Determination on the 2016 Weighted Average Cost of Capital for the Freight and Urban Railway Networks, and for Pilbara railways

28 October 2016

Economic Regulation Authority
WESTERN AUSTRALIA

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

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

Contents

Introduction

1. The Economic Regulation Authority (**Authority**) administers the Western Australian railways access regime. The regime consists of the *Railways (Access) Act 1998* (**Act**) and the *Railways (Access) Code 2000* (**Code**). The rail network and types of infrastructure subject to the regime are defined in this legislation. The Authority's role is to administer the Act and the Code.

Requirements of the Code

2. Schedule 4, clause 3(1) of the Code requires the Authority to make an annual calculation, as at 30 June, of the Weighted Average Cost of Capital (**WACC**) to be applied in determining the costs for each of the rail networks covered under Schedule 1 of the Code.[1] The Authority must then publish its determination of the WACC for each rail network in the Government Gazette as soon as practicable after it is made (Schedule 4, clause 3(1)(b)).

3. The Code also requires the Authority to undertake public consultation every fifth year, commencing 2003, before determining the WACC values for that year (Schedule 4, clause 3(2)). Consequently, the Authority was required to undertake a public consultation process prior to making its WACC determination for 30 June 2013.

4. This 2016 Determination updates the annual calculation, as at 30 June 2016, of the WACC to be applied in determining the costs for each of the rail networks covered under Schedule 1 of the Code for the 2016-17 period. The update follows the method set out in the 2013 rail WACC review.

The 2013 rail WACC review

5. The Authority undertook a public consultation program prior to making its annual WACC determination for the regulatory year commencing 1 July 2013.

6. The Authority released the Final Report in relation to the rail WACC method review on 18 September 2015.[2] The Final Report set out the method with regard to the following regulated rail networks:

   - Public Transport Authority;
   - Brookfield Rail; and
   - The Pilbara Infrastructure (TPI).

Roy Hill Infrastructure railway

7. The Roy Hill Infrastructure (**RHI**) railway became a regulated railway in August 2015 when the Code was applied with the modifications set out in Part 3 of the *Railway (Roy Hill Infrastructure Pty Ltd) Agreement Act 2010*. The RHI railway is a 344 km

[1] *Railways (Access) Code 2000*, Schedule 4.

[2] Economic Regulation Authority, *Review of the method for estimating the Weighted Average Cost of Capital for the Regulated Railway Networks: Final Decision*, 18 September 2015.

standard gauge, single line heavy haulage railway. It transports iron ore from the Roy Hill mine in the Chichester Ranges to port facilities at Port Hedland. The railway currently has a capacity of 55 million tonnes per annum.

8. In its revised 2015 rail WACC method, the Authority set out the following qualitative theoretical determinants of systematic risk which are used to inform the construction of the benchmark samples for the regulated rail entities:

- economic conditions;
- political and social considerations;
- market structure; and
- a firm's competitive position.

9. The Authority utilised these determinants to establish the benchmark sample for the three existing regulated rail networks.

10. The Authority's view is that, based on these determinants, the benchmark sample for RHI should be the same as that for TPI. RHI, like TPI:

- is 100 per cent dedicated to the bulk transport of iron ore, across one intermediate distance in the remote Pilbara;[3]
- is significantly exposed to cyclical international commodity markets;
- is a new network asset which is in the early years of its life;
- has a new, undiversified customer base, with exposure to only a limited number of potential users in the mining industry;
- has, or is likely to have, contractual arrangements which smooth the volatility of revenue;
- benefits from sound underlying economics, given the strong position of the Pilbara iron ore producers in the global cost curve.

11. The Authority does not consider that there are any material distinguishing features between TPI and the RHI for the purpose of establishing the benchmark sample or the relevant WACC parameters.

12. Accordingly, the Authority has determined that the WACC for RHI should be the same as for TPI, informed by the analysis for TPI which was set out in the 2015 rail WACC method.[4] Therefore, both TPI and RHI will be referred to as 'the Pilbara railways (TPI and RHI)', and treated identically.

[3] RHI is therefore typical of a United States 'class II/III type' railroad, which provides a better comparator than a large long distance (Class I) trans-national railroad network. 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. The Authority concluded that Genesee & Wyoming is the best, (albeit an imperfect) comparator for TPI (Economic Regulation Authority, *Review of the method for estimating the Weighted Average Cost of Capital for the Regulated Railway Networks: Final Decision*, 18 September 2015, p. 168).

[4] Economic Regulation Authority, *Review of the method for estimating the Weighted Average Cost of Capital for the Regulated Railway Networks: Final Decision*, 18 September 2015.

The 2016 rail WACC

13. The 2016 rail WACC – to apply for the regulated railway networks from 1 July 2016 to 30 June 2017 – applies a modified version of the method that was applied for the determination of the 2015 rail WACC.

14. In the 2013 rail WACC review the Authority determined that the method used to determine the 2015 rail WACC would be applied in the subsequent years, but with parameters updated for observable market variables (that is, the risk free rate, debt risk premium and market risk premium using 40 trading days). All other parameters were to remain unchanged from the 2015 rail WACC determination – including the expected inflation rate estimate of 2.5 per cent.[5]

15. The Authority considers that the inflation rate should be estimated annually, not based on an assumed long-term rate of 2.5 per cent as in previous determinations. This year, the use of a fixed 2.5 per cent inflation rate resulted in a negative real risk free rate. Yields from Treasury Indexed Bond markets, used as a proxy for the real risk free rate, are greater than zero and so do not support a negative real risk free rate of return. In addition, the use of a fixed 2.5 per cent inflation rate potentially overinflates the MRP estimate. Further details on these issues are shown in Appendix 4. The Authority will therefore depart from the use of a fixed 2.5 per cent inflation rate and apply an updated expected inflation estimate in this determination using the method outlined in Appendix 4. Determinations in subsequent years will also update inflation using the method outlined in Appendix 4.

16. The Authority has determined the following real pre-tax 2016 rail WACC values, to apply for the 2016 regulatory year, from 1 July 2016 to 30 June 2017:

    - Public Transport Authority: 4.47 per cent
    - Brookfield Rail: 7.67 per cent
    - the Pilbara railways (TPI and RHI): 10.90 per cent

17. The complete set of parameter inputs contributing to these real pre-tax estimates are shown in Table 1.

[5] Ibid.

Table 1 Determination on 2016 WACC values

Determination	Public Transport Authority	Brookfield Rail	Pilbara railways
Nominal Risk Free Rate (10 year term)	2.22%	2.22%	2.22%
Real Risk Free Rate	0.47%	0.47%	0.47%
Inflation Rate[6]	1.74%	1.74%	1.74%
Gearing	50%	25%	20%
Debt Risk Premium	2.111%	2.450%	3.578%
Debt Issuing Cost	0.125%	0.125%	0.125%
Australian Market Risk Premium	7.40%	7.40%	7.40%
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	4.456%	4.795%	5.923%
Real Cost of Debt	2.670%	3.003%	4.111%
Real After Tax Cost of Equity	4.84%	7.26%	10.02%
Nominal Pre Tax Cost of Equity	8.12%	11.13%	14.55%
Real Pre Tax Cost of Equity	6.27%	9.23%	12.59%
Nominal Pre Tax WACC	6.29%	9.55%	12.83%
Real Pre Tax WACC	**4.47%**	**7.67%**	**10.90%**
Nominal After Tax WACC	5.56%	8.04%	10.73%
Real After Tax WACC	3.75%	6.20%	8.84%

Source: Economic Regulation Authority analysis

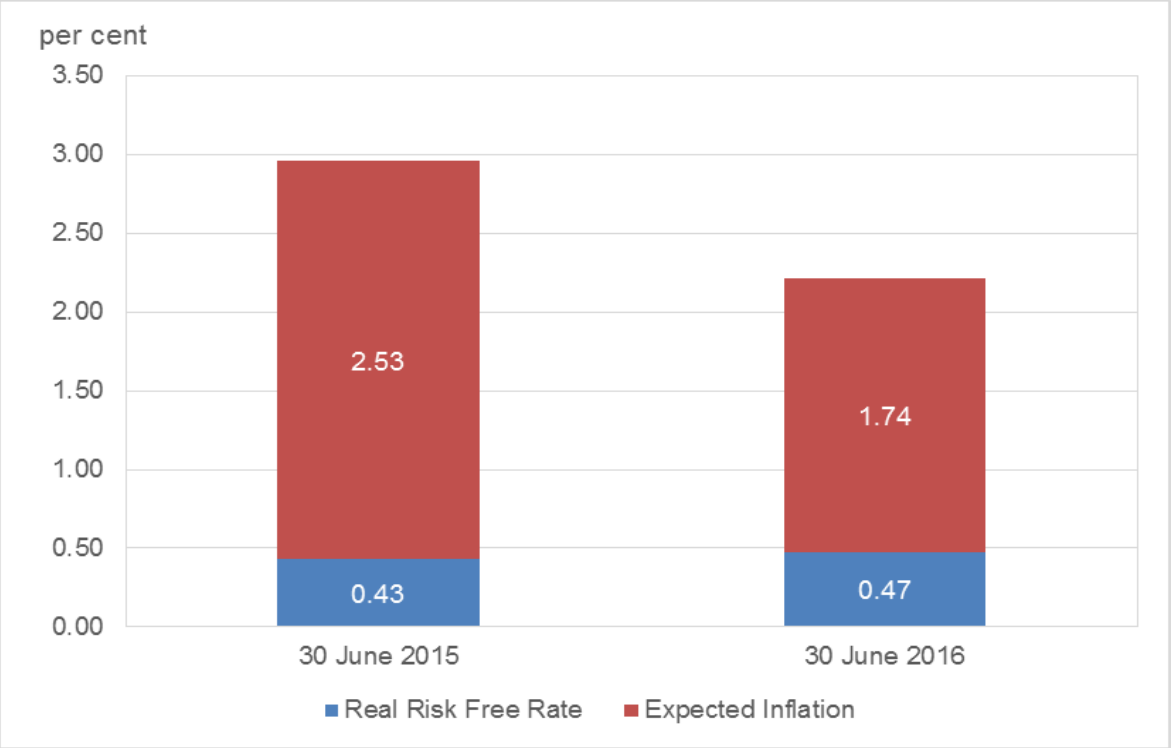
[6] This is a forecast over perpetuity based on the Reserve Bank of Australia's target range instead of inflation implied from Treasury Indexed Bonds.

Explanation of updated parameter estimates

Nominal Risk Free Rate

18. The 10 year nominal risk free rate has fallen by 75 basis points from 2.97 to 2.22 per cent since the 2015 determination. From a numerical view point, this is a result of inflation implied in the nominal risk free rate falling to 1.74 per cent (Figure 1).[7] The real 10 year risk free rate has actually increased by 4 basis points based on Treasury Indexed Bond yields.

Figure 1 Nominal 10 year Risk Free Rate Composition – June 2015 and 2016



Source: ERA Analysis, Reserve Bank of Australia

Debt Risk Premium

19. The debt risk premium across the three relevant credit ratings have increased from:
    - 1.660 to **2.111 per cent** for PTA;
    - 2.223 to **2.450 per cent** for Brookfield; and from
    - 3.234 to **3.578 per cent** for TPI since 2015.

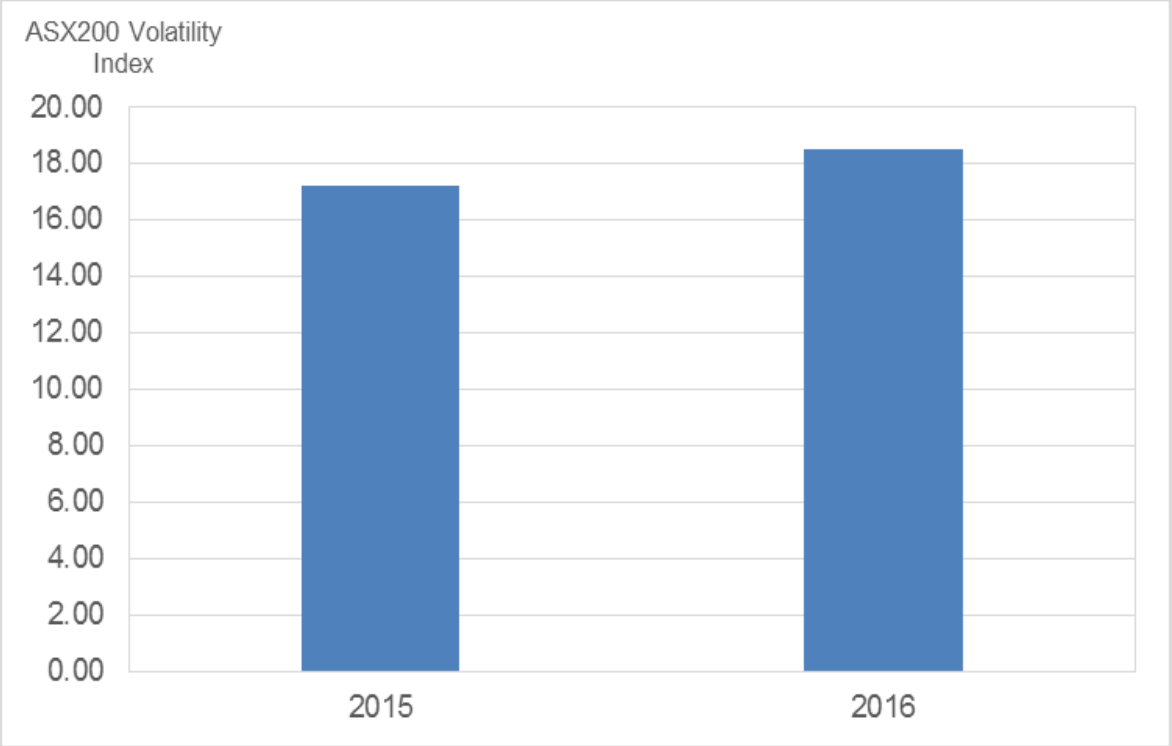
20. These premiums were estimated using the Authority's bond yield approach set out in the 2013 rail WACC review.[8] The sample of bonds used and the resulting estimates are shown in Appendix 1 and 2.

[7] Implied inflationary expectations are derived by discounting the real yield on Treasury inflation indexed bonds out of the nominal yield on conventional Treasury bonds. The real risk free rate and implied inflation figures graphed must be compounded to arrive at the nominal risk free rate – not added.

[8] The Authority determined these credit ratings for each of the rail networks based on the analysis in the 2013 rail WACC review.

21. In an attempt to verify and understand these increases the Authority examined indicators of risk specifically in financial markets in which debt is traded and indicators of risk among corporates who issue debt. These indicators of Australian financial system risk had decreased since the last determination.[9] However, indicators of risk in the broader Australian corporate sector had increased. The implied volatility index on the ASX 200 is a measure of risk in the Australian equity market. This can be considered a proxy for risk in the Australian corporate sector more broadly as the ASX 200 is mainly comprised of equity in large Australian corporations. For consistency with the rail averaging period the *40 day* trailing averages of this measure are shown in Figure 2. The average has moved from 17.2 at 30 June 2015 to 18.5 at 30 June 2016 indicating that risk in the equity market has increased slightly. While not conclusive, this suggests that the observed increases in the DRPs stem from the broader Australian corporate sector.

Figure 2 Australian Stock Exchange (ASX) 200 Volatility Index: 40 day trailing June 2015 versus June 2016



Source: ERA Analysis, Bloomberg

22. The commentary in RBA's May 2016 Statement on Monetary Policy tends to corroborate the notion that risk in the broader corporate sector has increased. It highlights that economic conditions in Australia's major trading partners have eased of late, placing particular emphasis on slower growth in China. While the statement notes China's stimulatory policy settings, it expressed concern about excess capacity in key sectors of the Chinese economy.[10]

[9] The Authority examined the 40 day trailing average of the 10 year interest rate swap spread over the risk free rate on 30 June 2015 and 30 June 2016. The 2016 figure was lower than the 2015 figure indicating decreased financial system risk.

[10] Reserve Bank of Australia, *Statement on Monetary Policy*, May 2016, pp. 5-6.

23. The statement reports that Australian employment indicators are mixed, while mining investment is expected to fall. It also reports that wage growth is very low and there is evidence of spare capacity.[11]

24. These observations support an uncertain outlook for future growth and perhaps have weighed on investor confidence in Australian corporates' ability to service debt. This is the most plausible reason for the increase in the debt risk premium observed across all three credit ratings in the latest estimates.

Market Risk Premium

25. The market risk premium (**MRP**) has increased by 10 basis points from 7.30 to 7.40 per cent since the 2015 determination. Estimating the MRP involves considerable discretion on account of a) the MRP being a forecast that is unobservable in financial markets before it is realised and b) the existence of multiple well-accepted estimation approaches producing significantly different forecasts.

26. The MRP consists of two components; the nominal risk free rate (outlined above) and the market return on equity. The MRP is generally calculated as follows:

$$MRP = E(R_M) - R_f$$

where:

$E(R_M)$ is the expected market return on equity observed in the Australian stock market; and

R_f is the 10 year risk free rate of return.

27. Estimation of these two components of the MRP is discussed below.

Estimating the expected market return on equity

28. One view is that – given a sufficient period of time – the market return on equity will revert to a long run historical average. This implies that the long run historical average is a good forecast of the market return on equity, despite the short term fluctuations around the average.[12] This outcome in fact, tends to be realised in Australian equity market data. The implication is that the long run historical average Australian market return on equity is a good forecast of the future market return on equity. This is because historical data indicates that over a long preiod of time the long run historical mean will tend to be realised *on average*.

29. Other methods attempt to account for the shorter term fluctuations observed in the market return on equity by using forward looking as opposed to historical data. The most common example is the Dividend Growth Model (**DGM**) which uses forecast cash flows (dividends) based on growth expectations and solves for a discount rate

[11] Ibid. p. 27.

[12] Economic Regulation Authority, *Appendices to the Explanatory Statement for the Rate of Return Guidelines: Meeting the requirements of the National Gas Rules*, 16 December 2013, p. 141.

which equates this stream of cash flows to the current stock price. This forward-looking discount rate is the implied market return on equity.

Estimating the risk free rate of return

30. The current risk free rate of return that will be realised for the next 10 years is observable.[13] Future 10 year risk free rates of return are unobservable and so must be forecast. There is no consensus as to whether historical rates or the 'on-the-day' rate should be used in the MRP calculation. Use of the on-the-day risk free rate assumes that the prevailing rate is a better forecast of future rates than the long term historical average rate. This is based on the premise that the risk free rate does not revert to a long run average and so using the latest observation minimises the deviation between the forecast and the realised rate. Australian Government bond yield data used as the measure of the risk free rate of return does not exhibit a tendency to return to a long run average.[14] The implication is that the on-the-day rate is a better forecast of the risk free rate than the long run average. Hence the current on-the-day observed risk free rate for the next 10 years is used for this WACC decision.

Specific methods for calculating the MRP

31. The MRP equation shown above is general. It does not fully specify how it should be applied. In its 2015 revised rail WACC methodology, the Authority set out a more specific method that accounts for practitioners' use of both the historical and forward looking data discussed above. Two well accepted methods for calculating the MRP using historical data are those of Ibbotson and Wright. These two methods in particular can produce very different results while using the same data and so the Authority takes both into consideration.

32. The Ibbotson method calculates the average of a series of annual *MRP observations*. The MRP is calculated for each calendar year spanning back over the longest period of time for which data is available. There are currently 133 annual Australian MRP observations dating back to 1883. These observations are derived by deducting the risk free rate in each calendar year from the realised market return on equity in that year. The arithmetic average of these observations is typically employed, but the geometric average is also often quoted. If one believes the risk free rate and market return on equity are related, such that they will not drift too far apart, the Ibbotson method would be emphasised. This is because it is reliant on reversion of the *MRP,* as opposed to market return on equity, to a long run average.

33. The Wright method uses the long run average of a series of annual *real market return on equity* observations. This average market return on equity is indexed with a 10 year inflation forecast. The inflation forecast used by the Authority is that implied from the difference between the on-the-day nominal and real 10 year risk free rate of return. To arrive at the Wright MRP estimate the on-the-day risk free rate is then subtracted from the indexed average market return on equity.[15] If one believes that

[13] Yields on Australian Treasury bonds are used as a proxy for the risk free rate of return. These yields are observable because a Treasury bond's current market price, coupon interest rate and principal payable upon maturity are observable prior to maturity. The discount rate that equates a bond's remaining coupon payments and principal with the current price is the current yield to maturity.

[14] Economic Regulation Authority, *Appendices to the Explanatory Statement for the Rate of Return Guidelines: Meeting the requirements of the National Gas Rules*, 16 December 2013, p. 140.

[15] Despite the naming convention the 'on-the-day' rate is usually an average over some short period of time such as 20 or 40 trading days prior to the day of the cost of capital determination date to reduce the risk of idiosyncratic events unduly influencing the risk free rate forecast.

the market *return on equity* will revert to a long run average rate – regardless of the behavior of the risk free rate – more emphasis would be placed on the Wright method. This is because the Wright method reflects a perpetual outlook on the real market return on equity.

34. The DGM based approach to estimating the MRP also deducts the 10 year on-the-day risk free rate of return from the DGM based estimate of the market return on equity. While the DGM based method has the benefit of being forward looking, and taking the current economic outlook into account – through dividend growth expectations – it is known to produce upwardly biased estimates. As noted by McKenzie and Partington in their report to the Australian Energy Regulator, the shortcomings of the DGM are:

- analyst forecasts have a tendency to be upwardly biased, as they are often based on over-optimistic expectations for target prices and earnings;
- DGMs may not fully reflect market conditions if firms follow a stable dividend policy; and
- DGMs do not capture non-dividend cash flows, such as share repurchases or dividend re-investment plans.[16]

35. The treatment of data under the three methods is outlined in Table 2.

Table 2 Data treatment in various market risk premium calculation methods

Approach	Market return on equity	Risk free rate
Ibbotson	Historical	Historical
Wright	Historical	On-the-day
DGM based	Forward looking	On-the-day

Application of methods to calculate the MRP

Historical data approaches

36. Brailsford, Handley and Maheswaran (**BHM**) produce the furthest backdated source of historical equity risk premium data for Australia.[17] However, in 2013 NERA Consulting raised concerns over potential downward bias in some of the older data observations and produced an adjusted version of the BHM data.[18] Professor Handley responded to these concerns highlighting shortcomings in NERA's adjusted series.[19] The Authority is not aware of any data that rectifies these issues or new information that favours the use of one data source over the other. To minimise the potential error from incorrectly favouring one source, the Authority uses the average of the NERA and BHM data.

37. Both of the historical equity return series are also adjusted for the value of imputation credits before being used in the MRP estimation process. The details of this process are given in Appendix 3.

[16] M. McKenzie and G. Partington, *Report to the AER, Part A: Return on equity*, October 2014, pp. 26-31.

[17] T. Brailsford, J. Handley and K. Maheswaran, 'The historical equity risk premium in Australia: post-GFC and 128 years of data', *Accounting and Finance*, vol.52, no.1, 2012, pp.237-247.

[18] NERA Economic Consulting, *Historical Estimates of the Market Risk Premium*, February 2015, pp.47-51.

[19] J. Handley, *Advice on the Return on Equity:, Report prepared for the Australian Energy Regulator*, 16 October 2014, pp.19-20.

38. The results of applying the Ibbotson method are shown in Table 3. There are four sub-periods that correspond to improvements in data quality prior to the sub-period from 1988 which corresponds to the introduction of the dividend imputation regime.[20]

Table 3 MRP results from Ibbotson method classified by sub-periods of improving data quality

	Arithmetic mean			Geometric mean		
Period	**BHM**	**NERA**	**Average**	**BHM**	**NERA**	**Average**
1883-2015	6.56%	6.20%	6.38%	***5.19%***	4.84%	5.01%
1937-2015	5.79%	5.84%	5.82%	3.93%	3.98%	3.95%
1958 - 2015	6.30%	6.30%	6.30%	3.92%	3.92%	3.92%
1980 - 2015	6.09%	6.09%	6.09%	3.77%	3.77%	3.77%
1988 - 2015	5.53%	5.53%	***5.53%***	3.89%	3.89%	3.89%

Source: Brailsford, Handley, Maheswaran (2012) and ERA Analysis.

39. The Authority notes that there are mixed views on the appropriate averaging process for historic returns. McKenzie and Partington state it is well understood that geometric average returns will tend to understate returns.[21] In the same report they also highlight Blume's 1974 study which shows that the arithmetic average will tend to overstate returns when it is compounded over more than one period. This is due to compounding the sampling error inherent in the data. Therefore the Authority's view is that an unbiased estimator is likely to lie somewhere between the two types of averages. In lieu of any other information, the Authority seeks to minimise any error associated with over-reliance on one of the two types of averages by using the simple average of the lowest arithmetic mean and highest geometric mean in Table 3.

40. The Authority considers that the average of the lowest arithmetic mean estimate of 5.53 per cent and highest geometric mean estimate of 5.19 per cent provides a reasonable Ibbotson based MRP estimate of 5.36 per cent.

41. The results of applying the Wright method to the historical data are shown in Table 4.

Table 4 MRP result from Wright method

	NERA	BHM	Average
Nominal market return on equity including realised inflation	12.12%	11.77%	11.95%
Real market return on equity excluding realised inflation	8.89%	8.53%	8.71%
Expected Inflation	1.74%	1.74%	1.74%
Nominal market return on equity including expected inflation	10.78%	10.42%	10.60%
10 year Risk Free Rate of Return	2.22%	2.22%	2.22%
Market Risk Premium	**8.56%**	**8.20%**	**8.38%**

Source: ERA Analysis December 2015, NERA (2013), Brailsford, Handley and Maheswaran (2012).

[20] T. Brailsford, J. Handley and K. Maheswaran, 'The historical equity risk premium in Australia: post-GFC and 128 years of data', *Accounting and Finance*, vol.52, no.1, 2012, p.240.

[21] M. McKenzie and G. Partington, *Supplementary report on the equity MRP*, 22 February 2012, p. 5.

42. The historical nominal market return on equity series is adjusted for realised inflation to create a real market return on equity series. The average of this series is 8.89 per cent using NERA's data and 8.53 per cent using the BHM data. These averages are then indexed for expected inflation of 1.74 per cent. The average of the resultant nominal market return on equity estimates is 10.60 per cent. Deducting the 10-year risk free rate of 2.22 per cent from this figure results in an MRP of 8.38 per cent.

Forward looking data approach (DGM)

43. In the 2015 determination various DGM estimates were considered in addition to the Authority's estimate to assist in developing a range. Dividend growth expectations are extremely variable due to the continuous arrival of new information in the market. The latest information is therefore the most relevant to the expected return. Accordingly, the Authority has included estimates that are less than two years old. The updated table of DGM estimates from a range of DGM models is shown in Table 5.

Table 5 Recent estimates of the MRP using the DGM

Study/Author	Date	Dividend yield source	Theta	Risk free rate (%)	Implied MRP (%)
SFG	May 2015	Thomson Reuters I/B/E/S	0.35	2.55	8.82
Frontier Economics	July 2015	Thomson Reuters I/B/E/S	0.35	2.85	8.35
AER	May 2016	Bloomberg	0.6	2.93	7.57 – 8.84
ERA	May 2016	Bloomberg	0.53	1.82	8.12
Estimated range of the MRP					**7.6 – 8.8**

Source:

Frontier Economics, *An updated estimate of the required market return on equity*, Report prepared for Ergon Energy, July 2015, p. 6.

SFG Consulting, *Updated estimate of the required market return on equity*, Report for SA Power Networks, May 2015, p. 4.

Australian Energy Regulator, *Final decision: AusNet Services distribution determination 2016 to 2020*, Attachment 3: Rate of return, May 2016.

Economic Regulation Authority, *Final Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline 2016 – 2020: Appendix 4 Rate of Return*, 30 June 2016, p. 114.

44. The Authority has also updated its two stage DGM estimate. The data input into the DGM are also augmented with imputation credit yields using the process outlined in Appendix 3. The DGM estimate is based on a two stage approach outlined below:

$$P_0 = \frac{m \text{ x } E(D_0)}{(1+k)^{m/2}} + \sum_{t=1}^{N} \frac{E(D_t)}{(1+k)^{m+t-0.5}} + \frac{\frac{E(D_N)(1+g)}{k-g}}{(1+k)^{m+N-0.5}}$$

where:

P_0 is current price the of the equity index;

m is the fraction of the current year remaining;

$E(D_0)$ is the dividend inclusive of imputation credit value per share expected in the current year;

$E(D_t)$ is the dividend inclusive of imputation credit value per share expected t years into the future;

k is the market 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.

45. Monthly cash (or net) dividend per share forecasts for the All Ordinaries Index are sourced from Bloomberg for the current year, the next year and the year after. The monthly closing price for the All Ordinaries index is also sourced from Bloomberg.

46. The assumption for the long run dividend growth rate g is 4.6 per cent. This is based on Professor Lally's 2013 study which 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.[22]

47. The Authority's DGM based MRP estimate is 7.85 per cent. This is a result of subtracting the risk free rate of 2.22 per cent from the solution for the market return on equity k of 10.07 per cent. This estimate falls within the range of DGM estimates in Table 5.

48. Table 6 shows the MRPs calculated using the Ibbotson, Wright and DGM methods as well as the DGM range observed from other decisions.

Table 6 MRP calculation results from the three methods

	Ibbotson	Wright	DGM	DGM Range
MRP	5.36%	8.38%	7.85%	7.6 – 8.8%

[22] M. Lally, *The Dividend Growth Model*, 4 March, 2013, p. 17.

Determining the final estimate of the MRP

49. Where possible, the Authority has sought to replicate the rationale applied to arrive at the final MRP estimate in the 2015 rail WACC determination.

50. The final MRP estimate in the 2015 determination (7.3 per cent) was derived from a range based on historical information, with the Wright based calculation forming the upper bound (8.5 per cent) and Ibbotson based calculation (5.3 per cent) forming the lower bound. The rounded Ibbotson lower bound of 5.4 per cent for 2016 is higher than that of 2015 by around 10 basis points. A comparison of the rounded estimates are shown in Table 7.

Table 7 Ibbotson MRP- 30 June 2015 versus 2016 estimate

Ibbotson Method	2015	2016
Market Risk Premium	5.3%	5.4%

Source: ERA Analysis

51. The 2016 upper bound of 8.4 per cent based on the rounded Wright estimate is around 10 basis points lower than in 2015 (see Table 8).

Table 8 Wright MRP- 30 June 2015 versus 2016 estimate

Wright Method	2015	2016
Market Risk Premium	8.5%	8.4%

Source: ERA Analysis

52. In the 2015 review the Wright MRP was given most weight according to the following rationale:

> …the Authority considers that the Wright estimate provides a strong indicator for the likely market return on equity for the next 50 years, given the statistical evidence for the mean reversion of the market return on equity…
>
> … the Authority is inclined somewhat more toward the Wright view of the world, given the long term nature of the estimate...

53. The weighting accorded to the Wright MRP and direction of its change, supports the smallest downward adjustment to last year's MRP estimate of 7.3 per cent. The MRP is conventionally changed in increments of 10 basis points. Accordingly, the information from the Wright approach supports an MRP estimate of 7.2 per cent.

54. The DGM estimates in Table 5, however, support an MRP estimate between 7.6 per cent and 8.8 per cent. The mid-point is 8.2 per cent.

55. In the 2015 determination the Authority noted:

> … 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.

56. This indicates that the final MRP estimate should reflect more weight being given to the lower half of the DGM based range. The lower half of the externally observed DGM based range is 7.6 and 8.2 per cent. The Authority's updated DGM estimate of 7.85 per cent falls within this range and also has the advantage of being the most up to date estimate, thus it should be afforded more weight. As discussed above, DGM estimates tend to be upwardly biased. The Authority therefore considers its DGM estimate of 7.85 per cent to be a reasonable upper bound for the overall MRP range. This establishes an MRP range with a lower bound based on the Authority's

preferred Wright etimate of 7.2 per cent and upper bound based on the DGM estimate of 7.85 per cent.

57. The Authority's 2016 DGM estimate is substantially higher than the 2015 estimate as shown in Table 9.

Table 9 Two stage DGM MRP- 30 June 2015 versus 2016 estimate

Two Stage DGM Method	2015	2016
Market Risk Premium	7.30%	7.85%

58. This tends to support an increase in the MRP as compared to 2015. Any increase should, again, be tempered by the Authority's preference for the estimate informed by Wright and view that the DGM is upwardly biased. Given that the mid-point of the 7.2 to 7.85 per cent range established in paragraph 56 is 7.53 per cent, the Authority determines an estimate of 7.4 per cent adequately reflects all of the considerations outlined above. This is because it is closer to the lower bound, but still reflects some of the substantial increase observed in the two stage DGM based estimate of the MRP.

59. To summarise the rationale applied:

- The Wright historic MRP estimate of 8.4 per cent is given the most weight, in line with the 2015 approach. The Wright estimate for 2016 is 10 basis points lower than the Wright estimate for 2015. This indicates that the final MRP determination for 2016 should be marginally lower than last year's final estimate of 7.3 per cent. This supports an MRP estimate of 7.2 per cent.
- The Ibbotson historic MRP estimate of 5.4 per cent is given less weight, in line with the 2015 approach. The resulting overall historic data MRP estimate, of 7.2 per cent, is consistent with this lower weighting of the Ibbotson result.
- The Authority then accounts for the DGM estimate of the MRP. In the 2015 determination the Authority placed more weight on the lower half of the range of externally observed DGM estimates than the upper half, in recognition of DGM estimates' inherent upward bias.
- The Authority's most recent two stage DGM based MRP estimate is 7.85 per cent. This estimate falls within the lower half of the range of observed DGM estimates and is the most up to date, thus is considered the most relevant DGM estimate. This estimate has increased significantly since 2015. The increase supports an increase in the overall MRP, as compared to 2015. However, the increase is tempered by the Authority's preference for the Wright estimate, and the view that the DGM is upwardly biased.
- A reasonable range for the MRP then is 7.2 - 7.85 per cent. The lower bound is based on the historic estimates (favouring Wright) while the upper bound is based on the Authority's DGM estimate.
- The mid-point of the 7.2 – 7.85 per cent range is 7.53 per cent.
- The Authority determines that a final overall MRP estimate, of 7.4 per cent – which is somewhat closer to the historic lower bound – adequately reflects all of the considerations outlined above. That MRP estimate of 7.4 per cent is therefore adopted for this rail WACC decision.

Appendix 1 International bond sample

Figure 3 Public Transport Authority Sample

Ticker	Issuer (Short name)
EJ8553483 Corp	BHP FINANCE USA
EJ9294731 Corp	TELSTRA CORP LTD
EJ2120362 Corp	BHP BILLITON FIN
EI8892560 Corp	OPTUS FINANCE
EJ9741780 Corp	OPTUS FINANCE
EJ1021298 Corp	WESFARMERS LTD
EH7633785 Corp	BHP FINANCE USA
EK0838251 Corp	VICTORIA POWER N
EI0055331 Corp	OPTUS FINANCE
EI6011817 Corp	ETSA UTILITIES
EJ5424159 Corp	AUSNET SERVICES
EJ5681071 Corp	AUSNET SERVICES
EJ5679471 Corp	WESFARMERS LTD
EI1892617 Corp	TELSTRA CORP LTD
EK8757206 Corp	BHP BILLITON FIN
EJ6958775 Corp	AUSTRALIA PACIFI
EI2917587 Corp	TELSTRA CORP LTD
EJ7525219 Corp	AUSNET SERVICES
EI4007098 Corp	OPTUS FINANCE
EJ3721366 Corp	BHP BILLITON FIN
EK8989288 Corp	WESFARMERS LTD
EK9024770 Corp	WESFARMERS LTD
EI4432049 Corp	TELSTRA CORP LTD
EI6263145 Corp	AUSNET SERVICES
EI6010694 Corp	VICTORIA POWER N
EK5233391 Corp	WESFARMERS LTD
EI6383935 Corp	TELSTRA CORP LTD
EI8810216 Corp	BHP FINANCE USA
EI6011379 Corp	VICTORIA POWER N
EJ0387146 Corp	BHP FINANCE USA
EI8731610 Corp	TELSTRA CORP LTD
EJ2023566 Corp	NEW ZEALAND MILK
EK9664815 Corp	OPTUS FINANCE
EK9698532 Corp	OPTUS FINANCE
EJ2512352 Corp	AUSNET SERVICES
EJ2514606 Corp	AUSNET SERVICES
EJ2973612 Corp	WESFARMERS LTD
UV8008012 Corp	AUSTRALIA PACI
UV8270729 Corp	TELSTRA CORP LTD

Ticker	Issuer (Short name)
EJ0952857 Corp	TELSTRA CORP LTD
EK8757560 Corp	BHP BILLITON FIN
EJ5831940 Corp	TELSTRA CORP LTD
EJ8457800 Corp	AUSTRALIA PACIFI
EJ8553962 Corp	BHP FINANCE USA
EI9022241 Corp	TELSTRA CORP LTD
EI9023967 Corp	TELSTRA CORP LTD
EK0554445 Corp	AUSNET SERVICES
EJ2120461 Corp	BHP BILLITON FIN
EK3489227 Corp	AUSNET SERVICES
EJ3722562 Corp	BHP BILLITON FIN
EK5369849 Corp	AUSTRALIA PACI
EK8353493 Corp	TELSTRA CORP LTD
QJ5397360 Corp	AUSTRALIA PACI
DD1056769 Corp	BHP FINANCE USA
JK7301761 Corp	TELSTRA CORP LTD
DD1091428 Corp	WMC FINANCE USA
EK7552160 Corp	AUSNET SERVICES
EJ3721465 Corp	BHP BILLITON FIN
EK8757685 Corp	BHP BILLITON FIN
EJ6510642 Corp	BHP BILLITON FIN
ED1042677 Corp	WMC FINANCE USA
ED9928182 Corp	FBG FINANCE LTD
EJ0387187 Corp	BHP FINANCE USA
EJ3722414 Corp	BHP BILLITON FIN
EJ8554085 Corp	BHP FINANCE USA

Figure 4 Brookfield Sample

Ticker	Issuer (Short name)
EJ3377821 Corp	COCA-COLA AMATIL
EI8834174 Corp	CALTEX AUST LTD
EJ7922069 Corp	INCITEC PIVOT
EH7350695 Corp	WOODSIDE FINANCE
EJ0949291 Corp	WOOLWORTHS LTD
EI6030205 Corp	AMCOR LTD
EI6204404 Corp	BRISBANE AIRPORT
EJ4333419 Corp	COCA-COLA AMATIL
EK5876389 Corp	CROWN GROUP LTD
EI0704078 Corp	INCITEC PIVOT FI
EI1592092 Corp	TRANSURBAN FIN
EI1608021 Corp	TRANSURBAN FIN

Ticker	Issuer (Short name)
EJ5984160 Corp	SPI AUSTRALIA AS
EI2000491 Corp	BRAMBLES USA INC
EJ6899243 Corp	COCA-COLA AMATIL
EI3253362 Corp	APT PIPELINES
EJ7588209 Corp	PERTH AIRPORT
EJ7646361 Corp	QPH FINANCE CO P
EI4044356 Corp	WOOLWORTHS LTD
EJ8616397 Corp	TRANSURBAN FIN
EJ8798880 Corp	BRISBANE AIRPORT
EJ8893137 Corp	AURIZON NETWORK
EJ9225768 Corp	COCA-COLA AMATIL
EI5615311 Corp	SPI AUSTRALIA AS
EI4214900 Corp	SYDNEY AIRPORT F
EK1048710 Corp	SGSP AUSTRALIA
EK1306886 Corp	PERTH AIRPORT
EI6348474 Corp	WOOLWORTHS LTD
EI6641167 Corp	WOODSIDE FINANCE
EK2622026 Corp	COCA-COLA AMATIL
EK3554137 Corp	QPH FINANCE CO P
EI7486208 Corp	COCA-COLA AMA NZ
EK4152378 Corp	COCA-COLA AMATIL
EI8144731 Corp	COCA-COLA AMATIL
EG0640763 Corp	SYDNEY AIRPORT F
EK6279310 Corp	SUN GROUP FINANC
EK8055148 Corp	APT PIPELINES
EK3157451 Corp	SGSP AUSTRALIA
EJ2714362 Corp	COCA-COLA AMATIL
LW8323849 Corp	COCA-COLA AMATIL
EJ3906165 Corp	APT PIPELINES
EG0219857 Corp	SYDNEY AIRPORT F
EJ5962760 Corp	AMCOR LTD
EJ4068577 Corp	SYDNEY AIRPORT F
EJ3849779 Corp	SPI AUSTRALIA AS
LW2393780 Corp	QPH FINANCE CO P
LW4748379 Corp	SGSP AUSTRALIA
EK1561159 Corp	SYDNEY AIRPORT F
EK3156859 Corp	BRAMBLES FINANCE
EK4655081 Corp	TRANSURBAN FIN
EK4685294 Corp	AURIZON NETWORK
EJ4508010 Corp	APT PIPELINES
EK6424791 Corp	SUN GROUP FINANC
EK7758478 Corp	WOODSIDE FINANCE

Ticker	Issuer (Short name)
EK8078215 Corp	APT PIPELINES
EK8787450 Corp	SYDNEY AIRPORT F
EK9118226 Corp	TRANSURBAN FIN
UV8551672 Corp	COCA-COLA AMATIL
QJ2217868 Corp	BRAMBLES USA INC
JV3204296 Corp	COCA-COLA AMATIL
QJ4132016 Corp	TRANSURBAN FIN
JK8498749 Corp	AMCOR FIN USA
JK8763837 Corp	SYDNEY AIRPORT F
JK9360021 Corp	COCA-COLA AMATIL
LW0777554 Corp	AURIZON NETWORK
LW9385011 Corp	SGSP AUSTRALIA
EK8055387 Corp	APT PIPELINES
EK8055262 Corp	APT PIPELINES
EK8078397 Corp	APT PIPELINES
QJ1896811 Corp	BHP FINANCE USA
QJ1928531 Corp	BHP FINANCE USA
JV5237112 Corp	AUSNET SERVICES
QJ1906909 Corp	BHP BILLITON FIN
QJ1910778 Corp	BHP BILLITON FIN
QJ1908806 Corp	BHP BILLITON FIN

Figure 5 The Pilbara railways Sample

Ticker	Issuer (Short name)
EJ8660791 Corp	ORIGIN ENER FIN
EI1562293 Corp	CIMIC FINANCE LT
EJ8818027 Corp	ADANI ABBOT POIN
EJ7922069 Corp	INCITEC PIVOT
EJ0949291 Corp	WOOLWORTHS LTD
EI6030205 Corp	AMCOR LTD
EI6204404 Corp	BRISBANE AIRPORT
EJ3879651 Corp	ORIGIN ENER FIN
EJ4265850 Corp	DBNGP FINANCE CO
EK5876389 Corp	CROWN GROUP LTD
EK5989620 Corp	ALUMINA LTD
EI0704078 Corp	INCITEC PIVOT FI
EJ6468916 Corp	QANTAS AIRWAYS
EK2849330 Corp	ADANI ABBOT POIN
EK9545295 Corp	ENERGY PARTNERSH
EK9580078 Corp	ENERGY PARTNERSH
EI7021476 Corp	CIMIC FINANCE US
EI3253362 Corp	APT PIPELINES

Ticker	Issuer (Short name)
EJ7588209 Corp	PERTH AIRPORT
EJ7646361 Corp	QPH FINANCE CO P
EI4044356 Corp	WOOLWORTHS LTD
EI4098048 Corp	ASCIANO FINANCE
EK5107249 Corp	DBNGP FINANCE CO
EJ8798880 Corp	BRISBANE AIRPORT
EJ6371623 Corp	ORIGIN ENER FIN
EI4214900 Corp	SYDNEY AIRPORT F
EK1306886 Corp	PERTH AIRPORT
EI6348474 Corp	WOOLWORTHS LTD
EK3117976 Corp	QANTAS AIRWAYS
EK3554137 Corp	QPH FINANCE CO P
EJ8598074 Corp	ORIGIN ENER FIN
EI8364461 Corp	ORIGIN ENER FIN
EI8703494 Corp	NEWCREST FINANCE
EG0640763 Corp	SYDNEY AIRPORT F
EK6279310 Corp	SUN GROUP FINANC
EK8055148 Corp	APT PIPELINES
EK2690916 Corp	QANTAS AIRWAYS
EJ3784331 Corp	NEWCREST FINANCE
EJ3906165 Corp	APT PIPELINES
EG0219857 Corp	SYDNEY AIRPORT F
EJ4317107 Corp	CIMIC FINANCE US
EJ5962760 Corp	AMCOR LTD
EJ4068577 Corp	SYDNEY AIRPORT F
EJ6105286 Corp	ORIGIN ENER FIN
EI6307918 Corp	ASCIANO FINANCE
LW2393780 Corp	QPH FINANCE CO P
EJ8324406 Corp	ASCIANO FINANCE
UV3027009 Corp	DBNGP FINANCE CO
EK1561159 Corp	SYDNEY AIRPORT F
EJ4508010 Corp	APT PIPELINES
EK6424791 Corp	SUN GROUP FINANC
EK8078215 Corp	APT PIPELINES
EK8787450 Corp	SYDNEY AIRPORT F
EK9072910 Corp	ASCIANO FINANCE
JK8498749 Corp	AMCOR FIN USA
JK8763837 Corp	SYDNEY AIRPORT F
EK8055387 Corp	APT PIPELINES
EK8055262 Corp	APT PIPELINES
EK8078397 Corp	APT PIPELINES
EJ3049461 Corp	CALTEX AUST LTD
EI8704930 Corp	NEWCREST FINANCE
JV5237112 Corp	AUSNET SERVICES

Appendix 2 Debt Risk Premium estimates

60. In the 2013 rail WACC review the Authority acknowledged stakeholder concerns relating to insufficient bond sample sizes to produce robust estimates. This led the Authority to expand the samples for each benchmark credit rating by including additional credit rating steps within the broader rating band. Additional DRP estimates based on these augmented samples were then used as a robust reference point for evaluation and adjustment of the DRP estimates based on the pure benchmark credit ratings.

61. The 2016 bond sample sizes for each of the benchmark credit ratings were:

- 38 bonds for the PTA A rated sample;
- 40 bonds for the Brookfield BBB+ rated sample; and
- 27 bonds for the Pilbara railways (TPI and RHI) BBB- rated sample.

62. These small sample sizes warrant applying the same sample augmentation process carried out in 2015. The samples are augmented as follows:

- PTA sample extended from the A benchmark to A+/A/A- increasing the sample from 39 to 65 bonds;
- Brookfield sample extended from the BBB+ benchmark to BBB+/BBB increasing the sample from 38 to 72 bonds; and
- the Pilbara railways sample extended from the BBB- benchmark to BBB/BBB- increasing the sample from 28 to 62 bonds.

63. The DRPs based on the augmented samples benefit from a reduced estimation error around the point estimate. However, introducing a sample of bonds with a credit rating that differs from the target benchmark rating will tend to bias the DRP estimate upward - as lower rated bonds are added - or downward, as higher rated bonds are added. To mitigate this bias, the Authority firstly establishes the direction of the bias. The Authority's bond yield approach used to estimate the DRP uses three estimation methods (Nelson Siegel, Nelson Siegel Svensson and Gaussian kernel).[23] If the bias in an augmented sample based estimate is likely to be downward, the Authority uses the highest augmented sample estimate coming from these three methods. This estimate is then averaged with the highest estimate from the original benchmark rated sample.[24] The symmetrically opposed approach is conducted if the bias is likely to be upward. The Authority considers that this sample augmentation/averaging approach balances bias and estimation error. It mitigates the potential errors that arise given the data limitations.

64. The results of this process applied to each of the three rail networks are outlined below.

[23] For further technical details on how the bond yield approach is applied see Economic Regulation Authority, *Review of the method for estimating the Weighted Average Cost of Capital for the Regulated Railway Networks: Final Decision*, 18 September 2015, pp. 78-83.

[24] The highest augmented sample estimate is still likely to be downwardly biased. To offset this bias it is averaged with the *highest* of the original benchmark sample estimates (rather than, say, the average of the original benchmark sample estimates). This provides for a conservative approach which is intended to limit the bias inherent in expanding the sample away from the target credit rating band. Similar rationale is applied to augmented sample estimates considered upwardly biased - the *lower* of the augmented sample and original benchmark sample estimates are averaged.

65. The augmented PTA sample was expanded to allow the inclusion of A+ and A- rated bonds, however, no A+ rated bond yield data was available on Bloomberg over the period in question. As a result the PTA A rated sample was only augmented with A- bonds. The addition of bonds with a lower credit rating will tend to bias the estimates upward. For this reason the lowest of the augmented sample based estimates (2.062 per cent) is averaged with the lowest original A rated sample based estimate (2.159 per cent) to produce an estimate of 2.111 per cent (see Table 10).

Table 10 Public Transport Authority - Augmented and original benchmark sample DRP estimates (per cent)

Approach	High	Mid	Low
A	2.334	2.226	**2.159**
A+/A/A-	2.219	2.174	**2.062**
Average of two lowest estimates			**2.111**

Source: ERA Analysis, Bloomberg

66. The augmented Brookfield BBB+ sample was expanded to allow the inclusion of BBB rated bonds. The addition of bonds with a lower credit rating will tend bias the estimates upward. For this reason the lowest of the augmented sample based estimates (2.516) is averaged with the lowest original BBB+ rated sample based estimate (2.383) to produce an estimate of 2.450 per cent (see Table 11).

Table 11 Brookfield - Augmented and original benchmark sample DRP estimates (per cent)

Approach	High	Mid	Low
BBB+	2.907	2.408	**2.383**
BBB+/BBB	2.751	2.526	**2.516**
Average of two lowest estimates			**2.450**

Source: ERA Analysis, Bloomberg

67. The augmented Pilbara railways BBB- sample was expanded to allow the inclusion of BBB rated bonds. The addition of bonds with a higher credit rating will tend to bias the estimates downward. For this reason the highest of the augmented sample based DRP estimates (4.091) is averaged with the highest original BBB- rated sample based estimate (3.064) to produce an estimate of 3.578 per cent (see Table 12).

Table 12 The Pilbara railways – Augmented and original benchmark sample DRP estimates (per cent)

Approach	High	Mid	Low
BBB-	**4.091**	3.805	3.270
BBB/BBB-	**3.064**	2.951	2.556
Average of two lowest estimates	**3.578**		

Source: ERA Analysis, Bloomberg

Appendix 3 Adjustment for imputation credit yield

68. The historical and DGM based market return on equity applied in the MRP estimates above are augmented with imputation credit yields. This is so that the return reflects the *total* market return on investing in equity. The imputation credit yield reflects the part of the total return that is gained through receiving imputation credits for taxes paid on dividends that can be rebated upon submission of an Australian taxation return. This idea is outlined in the stylised equation below.

$$\text{Total Market Return on Equity} = \text{Capital Gain} + \text{Dividend Yield} + \text{Imputation Credit Yield}$$

69. Capital gains are the source of return that come from appreciation in price. Dividend yields and imputation credit yield are the cash dividend (net of tax) and the imputation credit expressed as a proportion of the price paid for the investment. The total market return on equity estimated from the approaches outlined in this Determination is interpreted as the investor's 'required rate of return' on equity. The required rate of return in turn is the *minimum* annual return that induces investment in an asset. It is necessary to include the imputation credit yield to ensure this minimum return estimate in not underestimated.

70. Prior to 1988 total market returns on equity were only comprised of capital gains and dividend yield. Dividend imputation was introduced in Australia from 1 July 1987.

71. The implications of this for historical equity risk premium data series, such as from BHM and NERA, is that from 1988 some part of the required return on equity is received via imputation credits. Unlike capital gains and dividend yields, the value gained from these imputation credits is not observable in financial markets and so must be estimated and then incorporated into the return on equity.

72. To calculate the value of imputation credit yields in each year from 1988 (inclusive) onwards the equation below is used:[25]

$$c_t = \rho\theta \; x \left(\frac{T_t}{1-T_t} \right) x \; d_t$$

where:

θ is the value of distributed imputation credits consistent with the Authority's estimate of gamma;

d_t is the dividend yield in year t;

ρ is the proportion of dividends which are franked; and

T_t is the corporate tax prevailing in that year.

[25] This equation is based on that in 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 ρ in this equation is taken to be 0.75, hence a value for theta of 0.53 corresponds to an estimate of gamma of 0.4.

73. The yield c_t is then added on to the capital gain and dividend based return in each year of the NERA and BHM series from 1988 through to 2015. The resultant series represents total market return on equity for each calendar year.

74. The implications for the DGM model are that each of the cash (or net) dividend forecasts need to be adjusted upward to incorporate the estimated value of imputation credits. The following formula is used:

$$\text{Imputation Value Adjusted Dividend Forecast} = \text{Dividend Forecast}\left[1+\rho\theta\left(\frac{T_t}{1-T_t}\right)\right]$$

75. This ensures that the solution for the market return on equity in the DGM model (k) set out below reflects the estimated value of imputation credits.

Appendix 4 Annual updates of expected inflation

76. In the 2013 Rail WACC review the Authority determined that the long run forward looking estimate of inflation was 2.5 per cent. The rationale for this was as follows:

> 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.[26]

77. It was also determined that the nominal risk free rate estimated over a term of 10 years would be used as a proxy for the long term risk free rate. As of 30 June 2016 the nominal risk free rate estimate was 2.22 per cent. Discounting the 2.5 per cent inflation assumption out of this risk free rate estimate implies a real interest rate of -0.27 per cent. As of 30 June 2016 the estimate of the real risk free rate of return based on 10 year Treasury Indexed Bonds (TIB) was 0.47 per cent.[27] This indicates that the inflation forecast of 2.5 per cent is significantly different from inflation expectations implicit in prices observed in the market and thus is not consistent with the market derived prices used to calculate the rail WACC.

78. As per the 2013 Rail WACC review, the fixed 2.5 per cent inflation estimate was also used to inflate the long run average market return on equity used in the calculation of the 'Wright' MRP. After inflating the average market return on equity using the 2.5 per cent estimate, the Wright MRP deducts the on-the-day nominal risk free rate. The inflation implicit in this risk free rate is 1.74 per cent. This is 76 basis points lower than the inflation estimate used to index the average market return on equity used in the Wright estimate. Deducting an implicit inflation rate of 1.74 per cent from a market return on equity estimate indexed at a rate of 2.5 per cent results in an MRP that includes around 76 basis points of inflation. The MRP is a premium for risk - not inflation and so inclusion of inflation results in an overestimate of the MRP.

79. For these reasons, the Authority replaces the fixed 2.5 per cent inflation estimate used in the calculation of the rail WACC with an annually updated estimate (π_e) implied from Treasury Bonds and TIBs using the Fisher equation below:

$$\pi_e = \frac{1+R_f}{1+R_f^R} - 1$$

where:

R_f is the 10 year risk free rate of return estimated on Treasury Bonds; and

R_f^R is the 10 year real risk free rate of return estimated on Treasury Indexed Bonds.

[26] Economic Regulation Authority, *Review of the method for estimating the Weighted Average Cost of Capital for the Regulated Railway Networks: Final Decision*, 18 September 2015, p. 209.

[27] The Bloomberg tickers for the associated bonds are EH9944131 Corp and EI4051146 Corp. The Bloomberg liquidity (LQA) scores on the two bonds used to estimate this real rate of return is close to the 'most liquid' end of the rating scale indicating that the pricing data on these bonds is suitable for producing reliable estimates.