta_i$  is the required equity beta for asset  $i$ ;

$r_{it}$  is the observed raw returns to asset  $i$  in year  $t$ ;

$r_{mt}$  is the observed market returns in year  $t$ ;

$\alpha_i$  is a constant specific to asset  $i$ ; and

$\varepsilon_{it}$  are the residuals.

2. Based on this advice, the Authority has adopted equation (29) as the basis for empirically estimating the equity beta for regulated rail networks. The Authority notes that equation (7) produces an estimate of a firm's equity beta. In order to arrive at an estimate of a firm's asset beta, the estimated equity beta is de-levered by the use of the Brealey-Myers formula as shown in equation (30).

$$\beta_a = \frac{E}{(D + E)} \beta_e \quad (30)$$

where:

$\beta_e$  is the estimated equity beta;

$\beta_a$  is the estimated asset beta;

$E$  is the benchmark assumed level of equity; and

$D$  is the assumed level of debt.

3. As discussed above, the Authority requires an estimate of each comparable firm's asset beta to inform the permissible range of asset betas for the regulated entities. After estimating the required asset beta for each of the regulated entities, the Authority will calculate the required equity beta by the use of equation (30) and assumed benchmark gearing level to re-lever the asset beta to the assumed level of gearing.
4. Returns employed in CAPM regressions are usually based on continuously compounded returns, which is presented in equation (31) below. Both the AER<sup>421</sup> and Henry found no evidence that estimates obtained from discretely compounded

<sup>420</sup> O. Henry, *Estimating  $\beta$* , 23 April 2009, p. 2.

<sup>421</sup> Australian Energy Regulator, *Explanatory Statement Rate of Return Guidelines*, December 2013, p. 84.

data, as presented in equation (32), are manifestly different from those obtained from continuously compounded data.

5. As a consequence, the Authority has used continuously compounded returns as described in equation (31) for estimating equity beta.

$$r_{i,t}^c = \ln \left[ (p_{i,t-1} + d_{i,t}) / p_{i,t-1} \right] \quad (31)$$

$$r_{i,t}^d = \frac{p_{i,t} - p_{i,t-1} + d_{i,t}}{p_{i,t-1}} \quad (32)$$

where

$r_{i,t}^c$  is the continuously compounded return for asset  $i$  in day  $t$ ; taking into account dividend  $d$ ;

$r_{i,t}^d$  is the discretely compounded return for asset  $i$  in day  $t$ ; taking into account dividend  $d$ ;

$p_{it}$  is the price of asset  $i$  in day  $t$ ; and

$d_{it}$  is the dividend payout to asset  $i$  on day  $t$ .

6. The Authority is of the view that weekly data is preferred to monthly data. It is noted that estimates of equity beta using monthly data create a smaller sample which is likely to result in a reduced statistical efficiency of the estimates. In addition, the Authority notes that estimates using monthly data are also vulnerable to the 'day-of-the-week effect'. This means that if prices are dependent on the day-of-the-week, then this effect is required to be controlled to ensure that returns are observed on the same weekday (Monday, Tuesday, Wednesday, Thursday, Friday). This effect cannot be controlled when monthly data is used because a calendar month can end on any day of the week. In his advice to the AER in 2008, Henry discussed the issue of daily versus monthly estimates.<sup>422</sup> He then concluded that weekly data is an appropriate trade-off between noisy daily data and lack of degrees of freedom (due to smaller samples) using monthly data. The Authority therefore concludes that weekly intervals, ending on a Friday, are appropriate for equity beta estimation.

---

<sup>422</sup> Ibid.

7. Formally, the beta coefficient of each comparator company,  $\beta$ , is estimated by utilising a regression estimator on the following equation:

$$r_{i,t} = \alpha_i + \beta_i r_{m,t} + \varepsilon_{i,t} \quad (33)$$

where

$\alpha_i$  is the return due to factors unrelated to market movements;

$\beta_i$  is the equity beta; and

$\varepsilon_{i,t}$  is an error term.

8. The traditional regression estimator, the Ordinary Least Squares (**OLS**) estimator, is only appropriate if the Gauss-Markov conditions are satisfied. If equation (33) satisfies the conditions below (known as the Gauss-Markov assumptions), then the Best Linear Unbiased Estimator (**BLUE**) for equation (33) would be the Ordinary Least Squares estimator, with the following properties:<sup>423</sup>

$$E[\varepsilon_i] = 0.$$

$$\text{Var}[\varepsilon_i] = \sigma^2$$

$$\text{Cov}[\varepsilon_i, \varepsilon_j] = 0 \text{ if } i \neq j$$

$$\varepsilon_i \sim N(0, \sigma^2)$$

9. The statistical literature contains vast evidence describing the failure of OLS to correctly estimate regression coefficients in the situation where the Gauss-Markov assumptions are violated.<sup>424</sup> The Authority notes that testing the validity of the Gauss-Markov assumptions can only occur after equation (15) has been estimated, and has proceeded to do so in Appendix 4.
10. In his analysis, Henry outlined the possibility of the existence of heteroscedasticity and outliers existing in the data used to estimate beta. Heteroscedasticity refers to the errors of a regression model being related to the current observation,  $\text{Var}[\varepsilon_{i,t}] = \sigma_i^2$ . This conflicts with the Gauss-Markov assumptions of a constant variance across the errors,  $\text{Var}[\varepsilon_i] = \sigma^2$ . In addition, the existence of outliers can cause traditional regression techniques to fail, and cause the resulting beta estimate to not reflect the bulk of the data. The existence of outliers in the data contradicts the Gauss-Markov assumption of normally distributed errors, or  $\varepsilon_i \sim N(0, \sigma^2)$ . It is noted that the Authority has previously rejected approaches which are used to remove outliers based on prior knowledge on the basis that they can be subjective.<sup>425</sup>

<sup>423</sup> Hill R.C., Griffiths W.E, Lim G.C, *Principles of Econometrics*, 2008, p. 32.

<sup>424</sup> Gross J., *Linear Regression*, Springer Publishing, 2003, p. 53.

<sup>425</sup> Economic Regulation Authority, *Explanatory Statement for the Rate of Return Guidelines*, December 2013, p. 165.

11. Evidence evaluated by the Authority regarding OLS highlights the non-normality of data used for estimating equity beta.<sup>426</sup> The Authority notes that it is also likely that the variance of the errors will change over time and the residuals are likely to be correlated. For example, during periods of high volatility, it is expected that larger errors would be observed. As a consequence, the Authority is of the view that the Gauss-Markov assumptions are violated when estimating the equity beta of rail comparator companies. As a consequence, utilising only the OLS estimator is inappropriate for beta estimation.
12. Henry suggested using the Least Absolute Deviations (**LAD**) estimator, to reduce the influence of outliers and heteroscedasticity on the resulting beta estimate. The Authority has employed the OLS and LAD methods, in addition to: (i) (**MM**) the robust regression methodology, and (ii) the Theil-Sen methodology in estimating the required beta. The use of these four regression estimators is a consequence of Andersen (2008), who notes that unless data is well behaved different robust estimators will give widely different results, and as a consequence suggests utilising a variety of robust regression procedures in addition to OLS when undertaking regression analysis.<sup>427</sup>
13. The Authority notes that the use of robust regression is not primarily to reduce the influence outliers have on beta estimation. Rather, the introduction of 'outlier-resistant' technique has been a consequence of the assumptions underpinning the OLS estimator being violated. The MM estimator has previously been utilised in studies which have been used in regulatory decisions with respect to gamma.<sup>428</sup> The Authority has also adopted this MM method in its recent empirical study on the estimate of the market value of franking credits. The MM regression is a form of robust regression that has a high breakdown point (50 per cent) and high statistical efficiency (95 per cent). The MM regression has the highest breakdown point and statistical efficiency of robust regression estimators currently available, and for this reason, it was adopted in the Authority's analysis of the equity beta for gas networks in 2013.<sup>429</sup> A detailed discussion of the MM estimator can be found in Appendix 17 of the gas Rate of Return Guidelines for gas.<sup>430</sup>
14. Fabozzi (2013) suggests the use of the Theil-Sen estimator for estimating the appropriate value for beta.<sup>431</sup> Fabozzi proposes this estimator in response to the OLS estimator being acutely sensitive to outliers. Fabozzi suggests that outliers in financial data are far more common than is usually assumed, and that it is surprising that the Theil-Sen estimator is not more widely used and appreciated. This was one of the main reasons behind the Authority's adoption of the method in its 2013

<sup>426</sup> Economic Regulation Authority, *Review of the method for estimating the Weighted Average Cost of Capital for the Regulated Railway Networks: Revised Draft Decision*, 28 November 2014, Appendix 4, p. 140.

<sup>427</sup> Andersen, R., *Modern Methods for Robust Regression*. Thousand Oakes: SAGE Publications, 2008, pp. 91-92.

<sup>428</sup> SFG 2011, *Dividend drop-off estimate of theta*, A report to the Australian Competition Tribunal and the Australian Energy Regulator, Final Report, 21 March 2011.

<sup>429</sup> Economic Regulation Authority, *Explanatory Statement for the Rate of Return Guidelines*, December 2013.

<sup>430</sup> Economic Regulation Authority, *Appendices to the Explanatory Statement for the Rate of Return Guidelines*, December 2013. p. 145.

<sup>431</sup> Fabozzi, F.J., *Encyclopaedia of Financial Models*, Wiley Publications, 2013, p. 442.

analysis.<sup>432</sup> A detailed discussion of the Theil-Sen estimator can be found in Appendix 17 of the gas Rate of Return Guidelines for gas.<sup>433</sup>

---

<sup>432</sup> Economic Regulation Authority, *Explanatory Statement for the Rate of Return Guidelines*, December 2013.

<sup>433</sup> Economic Regulation Authority, *Appendices to the Explanatory Statement for the Rate of Return Guidelines*, December, 2013, p. 145.

## Appendix 2 Adjustments to Bloomberg's reporting of data

1. The Bloomberg terminal offers the ability to adjust reported stock prices for events such as stock splits, to keep prices movements comparable to the historical series. For example, if a two-for-one stock split occurs, a share in a particular company that was value at \$50, holding all other factors constant, is now valued at \$25. To maintain comparability to the past data, an adjustment can be made.
2. In the data set using historical pricing, adjustments were made to reflect company equity policy such as spin-offs, stock splits/consolidations, stock dividend/bonus, rights offerings/entitlement. Similarly, the price may drop as a result of dividend payouts which take many forms.
3. The last price was adjusted for all normal and abnormal cash dividend types except omitted, discontinued, deferred or cancelled.
4. Normal dividend adjustments included those dividends made for regular cash, interim, first interim, second interim, third interim, fourth interim, income, estimated partnership distribution, interest on capital, distribution and prorated dividends.
5. Abnormal dividend adjustments were made for special cash, liquidation, capital gains, long-term capital gains, short-term capital gains, memorial, return of capital, rights redemption, miscellaneous, return premium, preferred rights redemption, proceeds/rights, proceeds/shares and proceeds/warrants.
6. Bloomberg offers the ability to make adjustments for changes in volume; however, no such adjustments were made to the series used in this analysis.

## Appendix 3 The bond yield approach's extended benchmark sample

1. The following tables set out the bonds utilised in the enhanced bond yield approach benchmark sample.

### 'A' credit rating

No.	Bond	Country of Domicile	Country of Risk	S&P Credit Rating	Years to maturity	Currency	Spread to Swap with Cross Currency Conversion (40 Day Average in bp)	Amount (A\$)	Redemption
1	Telstra Corp Ltd	AU	AU	A	2.1	AUD	52.63	275,000,000	AT MATURITY
2	Telstra Corp Ltd	AU	AU	A	2.4	EUR	65.52	1,000,000,000	AT MATURITY
3	Telstra Corp Ltd	AU	AU	A	3.0	AUD	31.61	750,000,000	AT MATURITY
4	Telstra Corp Ltd	AU	AU	A	4.0	AUD	41.11	500,000,000	AT MATURITY
5	Optus Finance Pty Ltd	AU	AU	A	4.1	AUD	56.38	75,000,000	AT MATURITY
6	Optus Finance Pty Ltd	AU	AU	A	4.1	AUD	51.55	300,000,000	AT MATURITY
7	Optus Finance Pty Ltd	AU	AU	A	4.9	USD	111.85	500,000,000	AT MATURITY
8	Telstra Corp Ltd	AU	AU	A	5.4	EUR	94.65	1,000,000,000	AT MATURITY
9	Telstra Corp Ltd	AU	AU	A	5.7	AUD	54.59	500,000,000	AT MATURITY
10	Optus Finance Pty Ltd	AU	AU	A	5.9	EUR	113.02	700,000,000	AT MATURITY
11	Telstra Corp Ltd	AU	AU	A	6.4	EUR	104.42	500,000,000	AT MATURITY
12	Telstra Corp Ltd	AU	AU	A	6.9	USD	98.60	1,000,000,000	AT MATURITY
13	Telstra Corp Ltd	AU	AU	A	6.9	USD	99.03	1,000,000,000	AT MATURITY
14	Telstra Corp Ltd	AU	AU	A	7.5	EUR	105.77	750,000,000	AT MATURITY
15	New Zealand Milk Australasia Pty Ltd	AU	AU	A	7.5	AUD	73.72	150,000,000	AT MATURITY
16	Telstra Corp Ltd	AU	AU	A	7.9	EUR	106.36	1,000,000,000	AT MATURITY
17	Telstra Corp Ltd	AU	AU	A	8.9	EUR	104.59	1,000,000,000	AT MATURITY
18	Telstra Corp Ltd	AU	AU	A	9.1	AUD	70.79	50,000,000	AT MATURITY
19	Telstra Corp Ltd	AU	AU	A	9.1	EUR	136.70	75,000,000	AT MATURITY
20	Telstra Corp Ltd	AU	AU	A	2.1	AUD	52.63	275,000,000	AT MATURITY

### 'BBB-' credit rating

No.	Bond	Country of Domicile	Country of Risk	S&P Credit Rating	Years to maturity	Currency	Spread to Swap with Cross Currency Conversion (40 Day Average in bp)	Amount (A\$)	Redemption
1	DBNGP Finance Co Pty Ltd	AU	AU	BBB-	2.5	AUD	189.06	275,000,000	CALLABLE
2	Leighton Finance USA Pty Ltd	AU	AU	BBB-	2.7	USD	249.51	145,000,000	AT MATURITY
3	Premier Finance Trust Australia	AU	AU	BBB-	2.8	AUD	140.07	190,000,000	AT MATURITY
4	DBNGP Finance Co Pty Ltd	AU	AU	BBB-	3.5	AUD	212.18	325,000,000	CALLABLE
5	Leighton Finance Ltd	AU	AU	BBB-	3.9	USD	289.56	79,000,000	AT MATURITY
6	Adani Abbot Point Terminal Pty Ltd	AU	AU	BBB-	4.0	AUD	247.98	500,000,000	AT MATURITY
7	Premier Finance Trust Australia	AU	AU	BBB-	4.8	AUD	139.73	190,000,000	AT MATURITY
8	DBNGP Finance Co Pty Ltd	AU	AU	BBB-	4.9	AUD	152.25	300,000,000	CALLABLE
9	Adani Abbot Point Terminal Pty Ltd	AU	AU	BBB-	5.6	AUD	266.73	100,000,000	AT MATURITY
10	Leighton Finance USA Pty Ltd	AU	AU	BBB-	5.7	USD	311.56	115,000,000	AT MATURITY
11	DBNGP Finance Co Pty Ltd	AU	AU	BBB-	5.9	AUD	164.60	100,000,000	CALLABLE
12	Newcrest Finance Pty Ltd	AU	AU	BBB-	7.0	USD	356.35	750,000,000	AT MATURITY
13	Newcrest Finance Pty Ltd	AU	AU	BBB-	7.0	USD	356.89	750,000,000	AT MATURITY
14	Newcrest Finance Pty Ltd	AU	AU	BBB-	7.9	USD	384.89	750,000,000	AT MATURITY
15	Newcrest Finance Pty Ltd	AU	AU	BBB-	7.9	USD	384.44	750,000,000	AT MATURITY
16	Leighton Finance USA Pty Ltd	AU	AU	BBB-	8.0	USD	320.89	500,000,000	AT MATURITY
17	Leighton Finance USA Pty Ltd	AU	AU	BBB-	8.0	USD	322.66	500,000,000	AT MATURITY
18	Caltex Australia Ltd	AU	AU	BBB-	22.9	AUD	291.33	550,000,000	CALLABLE
19	Newcrest Finance Pty Ltd	AU	AU	BBB-	27.0	USD	438.48	500,000,000	AT MATURITY
20	Newcrest Finance Pty Ltd	AU	AU	BBB-	27.0	USD	441.31	500,000,000	AT MATURITY



**'BBB+' credit rating**

No.	Bond	Country of Domicile	Country of Risk	S&P Credit Rating	Years to maturity	Currency	Spread to Swap with Cross Currency Conversion (40 Day Average in bp)	Amount (A\$)	Redemption
1	AusNet Electricity Services Pty Ltd	AU	AU	BBB+ /#+	2.1	USD	161.16	100,000,000	AT MATURITY
2	Coca-Cola Amatil Ltd	AU	AU	BBB+	2.2	AUD	56.37	250,000,000	AT MATURITY
3	SGSP Australia Assets Pty Ltd	AU	AU	BBB+	2.3	AUD	98.49	400,000,000	AT MATURITY
4	Powercor Australia LLC	AU	AU	BBB+	2.5	AUD	114.43	200,000,000	AT MATURITY
5	CitiPower I Pty Ltd	AU	AU	BBB+	2.7	AUD	70.15	300,000,000	CALLABLE
6	CitiPower I Pty Ltd	AU	AU	BBB+	2.7	AUD	101.33	275,000,000	CALLABLE
7	Coca-Cola Amatil Ltd	AU	AU	BBB+	3.3	AUD	25.58	100,000,000	AT MATURITY
8	Jemena Ltd	AU	AU	BBB+	3.4	USD	158.36	150,000,000	AT MATURITY
9	Jemena Ltd	AU	AU	BBB+	3.4	USD	151.05	150,000,000	AT MATURITY
10	Brambles Finance PLC	GB	AU	BBB+	3.5	EUR	100.58	500,000,000	AT MATURITY
11	Coca-Cola Amatil Ltd	AU	AU	BBB+	3.8	AUD	46.09	200,000,000	AT MATURITY
12	Caltex Australia Ltd	AU	AU	BBB+	4.0	AUD	105.28	150,000,000	AT MATURITY
13	Woodside Finance Ltd	AU	AU	BBB+	4.3	USD	123.95	600,000,000	AT MATURITY
14	Woodside Finance Ltd	AU	AU	BBB+	4.3	USD	125.02	600,000,000	AT MATURITY
15	CitiPower I Pty Ltd	AU	AU	BBB+	4.4	AUD	141.92	150,000,000	CALLABLE
16	Coca-Cola Amatil Ltd	AU	AU	BBB+	5.0	AUD	56.56	150,000,000	AT MATURITY
17	SGSP Australia Assets Pty Ltd	AU	AU	BBB+	5.4	AUD	128.72	150,000,000	AT MATURITY
18	Brambles USA Inc	US	AU	BBB+	5.4	USD	145.92	500,000,000	AT MATURITY
19	Brambles USA Inc	US	AU	BBB+	5.4	USD	127.91	500,000,000	AT MATURITY
20	Coca-Cola Amatil Ltd	AU	AU	BBB+	5.6	AUD	59.64	205,000,000	AT MATURITY
21	Aurizon Network Pty Ltd	AU	AU	BBB+	6.0	AUD	116.69	525,000,000	AT MATURITY
22	Coca-Cola Amatil Ltd	AU	AU	BBB+	6.1	AUD	68.66	100,000,000	AT MATURITY
23	SGSP Australia Assets Pty Ltd	AU	AU	BBB+	6.3	GBP	160.75	250,000,000	AT MATURITY
24	SGSP Australia Assets Pty Ltd	AU	AU	BBB+	6.4	AUD	117.49	350,000,000	AT MATURITY
25	Woodside Finance Ltd	AU	AU	BBB+	6.5	USD	136.19	700,000,000	CALLABLE
26	Woodside Finance Ltd	AU	AU	BBB+	6.5	USD	137.11	700,000,000	CALLABLE
27	Coca-Cola Amatil Ltd	AU	AU	BBB+	6.5	AUD	79.02	100,000,000	AT MATURITY
28	Coca-Cola Amatil NZ Ltd	AU	AU	BBB+	6.7	AUD	79.93	45,000,000	AT MATURITY
29	Coca-Cola Amatil Ltd	AU	AU	BBB+	6.8	AUD	81.63	100,000,000	AT MATURITY
30	Powercor Australia LLC	AU	AU	BBB+	6.8	AUD	118.77	300,000,000	AT MATURITY
31	Coca-Cola Amatil Ltd	AU	AU	BBB+	6.9	AUD	81.17	30,000,000	AT MATURITY
32	Powercor Australia LLC	AU	AU	BBB+	7.2	AUD	119.23	630,000,000	AT MATURITY
33	SGSP Australia Assets Pty Ltd	AU	AU	BBB+	7.7	EUR	145.92	500,000,000	AT MATURITY
34	Coca-Cola Amatil Ltd	AU	AU	BBB+	7.7	AUD	80.40	30,000,000	AT MATURITY
35	SGSP Australia Assets Pty Ltd	AU	AU	BBB+	8.4	USD	190.68	500,000,000	AT MATURITY
36	Brambles Finance Ltd	AU	AU	BBB+	9.6	EUR	150.02	500,000,000	CALLABLE
37	Aurizon Network Pty Ltd	AU	AU	BBB+	9.9	EUR	175.83	500,000,000	AT MATURITY

## Appendix 4 Converting Foreign Currency Yields into Australian Dollar Equivalents

1. The Authority's process for converting foreign currency yields into Australian dollar equivalents is detailed here. This provides for replicability and transparency of the Authority's approach.
2. Bloomberg LP have recently developed functionality that allows for the conversion of foreign currency bond yields into hedged Australian dollar equivalents for historical dates. The solution requires a Bloomberg users' account to be enabled to access the 'Swaps Toolkit (beta)'. Once enabled a user can interface with Bloomberg's Swap Manager through Microsoft Excel. A sample of bonds with their associated fields can then be loaded into Excel where historical yields and spreads for each bond can be converted into hedged Australian dollar equivalents by accessing Bloomberg's swap manager function.
3. The facility can convert the yields on the following instruments:
  - fixed rate instruments which receive a fixed coupon payment;
  - a floating rate instrument for which the coupon payments consist of a spread (quoted margin) over an index such as the bank bill swap rate in Australia or London Interbank Offered Rate (Libor) in foreign markets; or
  - a variable instrument which receives a coupon for that can vary due factors additional to the index.

### *Asset Swap Spreads*

4. The starting point is to acquire the 'mid' asset swap spread for instrument in the sample. This is calculated as the average of the bid and ask asset swap spreads (ASW spreads) returned from Bloomberg's asset swap calculator.
5. The ASW spread is the spread between the instruments yield and the relevant point on the swap curve (index) for the currency of each instrument in question. This is calculated using a 'par/par breakeven asset swap spread' formula which solves for an ASW spread such that the present value of the bonds cash flows on the fixed side of the swap equals the present value of cash flows based on the index plus ASW spread (at each future payment date).
6. The swap has two legs; a floating leg in which the ASW spread plus index is received; and a fixed side which pays the floating leg in exchange for the fixed payment. If the payments made on the fixed side are in a currency other than Australian dollars (due to the instrument being issued in a foreign currency) the currency of the instrument in question is input into the swap calculation making it a 'cross currency' swap so that the floating payments received are converted into Australian dollars. The costs of swapping from this currency to Australian dollars are determined using Bloomberg's default cross currency basis curves.
7. The ASW spread is calculated assuming a quarterly payment frequency and is adjusted to account for differences between the frequencies of payments on the fixed and floating side of the swap.
8. The Australian dollar ASW mid spread is then effectively converted to a yield to maturity using the Bloomberg swap manager.

*Bloomberg Swap Manager*

9. The swap manager is a facility used for calculating various aspects of a swap such as premiums, notional principal and spreads. For the purposes of converting the mid Australian dollar ASW spread into an effective yield to maturity, the swap is treated as a 'fixed float swap' where a fixed payment (which effectively represents the yield to maturity) is received in exchange for a floating payment (discussed above) made.
10. The main input is the 'mid' Australian dollar ASW spread which is treated as the spread component of the floating payment made. The output is a fixed coupon payment fully hedged in Australian dollars.<sup>434</sup> This fixed coupon payment can effectively be treated as the yield to maturity for two reasons. Firstly, it uses the Australian swap curve as the index to which the calculated hedged Australian dollar spread is added. It therefore reflects Australian interest rates for the date the calculation is made. Secondly, it is calculated on the assumption that the premium on the fixed leg of the swap is zero.<sup>435</sup> In other words it is trading at 'par' per 100 Australian dollars. When the fixed instrument is traded at par the coupon per 100 dollars is effectively equal to the yield to maturity. On the fixed leg the payment frequency is set to semi-annual while on the floating leg the payment frequency is set to quarterly. The reset frequency is also set at quarterly.
11. The priority of pricing sources or 'pricing water fall' used in the conversions to Australian dollar equivalent yields in Excel are shown in Table 39.

**Table 39 Pricing Waterfall Set in Bloomberg for AUD Equivalent Yield Conversion**

Currency of Issuance	1st Pricing Source	2nd Pricing Source
USD	BVAL	TRAC
EUR	BVAL	BGN
GBP	BVAL	BGN
AUD	BVAL	CBBT

<sup>434</sup> The 'BPRICE' formula in Excel that calls the Swap Manager must have 'Target' set to 'FixedCoupon' while the 'BView' formula must be set to output the fixed coupon.

<sup>435</sup> The 'BPRICE' formula in Excel that calls the Swap Manager must have 'Premium' set to zero.

## **Appendix 5 The 2015 WACC for the regulated rail businesses**

1. This appendix provides the 2015 estimates of the rail WACCs under the method set out in this Final Decision.
2. All parameters accord with this Final Decision, and are based on 40 trading days ending 30 June 2015.
3. The following summarises the resulting 2015 WACC outcomes for each rail network (Table 40).

**Table 40 The 2015 WACC for the regulated rail businesses – Final Decision**

Determination	Public Transport Authority	Brookfield Rail	The Pilbara Infrastructure
Nominal Risk Free Rate (10 year term)	2.97%	2.97%	2.97%
Real Risk Free Rate	0.46%	0.46%	0.46%
Inflation Rate	2.50%	2.50%	2.50%
Gearing	50%	25%	20%
Debt Risk Premium	1.660%	2.223%	3.234%
Debt Issuing Cost	0.125%	0.125%	0.125%
Australian Market Risk Premium	7.30%	7.30%	7.30%
Equity Beta	0.6	0.9	1.3
Asset Beta	0.30	0.70	1.05
Corporate Tax Rate	30%	30%	30%
Franking Credit	40%	40%	40%
Nominal Cost of Debt	4.755%	5.318%	6.329%
Real Cost of Debt	2.200%	2.749%	3.736%
Nominal After Tax Cost of Equity (grossed up and before personal tax)	7.35%	9.78%	12.55%
Nominal Pre Tax Cost of Equity	8.96%	11.93%	15.31%
Real Pre Tax Cost of Equity	6.31%	9.20%	12.49%
Nominal Pre Tax WACC	6.86%	10.28%	13.51%
<b>Real Pre Tax WACC</b>	<b>4.25%</b>	<b>7.59%</b>	<b>10.74%</b>
Nominal After Tax WACC	6.05%	8.67%	11.31%
Real After Tax WACC	3.47%	6.02%	8.59%

Source: Economic Regulation Authority analysis