Final Determination

2018 and 2019 Weighted Average Cost of Capital

For the Freight and Urban Networks, and the Pilbara Railways

22 August 2019

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About this final determination

The *Railways (Access) Code 2000* requires the Economic Regulation Authority to determine each year a long-term Weighted Average Cost of Capital (WACC) to be applied in the establishment of capital costs for regulated railways in that year.[1, 2]

Clause 3 of Schedule 4 of the Code further requires the ERA, in every fifth year subsequent to 2003, to invite interested parties to make written submissions and consider those submissions prior to determining the WACC values for that year.

On 21 May 2018, the ERA published a consultation paper, inviting comment on the WACC framework, the method for estimating WACC parameters and any other matters associated with the ERA's determination of the WACC for 2018.[3]

The ERA received public submissions from ATCO Gas Australia and Synergies on behalf of Arc Infrastructure. The ERA also received one confidential submission.

The ERA released its draft determination of the 2018 rail WACC in May 2019.

The ERA received a public submission from Arc Infrastructure and one confidential submission regarding the draft decision.

Arc Infrastructure's submission focused on the market risk premium and the value of imputation credits.

The ERA has considered all submissions, however, the final determination does not directly discuss matters raised in the confidential submissions received.

The ERA has undertaken a review of the rail WACC and reviewed available information and submissions.

This document presents the ERA's final method and determination of the 2018 rail WACC.

As 30 June 2019 has passed, this document also presents the final determination for the 2019 rail WACC.

1 *Railways (Access) Code 2000*, Schedule 4, Clause 3.

2 Regulated railways are those cited in schedule 1 to the Code, currently the Public Transport Authority network, the Arc Infrastructure network, and The Pilbara Infrastructure and Roy Hill Infrastructure railways.

3 https://www.erawa.com.au/cproot/19011/2/WACC%20consultation%20paper%202018.pdf

1 The structure of this final determination

1. This final determination discusses the WACC and its individual parameters as they apply to Western Australian railways under the Western Australian regulatory rail framework.

2. For each WACC parameter, this paper details:

   - background, providing a brief description of each parameter
   - the draft determination, detailing the ERA's considerations and its draft position
   - public submissions in response to the ERA's draft determination
   - the final determination, detailing the ERA's considerations and its final position.

3. The WACC, and the individual parameters as they apply to each of the railways, is provided at the end of this final determination.

2 The *Railways (Access) Code 2000*

4. The Code describes the WACC as the "interest rate" to be used in an "equivalent annual cost or annuity" calculation of capital costs.[4]

> (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 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

5. The Code does not prescribe a method for determining the WACC.

6. The Code is subsidiary legislation under the *Railways (Access) Act 1998*. The object of the Act 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.[5]

7. The ERA has estimated the rail WACC consistent with the efficient financing costs of efficient entities with a similar degree of risk to the provision of the rail services. This approach is taken on the basis that efficient firms with efficient financing provide a benchmark for each regulatory decision. Basing regulatory decisions on efficient input costs and output prices will enable contestability in the provision of railway services.

[4] *Railways (Access) Code 2000*, Schedule 4, Clause 2.

[5] *Railways (Access) Act 1998*, section 2A.

3 The WACC framework

3.1 Background

8. The rate of return, based on a WACC, provides a service provider with a return on the capital it has invested in its business.

9. The WACC is calculated considering the relative weights of each component of the capital structure. The Code does not prescribe the components of capital costs to be assessed, or the means of weighting the components.

3.2 Draft determination

10. The ERA employed a generally-accepted WACC framework, which provided for:

- The cost of equity.
- The cost of debt.
- The shares of equity and debt in a benchmark financing portfolio as the weightings of these components.

11. For rail, the ERA calculated the WACC on a pre-tax basis.[6]

12. The pre-tax approach was preferred 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 gross replacement valuation basis.

13. In nominal terms, the WACC equation is expressed:

$$WACC_{nom} = R^{e}_{pre} * \frac{E}{V} + R^{d}_{pre} * \frac{D}{V} \quad \text{(equation 1)}$$

where[7]

$WACC_{nom}$	is the nominal pre-tax weighted average cost of capital
R^{e}_{pre}	is the pre-tax rate of return on equity, or the cost of equity
R^{d}_{pre}	is the pre-tax rate of return on debt, or the cost of debt
E/V	is the proportion of equity in the total financing (comprising equity and debt)

[6] See 2015 Decision paragraphs 39-45. Unlike gas pipelines, railways are not required to have the WACC calculated on a post-tax basis. In its 2015 decision, the ERA considered that a post-tax approach would require the development of a tax asset base calculated for a standalone entity, which would add considerable complexity to the estimation process. Further, 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. For these reasons, the ERA considers it reasonable to retain a pre-tax approach to estimate the rail WACC.

[7] All parameters are expected parameter values.

D/V is the proportion of debt in the total financing.

14. The pre-tax rate of return on equity is not readily available. Therefore, a post-tax rate of return on equity is used, which is more easily observed.

15. It is then necessary to adjust the post-tax rate of return on equity for taxation effects, including recognition of the value of imputation credits (commonly known as gamma).

16. The imputation tax system prevents corporate profits from being taxed twice. The gamma parameter accounts for the reduction in the effective corporate taxation that is generated by the distribution of franking credits to investors. Generally, investors who are able to use franking credits will accept a lower required rate of return, before personal tax, on an investment that has franking credits, compared with an investment that has similar risk and no franking credits.

17. This provides a framework for calculation of a nominal pre-tax WACC, as follows: [8]

$$WACC_{nom} = R^{e}_{post} * \frac{1}{(1-T*(1-\gamma))} * \frac{E}{V} + R^{d}_{pre} * \frac{D}{V} \quad \text{(equation 2)}$$

where:

$WACC_{nom}$ is the nominal pre-tax weighted average cost of capital

R^{e}_{post} is the post-tax rate of return on equity, or cost of equity

R^{d}_{pre} is the pre-tax rate of return on debt, or the cost of debt

T is the tax rate

γ is the value of imputation credits (gamma)

E/V is the proportion of equity in the total financing (comprising equity and debt)

D/V is the proportion of debt in the total financing.

18. The real WACC is obtained from the nominal WACC by removing expected inflation (π) from the nominal pre-tax WACC, as follows:[9]

$$WACC_{real} = \frac{(1+WACC_{nom})}{1+\pi} - 1 \quad \text{(equation 3)}$$

19. The resulting WACC for a benchmark efficient entity represents efficient financing costs for the provision of assets.

3.3 Public submissions

20. No public submissions were received on the general WACC framework in response to the draft determination.

[8] Known as the "Officer/Monkhouse framework".

[9] This has been referred to as the "Market Transformation Method".

3.4 Final determination

21. The ERA will continue to apply the general WACC framework as described in the draft determination (refer to paragraphs 10 to 19 above). Specific assumptions and parameter values are summarised in the final determination section of this determination document.

4 The term of the WACC

4.1 Background

22. The Code describes the WACC as the "target long-term weighted average cost of capital appropriate to the railway infrastructure".[10]

23. A WACC with a term consistent with the long economic lives of the assets will best meet the Code's requirements.[11] This is because the capital cost determinations required by the Code are constructed to apply in perpetuity from a fixed point in time, and not over a defined (shorter) term of an access arrangement.[12]

4.2 Draft determination

24. The ERA applied a long-term approach to the determination of the WACC.

25. For the return on equity and debt, a term of 10 years was used to estimate returns. Although terms longer than 10 years are available for the risk free rate, a risk free rate with a 10-year term allows components of models to be estimated consistently.

4.3 Public submissions

26. No public submissions were received on the term of the WACC in response to the draft determination.

4.4 Final determination

27. The ERA will continue to apply a long-term approach to the determination of the WACC.

28. The term of 10 years is used for the estimate of the return on equity and the return on debt. This 10-year term is consistently applied to estimate components of the final WACC.

[10] *Railways (Access) Code 1998*, Schedule 4, Clause 2.

[11] The weighted average economic life of a typical heavy haul rail route may be as high as 50 years.

[12] The capital cost determined is a Gross Replacement Value annuity, calculated as payable over the economic life of the asset.

5 The benchmark efficient entity and risk

5.1 Background

29. Regulators use a benchmark efficient entity to inform the WACC parameters set for a regulated entity. This is consistent with incentive regulation and ensures that a regulator does not compensate a regulated service provider for its actual costs, but compensates it as if it were operating efficiently.

30. When determining a benchmark efficient entity, a regulator needs to account for the risks of providing the regulated services.

5.2 Draft determination

31. The ERA used a benchmark entity for rail service providers that were judged to be similar.

32. The ERA defined the benchmark efficient entity 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.

33. The ERA considered the components of this definition as follows:

- A "pure-play" business focuses exclusively on rail services. This solely reflects the risk in providing rail services and does not reflect the provision of any other business activities that may have a different risk profile.
- "Regulated rail facility" is intended to account for the specific types of business activity being dealt with.
- "Operating within Australia" is intended to account for country-specific factors such as currency, the level of economic growth and laws affecting business. This is consistent with the ERA's intention to base the rate of return on data from domestic financial markets.
- "Without parental ownership" is intended to recognise that some risks associated with providing reference 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.
- "With a similar degree of risk as that which applies to the service provider in respect of the provision of the rail services" is intended to recognise the difference in the risk profile of the rail services.

34. Estimates of WACC components were based on domestic financial markets.[13] This met the guiding principle that the risk for the asset in question should stem from the economy in which the benchmark efficient entity is situated.[14]

- Market risk and systematic risk are the relevant risk considerations for equity markets. The market risk premium quantifies the risk premium for investing in a given economy as if a diversified portfolio of all listed firms in that economy were held. The risk premium is that part of the return that is in excess of the return on a risk free asset in that economy. Systematic risk is commonly quantified for a given economy through observing the co-variation between returns on listed equity in firms and the returns on a representative equity market index for the country in which that firm operates.

- To evaluate the cost of equity, Australian regulators have implemented this practice through the application of a domestic Capital Asset Pricing Model (CAPM) framework. The ERA considered that the regulatory costs of basing its analysis on international markets and the adoption of an international CAPM would be significant and may not improve accuracy.

- Using the domestic CAPM, Australian regulators have recognised the influence of foreign investors, where they invest domestically and thus contribute to market outcomes within Australia.

- The domestic debt market reflects the influence of international lenders supplying debt finance to Australian firms. Australian markets for debt are linked to international markets. Covered interest rate parity asserts that, once the differential between spot and forward exchange rates used for hedging is taken into account, no interest rate arbitrage opportunities (to make profit) exist between two currencies. Therefore, borrowing and lending in different currencies cost the same.

35. To supplement small domestic data sets, the ERA used international comparators where underlying risk factors were similar.

36. Rail services differ in their operations and network infrastructure. The WACC benchmark should account for these differences, as they give rise to different risk profiles for different operators. Given the differences in the services provided by the four regulated Western Australian rail networks, a single benchmark rail entity will not adequately capture the different risks faced by each network.

37. Urban and freight rail infrastructure have been distinguished on the following bases:[15]

- The location of the urban passenger service lessens ownership risk due to a low likelihood of asset stranding, obsolescence, regulatory changes, declining demand or volatility in demand forecasting.

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[13] The ERA considered that the regulatory costs associated with basing its analysis on international markets would be significant, with uncertain benefits in terms of improved accuracy.

[14] The country of risk is determined by Bloomberg's methodology. This consists of four factors listed in order of importance: management location, country of primary listing, country of revenue and reporting currency of the issuer. Management location is defined by country of domicile unless location of such key players as CEO, CFO, COO and/or General Counsel is proven to be otherwise.

[15] Macquarie Bank, *Western Australia Rail Access Regime: Independent Assessment of Maximum Rate of Return on Rail Infrastructure*, 23 August 1999, p. 6.

- Freight services do not receive community service obligation payments.
- Freight services are not regulated and are open to competition from road transport.

38. Relevant classification frameworks exist for railway systems on the basis of their operations and infrastructure. In the United States of America, the Surface Transportation Board classifies rail networks by their operating revenues and whether they perform switching services and/or terminal operations. This classification system refers to Class I, Class II and Class III railways.[16]

39. On this basis, dedicated iron-ore railways in the Pilbara[17] are different from the general freight networks[18] in the following ways:

- The class II/III type railroad industry is a better approximation to Pilbara railways than large trans-national railroad networks, which share characteristics with the general freight networks.
- The expectation that there would be some increased risk for stand-alone ore-carrying railways, given their reliance on a single industry with a particular exposure to economic fluctuations, creates an expectation that the asset beta would be higher than that of general freight.

40. Consequently, the ERA developed separate benchmarks for gearing, credit rating and equity beta specific to each of the regulated rail networks' infrastructure and operations. Using the same benchmark for all rail networks would not adequately capture their different risks, and therefore the efficient financing costs of each of the rail entities.

5.3 Public submissions

41. No public submissions were received on the benchmark entity and risk in response to the draft determination.

[16] Class I carriers are those with operating revenues of $250 million or more (1991 USD); Class II those with revenues in excess of $20 million (1991 USD); and Class III, those with revenues of up to $20 million (1991 USD). 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.

[17] The Pilbara Infrastructure PL and Roy Hill Infrastructure PL.

[18] For example, the Arc Infrastructure network.

5.4 Final determination

42. For the final determination, the ERA continues its approach to the benchmark efficient entity as presented in its draft determination.

43. In this final determination, 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.

44. In accordance with its position from the draft determination, for this final determination, the ERA recognises the differing risk profiles of the Western Australian railways and develops separate benchmarks for gearing, credit rating and equity beta specific to each of the regulated rail networks' infrastructure and operations.

6 Gearing

6.1 Background

45. Gearing is the proportion of a business's 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 generally expressed as follows:

$$Gearing = \frac{Debt}{Debt + Equity} \quad \text{(equation 4)}$$

46. This ratio is used to weight the costs of debt and equity when the regulated WACC is determined.

47. 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 is also used:

- To re-lever asset betas for the purposes of analysing the level of systematic risk across businesses in the estimate of equity beta.
- As a factor to determine an appropriate credit rating for deriving the debt risk premium.

48. Gearing differs across industries, and among different companies within the same industry.

49. Different firms have different risk profiles and, as a consequence, have varying debt capacities.[19] The optimal capital structure is determined by the business risk of firms in an industry and the expected loss if default occurs.[20] Given that a service provider's expected monetary risk is likely to differ from that of the comparable sample, the optimal capital structure of the entity is likely to differ as well. It may be appropriate to adjust any estimate of gearing levels to reflect differences in the level of risk between railway networks.

6.2 Draft determination

50. For the draft determination, the ERA recognised the differing risk profiles of Western Australian railways and used separate benchmarks for gearing specific to each type of regulated rail network's infrastructure and operations.

51. Due to a lack of suitable domestic comparators, the ERA's benchmark sample included international companies from the United States of America, Canada and New Zealand.

[19] Australian Competition & Consumer Commission, *Access Undertaking – Interstate Rail Network*, July 2008.

[20] Brealey, R., Myers, S. and Allen, F., *Corporate Finance*, McGraw Hill, 1996, p. 476.

52. The ERA considered the individual railway gearing as follows:[21]

- For the Public Transport Authority, network toll road companies were a rough approximation for a passenger rail network and should form the benchmark sample. However, toll roads were likely to have a more elevated risk profile than rail transport:
  - The risks faced by the Public Transport Authority were lower than those faced by the companies in the benchmark sample.
  - Therefore, a benchmark efficient entity representing the Public Transport Authority network will be able to sustain higher levels of gearing.
- For the Arc Infrastructure network a combination of Australian and overseas rail and freight businesses should form the benchmark sample:
  - Arc Infrastructure was likely to face less competition relative to overseas rail operators and the benchmark efficient rail entity representing the Arc Infrastructure network would be able to take on higher levels of gearing relative to overseas rail operators.
  - Arc Infrastructure was likely to face higher risk than transport infrastructure and services firms in Australia due to Arc Infrastructure's exposure to particular industries.
  - Therefore, a representative gearing range for Arc Infrastructure is formed by using the average of overseas railway operators as a lower bound and the Australian average as an upper bound.
- For the Pilbara Railways, a combination of Australian and overseas rail businesses should form the benchmark sample.

53. The ERA considered that, due to the lack of close comparators to regulated rail networks, regulatory discretion was needed to estimate the relevant benchmark efficient gearing for each rail network.

54. The ERA measured gearing for the benchmark sample over a 10-year timeframe. The 10-year term for the benchmark gearing was consistent with analysis of the equity beta and the term of the risk free rate to estimate the return on equity.

[21] ERA, *Review of the method for estimating the Weighted Average Cost of Capital for the Regulated Railway Networks – Final Decision,* September 2015, pp. 39-40, 49.

55. For the draft determination the ERA updated gearing estimates for the separate benchmark samples previously adopted by the ERA in its 2015 Decision (Table 1, Table 2 and Table 3).

Table 1: Public Transport Authority gearing estimates for benchmark sample[22]

Benchmark firm	2015 estimate (%)	2018 estimate (%)
Vinci SA	63	43
Albertis Infraestructuras SA	55	55
Atlantia SPA	51	51
European average	**56**	**50**
Macquarie Altas Roads	46	50
Transurban Group	34	35
Australian average	**40**	**43**
Average	**50**	**47**

Source: ERA analysis, Bloomberg

56. For the Public Transport Authority benchmark sample, the updated average gearing reduced slightly from the ERA's 2015 estimate to 47 per cent:

- The European average gearing reduced, driven by a large reduction in the gearing of Vinci SA.
- The Australian average gearing slightly increased.

57. The Public Transport Authority had lower risks than the benchmark sample, and therefore may have higher gearing levels than the average.

58. On balance, available information as at December 2018 supported the continuation of a benchmark gearing level for the Public Transport Authority of 50 per cent.

[22] Gearing is estimated as debt to value (debt and equity). Gearing is measured over a ten-year timeframe. Consistent with the ERA's 2015 estimates, equity is measured as current market capitalisation and debt is measured as a book value of net debt.

Table 2: Arc Infrastructure gearing estimates for benchmark sample[23]

Benchmark firm	2015 estimate (%)	2018 estimate (%)
Genesee & Wyoming Inc.	23	27
Union Pacific Corporation	11	16
Norfolk Southern Corporation	22	24
Kansas City Southern	15	23
CSX Corporation	24	25
United States average	**19**	**23**
Canadian Pacific Railway	18	24
Canadian National Railway	14	15
Canadian average	**16**	**20**
Aurizon Holdings	18	19
Toll Holding Limited[24]	23	28
Asciano[25]	36	39
Australian average	**26**	**29**
Port of Tauranga	11	13
New Zealand average	**11**	**13**
Average	**20**	**23**

Source: ERA analysis, Bloomberg

59. The sample of benchmark firms for Arc Infrastructure exhibited a slight increase in gearing from the 2015 estimate.

23 Gearing is estimated as debt to value (debt and equity). Gearing is measured over a ten-year timeframe. Consistent with the ERA's 2015 estimates, equity is measured as current market capitalisation and debt is measured as a book value of net debt.

24 The company was delisted on 29 May 2015.

25 The company was delisted on 25 August 2016.

60. To determine a gearing level for Arc Infrastructure:

- Representative gearing was calculated as the average of overseas railways operators as a lower bound and the Australian average as an upper bound.
- Average gearing for overseas railways was calculated as 22 per cent.
- Average gearing for transport infrastructure and services firms in Australia was 29 per cent.
- Representative gearing for Arc Infrastructure was calculated as 25 per cent.

61. On balance, available information as at December 2018 supported the continuation of a benchmark gearing level for Arc Infrastructure of 25 per cent.

Table 3: Pilbara Railways gearing estimates for benchmark sample[26]

Benchmark firm	2015 estimate (%)	2018 estimate (%)
Genesee & Wyoming Inc.	23	27
Union Pacific Corporation	11	16
Norfolk Southern Corporation	22	24
Kansas City Southern	15	23
CSX Corporation	24	25
United States average	**19**	**23**
Canadian Pacific Railway	18	24
Canadian National Railway	14	15
Canadian average	**16**	**20**
Aurizon Holdings	18	19
Australian average	**18**	**19**
Average	**18**	**22**

Source: ERA analysis, Bloomberg

62. For the Pilbara Railways benchmark sample, the updated average gearing increased from the ERA's 2015 estimate of 18 per cent to 22 per cent in 2018.

63. On balance, available information as at December 2018 has not changed significantly enough to change the benchmark gearing level for the Pilbara Networks from 20 per cent.

[26] Gearing is estimated as debt to value (debt and equity). Gearing is measured over a ten-year timeframe. Consistent with the ERA's 2015 estimates, equity is measured as current market capitalisation and debt is measured as a book value of net debt.

64. The ERA considered that benchmark gearing should be determined from observations from an appropriate benchmark comparator set and the use of regulatory discretion.

65. Given the imprecision of benchmark gearing estimates, the ERA rounded the gearing estimate to the nearest five per cent.

66. There was not a significant change in the gearing of the benchmark samples to require an adjustment to gearing levels.

67. For the draft determination, the ERA applied the following gearing ratios:

- 50 per cent for the Public Transport Authority
- 25 per cent for Arc Infrastructure
- 20 per cent for Pilbara Railways.

6.3 Public submissions

68. No public submissions were received on gearing in response to the draft determination.

6.4 Final determination

69. For the final determination, the ERA recognises the differing risk profiles of Western Australian railways and uses separate benchmarks for gearing specific to each type of regulated rail network's infrastructure and operations.

70. The ERA considers that benchmark gearing should be determined from observations from an appropriate benchmark comparator set and the use of regulatory discretion.

71. Consistent with its draft determination, for the final determination the ERA applies the following gearing ratios:

- 50 per cent for the Public Transport Authority
- 25 per cent for Arc Infrastructure
- 20 per cent for Pilbara Railways.

72. These gearing levels will remain fixed until the next rail WACC method review.

7 Cost of debt

7.1 Approach to cost of debt

7.1.1 Background

73. The ERA's past approach to estimating the rail cost of debt was based on a risk premium over and above the risk free rate, combined with a margin for administrative costs.

7.1.2 Draft determination

74. For the draft determination, the ERA estimated the rail cost of debt as:

$$\text{Return on debt} = \text{risk free rate} + \text{debt risk premium} + \text{debt raising costs} \quad \text{(equation 5)}$$

75. The risk free rate is the rate of return of a hypothetical investment with no risk of financial loss, over a given period of time.

76. The debt risk premium is the margin above the risk free rate of return, required to compensate holders of debt securities for the risk of providing debt finance. The debt risk premium is compensation for investors who tolerate the extra risk, compared to that of a risk free asset.

77. Debt raising costs are direct costs incurred by businesses raising debt financing.

78. The cost of debt estimate was based on prevailing rates on the day just prior to each determination of the annual rail WACC update. The ERA adopted a 40 business day averaging period for estimating the on-the-day risk free rate and the debt risk premium for the rail WACC annual update.[27]

79. Consistent with schedule 4, clause 3(1) of the Code, the annual calculation of the WACC is for the period as at 30 June.

80. For any given year where 30 June is not a business day, the ERA will approximate the 30 June value from the last business day before 30 June.

7.1.3 Public submissions

81. No public submissions were received on the cost of debt in response to the draft determination.

7.1.4 Final determination

82. The ERA will continue to apply the same approach, as determined in its draft determination, to estimate the cost of debt.

[27] The ERA employs an on-the-day approach in order to reflect the efficient cost of debt at the time of the decision, consistent with the use of an efficient forward-looking cost of debt. See 2015 Decision paragraphs 265-271.

7.2 Risk free rate

7.2.1 Background

83. The risk free rate is the return an investor would expect when investing in an asset with no risk.

84. 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.

85. The ERA's past rail approach to estimate the nominal risk free rate used the observed yield of 10-year Commonwealth Government bonds.

86. The 10-year term was consistent with the long term of the WACC estimate.

87. The risk free rate is re-evaluated for each annual WACC determination for a 40 business day averaging period as at 30 June.

88. This risk free rate will be used to inform estimates of both returns on equity and returns on debt.

7.2.2 Draft determination

89. Recognising the long-term nature of the WACC estimate for rail, the ERA gave further consideration to the longest term of reliable data to inform the risk free rate.

90. Regulatory practice in other frameworks, such as electricity and gas, applied a risk free rate set on the basis of five-year or 10-year Commonwealth bonds. However, these bond maturities may not best reflect rail's regulatory framework and its long-term WACC requirement.

91. The use of a risk free rate with a term less than the life of a rail asset may create a downward bias, given an upward sloping yield curve.

92. Commonwealth bonds with maturities of greater than 10 years do exist and indicative mid-rates are available.[28] [29] The longest Commonwealth bond maturities may approach close to 30 years.

93. However, the use of Commonwealth bonds with maturities of greater than 10 years will lead to inconsistency across WACC parameters.

    - The debt risk premium is not able to be calculated for 15 years or greater. Very few corporate bonds exist with a term beyond 15 years. Therefore, the return on debt would have to be calculated on the basis of, for example, a 15-year risk free rate plus a 10-year debt risk premium.

[28] Benchmark Treasury fixed coupon bonds on issue at 28 February 2019: https://aofm.gov.au/fixed-coupon-monthly/february-2019/

[29] Indicative Mid Rates of Australian Government Securities – F16 Table: https://www.rba.gov.au/statistics/tables/xls/f16.xls?v=2019-04-01-12-59-22

- The historic market risk premium is not able to be calculated with a 15-year or greater risk free rate. Commonwealth bond yield data for maturities of 15 years and above does not exist across the full time series used to calculate the historic market risk premium. Therefore, the return on equity would have to be calculated with a 15-year risk free rate and a market risk premium calculated from a 10-year risk free rate.

94. On balance, for the purposes of setting a risk free rate under the rail framework, the ERA used 10-year Commonwealth Government bonds to estimate the risk free rate.

7.2.3 Public submissions

95. No public submissions were received on the risk free rate in response to the draft determination.

7.2.4 Final determination

96. For the final determination, the ERA will continue to use 10-year Commonwealth Government bonds to calculate the risk free rate.

97. For the final determination, the risk free rate is:

- 2.76 per cent as at 30 June 2018
- 1.53 per cent as at 30 June 2019.

7.3 Debt risk premium

7.3.1 Background

98. The debt risk premium is the return above the risk free rate that lenders require to compensate them for the risk of providing debt funding to a benchmark business. The debt risk premium compensates holders of debt securities for the possibility of default by the issuer.

99. The debt risk premium 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 therefore the risk present in the bond.

100. The debt risk premium relies on two inputs:

- the term of debt
- the benchmark credit rating.

7.3.2 Draft determination

Term of debt

101. For the draft determination, the ERA estimated the debt risk premium with a 10-year term.

102. This was consistent with the long-term nature of rail assets and its regulatory framework.

103. Ten years was the longest feasible term that could be reliably estimated from the observed data. In Australia there is a limited market for corporate bonds of more than ten years, which makes estimating a long-term yield curve difficult.

Benchmark credit rating

104. For the draft determination, the ERA applied separate credit ratings to each of the rail entities. This practice reflects the differing operational and risk profiles of the individual rail business.

105. The ERA reviewed the credit ratings of the benchmark sample of firms. The tables below provided the credit ratings for each of the benchmark samples.

Table 4: Credit ratings for the benchmark sample for the Public Transport Authority, 2018

Benchmark firm	Credit rating
Vinci SA	A-
Albertis Infraestructuras SA	BBB
Atlantia SPA	BBB+
Macquarie Altas Roads	N/A
Transurban Group	N/A

106. The above sample produced a range of credit ratings between BBB and A-.

107. The Public Transport Authority is likely to face substantially lower risks than the companies contained in its benchmark sample, which is based on European toll road operators. Therefore, the ERA considered that a benchmark of A remains appropriate.

Table 5: Credit ratings for the benchmark sample for the Arc Infrastructure, 2018

Benchmark firm	Credit rating
Genesee & Wyoming Inc.	BB
Union Pacific Corporation	A-
Norfolk Southern Corporation	BBB+
Kansas City Southern	BBB-
CSX Corporation	BBB+
Canadian Pacific Railway Limited	BBB+
Canadian National Railway Company	A
Aurizon Holdings	BBB+
Toll Holding Limited	Delisted
Asciano	Delisted
Port of Tauranga	BBB+

Source: Bloomberg

108. The above sample produced a range of credit ratings between BB and A.

109. The ERA considered that Arc Infrastructure is comparable to a median credit rating. Therefore, the above credit ratings do not suggest that Arc Infrastructure's BBB+ benchmark credit rating should change.

Table 6: Credit ratings for the benchmark sample for the Pilbara Railways, 2018

Benchmark firm	Credit rating
Genesee & Wyoming Inc.	BB
Union Pacific Corporation	A-
Norfolk Southern Corporation	BBB+
Kansas City Southern	BBB-
CSX Corporation	BBB+
Canadian Pacific Railway Limited	BBB+
Canadian National Railway Company	A
Aurizon Holdings	BBB+

Source: Bloomberg

110. The above sample produced a range of credit ratings between BB and A.

111. While Genesse & Wyoming Inc was considered to be the best comparator company for the Pilbara Railways, the ERA considered that a credit rating of BB was inappropriate.[30] Given that the benchmark efficient entity was assumed to minimise its cost of capital, 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.

112. For the benchmark credit rating of the Pilbara Railways, the ERA used Kansas City Southern's credit rating of BBB-, the lowest possible investment grade rating. The BBB- credit rating was also at the lower end of credit ratings for the Pilbara Railways sample, consistent with the reasoning that the Pilbara Railways will face a higher level of risk relative to the comparators in its benchmark sample.

113. For the draft determination, the ERA considered the following credit ratings were appropriate:

- A for the Public Transport Authority
- BBB+ for Arc Infrastructure
- BBB- for Pilbara Railways.

Estimation method – a revised bond yield approach

114. The ERA used an in-house method to estimate the debt risk premium.[31]

[30] Genesse & Wyoming Inc is considered to be the only operationally comparable firm to the Pilbara Railways on the basis of it being the only class III regional and short-line operator.

[31] This method has been referred to as the "revised bond yield approach".

115. The ERA noted Synergies preferred the Reserve Bank of Australia/Bloomberg approach to estimating debt. This approach applies broad credit rating bands to estimate the cost of debt and is not able to accommodate specific credit ratings.

116. The ERA considered that its own revised bond yield approach provided a more flexible approach to calculate an efficient cost of debt, as it:

- provided more flexibility to estimate the cost of debt for a particular credit rating
- drew on market data
- reflected market conditions for a nominated averaging period
- recognised the reality that Australian firms source debt funding overseas
- directly addressed the issue of the effective tenor not matching 10 years.

117. The ERA's revised bond yield approach involves the following steps:[32]

- Step 1: Determining the benchmark sample – Identifying a sample of relevant corporate bonds that reflect the credit rating of the benchmark efficient entity.
- Step 2: Collecting data and converting yields to Australian dollar equivalents – Converting the bond yields from the sample into Australian dollar equivalent yields inclusive of Australian swap rates.
- Step 3: Averaging yields over the averaging period – Calculating an average Australian dollar equivalent bond yield for each bond across the averaging period.
- Step 4: Estimating curves - Estimating yield curves on this data by applying the Gaussian Kernel, Nelson-Siegel and Nelson-Siegel-Svensson techniques.
- Step 5: Estimating cost of debt - Calculating the 10-year cost of debt estimate for each of the yield curves in the benchmark sample and augmented benchmark sample. Adjusting the bias of cost of debt estimates from the augmented sample.
- Step 6: Calculating the debt risk premium – Calculating the debt risk premium by subtracting the 10-year risk free rate from the 10-year cost of debt.

118. These steps determine the debt risk premium at a point in time, being the date of calculation.

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[32] Through its 2018 gas rate of return guideline review of the debt risk premium updating process, the ERA has further improved the ease of implementation and robustness of the revised bond yield approach. Technical detail of the ERA's revised bond yield approach can be found at:

ERA, *Final Gas Rate of Return Guidelines Explanatory Statement – Appendix 5 Debt risk premium process for updating in R,* December 2018.

The R toolkit developed by ERA for the most recent gas rate of return guideline flexible enough to accommodate a bond sample at maximum of 300 bonds for maximum of 60 trading days. The tool can be used for estimating 10 years cost of debt for each of the three yield curves for benchmark bond sample and the augmented benchmark bond sample in rail.

It should be noted that rail debt risk premium differs from the gas debt risk premium process in that the rail calculation uses a bias adjustment process and a different risk free rate. Therefore, the final debt risk premium estimate produced in the "output sheet" of the R toolkit should not be used for rail.

119. To mitigate errors that may arise given the data limitations, the ERA augmented the bond sample:

- The Public Transport Authority sample is extended from the A benchmark to A+/A/A-.
- The Arc Infrastructure sample is extended from the BBB+ benchmark to BBB+/BBB.
- The Pilbara railways sample is extended from the BBB- benchmark to BBB/BBB-.

120. To mitigate potential bias, the ERA first established the direction of the bias:

- If the bias in an augmented sample-based estimate is likely to be downward, the ERA uses the highest augmented sample-based estimate coming from the three estimation methods. This estimate is then averaged with the highest estimate from the original benchmark rated sample.[33]
- The opposite approach is conducted if the bias is likely to be upward.

121. The 2018 bond sample sizes for each of the benchmark credit ratings were:

- 26 bonds for the Public Transport Authority A rated sample
- 46 bonds for the Arc Infrastructure BBB+ rated sample
- 21 bonds for the Pilbara Railways BBB- rated sample.

122. In 2018 the samples were augmented as follows:

- The Public Transport Authority sample was extended from the A benchmark to A+/A/A- increasing the sample from 26 to 83 bonds.
- The Arc Infrastructure sample was extended from the BBB+ benchmark to BBB+/BBB increasing the sample from 46 to 85 bonds.
- The Pilbara railways sample was extended from the BBB- benchmark to BBB/BBB- increasing the sample from 21 to 60 bonds.

Debt risk premium estimates

123. The debt risk premium for each benchmark entity rate is re-evaluated for each annual WACC determination.

124. The results of the ERA's 2018 debt risk premium estimation are outlined below.

125. The 10-year risk free rate used for the debt risk premium calculation was estimated from 10-year Australian Commonwealth Government securities.

[33] 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. 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.

Table 7: 2018 Public Transport Authority – Augmented and original benchmark sample debt risk premium estimates (%)

Approach	High	Mid	Low
A	1.482	1.401	1.357
A+/A/A-	1.401	1.397	1.388
Average of two lowest estimates			**1.373**

Source: ERA Analysis, Bloomberg

126. The augmented Public Transport Authority 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 Public Transport Authority A rated sample was augmented only 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 (1.388 per cent) is averaged with the lowest A rated sample-based estimate (1.357 per cent) to produce an estimate of 1.373 per cent (see table above).

Table 8: 2018 Arc Infrastructure – Augmented and original benchmark sample debt risk premium estimates (%)

Approach	High	Mid	Low
BBB+	1.674	1.596	1.586
BBB+/BBB	1.894	1.855	1.788
Average of two lowest estimates			**1.687**

Source: Bloomberg

127. The augmented Arc Infrastructure BBB+ sample was expanded to allow the inclusion of BBB rated 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 (1.788 per cent) was averaged with the lowest BBB+ rated sample-based estimate (1.586 per cent) to produce an estimate of 1.687 per cent (see table above).

Table 9: 2018 Pilbara Railways – Augmented and original benchmark sample debt risk premium estimates (%)

Approach	High	Mid	Low
BBB-	2.363	2.277	2.249
BBB/BBB-	2.124	2.104	2.095
Average of two highest estimates	**2.244**		

Source: ERA Analysis, Bloomberg

128. 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 tended to bias the estimates downward. For this reason, the highest of the augmented sample-based debt risk premium estimates (2.124) was averaged with the highest BBB- rated sample-based estimate (2.363) to produce an estimate of 2.244 per cent (see table above).

129. For the draft determination, the 2018 debt risk premium across the three rail businesses were:

- 1.373 per cent for the Public Transport Authority
- 1.687 per cent for Arc Infrastructure
- 2.244 per cent for Pilbara Railways.

7.3.3 Public submissions

130. No public submissions were received on the debt risk premium in response to the draft determination.

7.3.4 Final determination

7.3.4.1 Debt risk premium approach

131. For the final determination, the ERA will estimate the debt risk premium with a 10-year term.

132. The ERA maintains its position in the draft determination that the following credit ratings are appropriate:

- A for the Public Transport Authority
- BBB+ for Arc Infrastructure
- BBB- for Pilbara Railways.

133. Consistent with the draft determination, the ERA will continue to apply its revised bond yield approach to estimate the debt risk premium.

134. The debt risk premium for each benchmark entity rate will be re-evaluated for each annual WACC determination.

7.3.4.2 2018 debt risk premium estimate

135. The ERA's estimated debt risk premium estimates as at 30 June 2018 are consistent with the draft determination.

136. The final determinations of the 2018 debt risk premium across the rail businesses are:

- 1.373 per cent for the Public Transport Authority
- 1.687 per cent for Arc Infrastructure

- 2.244 per cent for Pilbara Railways.

7.3.4.3 2019 debt risk premium estimate

137. The ERA also estimated the debt risk premium estimate as at 30 June 2019.

138. The 2019 debt risk premium estimates for each of the WA rail networks is summarised as below.

139. In 2019 the samples were augmented as follows:

- The Public Transport Authority sample was extended from the A benchmark to A+/A/A- increasing the sample from 25 to 76 bonds.
- The Arc Infrastructure sample was extended from the BBB+ benchmark to BBB+/BBB increasing the sample from 41 to 82 bonds.
- The Pilbara railways sample was extended from the BBB- benchmark to BBB/BBB- increasing the sample from 10 to 51 bonds.

Table 10: 2019 Public Transport Authority – Augmented and original benchmark sample debt risk premium estimates (%)

Approach	High	Mid	Low
A	1.835	1.784	1.599
A+/A/A-	1.718	1.701	1.617
Average of two lowest estimates			**1.608**

Source: ERA Analysis, Bloomberg

140. The augmented Public Transport Authority sample was expanded to allow the inclusion of A+ and A- rated bonds. Compared to the small addition of A+ bonds added to the sample, there were substantially more A- added. The larger number of A- bonds with a lower credit rating will tend to bias the estimates upward. For this reason, the lowest of the augmented sample-based estimates (1.617 per cent) is averaged with the lowest A rated sample-based estimate (1.599 per cent) to produce an estimate of 1.608 per cent (see table above).

Table 11: 2019 Arc Infrastructure – Augmented and original benchmark sample debt risk premium estimates (%)

Approach	High	Mid	Low
BBB+	2.158	1.970	1.936
BBB+/BBB	2.336	2.271	2.226
Average of two lowest estimates			**2.081**

Source: Bloomberg

141. The augmented Arc Infrastructure BBB+ sample was expanded to allow the inclusion of BBB rated 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 (2.226 per cent) was averaged with the lowest BBB+ rated sample-based estimate (1.936 per cent) to produce an estimate of 2.081 per cent (see table above).

Table 12: 2019 Pilbara Railways – Augmented and original benchmark sample debt risk premium estimates (%)

Approach	High	Mid	Low
BBB-	3.680	3.542	3.252
BBB/BBB-	2.653	2.637	2.566
Average of two highest estimates	**3.167**		

Source: ERA Analysis, Bloomberg

142. 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 tended to bias the estimates downward. For this reason, the highest of the augmented sample-based debt risk premium estimates (2.653 per cent) was averaged with the highest BBB- rated sample-based estimate (3.680 per cent) to produce an estimate of 3.167 per cent (see table above).

143. For this final determination, the 2019 debt risk premium estimates are:

- 1.608 per cent for the Public Transport Authority
- 2.081 per cent for Arc Infrastructure
- 3.167 per cent for Pilbara Railways.

7.4 Debt-raising costs

7.4.1 Background

144. Debt-raising costs are the administrative costs incurred by businesses when obtaining debt financing.

145. Regulators across Australia have typically included an allowance to account for direct debt-raising costs in their regulatory decisions. Debt-raising costs may include underwriting, legal and company credit rating fees, and any other costs incurred when 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.

146. Australian regulators use benchmark estimates to determine debt-raising costs. To do so, regulators attempt to derive an estimate of debt-raising costs that mimics the costs that would be incurred by a well-managed efficient benchmark business operating in a competitive market.

147. The ERA and several other Australian regulators have adopted an estimate of debt-raising costs of 0.125 per cent in previous regulatory decisions.

148. The rationale for using a figure of 0.125 per cent dates back to work undertaken by the Australian Competition and Consumer Commission (ACCC) in the early 2000s. Based on advice from the Allen Consulting Group in December 2004, the ACCC affirmed that debt-raising costs were a legitimate expense that should be recovered through the revenues of a regulated utility.[34] This conclusion was consistent with the ACCC's decisions on the issue of debt-raising costs in its regulatory decisions prior to 2004.[35]

Debt hedging costs

149. Interest rate swaps are derivative contracts, which typically exchange – or swap – fixed-rate interest payments for floating-rate interest payments. They provide a means to hedge and manage risk, but also have a cost.

7.4.2 Draft determination

150. The ERA's draft determination reviewed the use of 0.125 per cent for debt-raising costs.

151. The ERA investigated the allowances provided by various Australian regulators and gave particular attention to research underpinning the Queensland Competition Authority's (QCA) 2014 *Cost of debt estimation methodology*.[36] In this report, the QCA reviewed Allen Consulting Group's 2004 findings and the origins of the 0.125 per cent estimate.

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[34] The Australian Competition and Consumer Commission, *Final Decision, NSW and ACT Transmission Network Revenue Cap, TransGrid 2004-05 to 2008-09*, April 2005, p. 144.

[35] For instance, the Australian Competition and Consumer Commission, *Final Decision, South Australian Transmission Network Revenue Cap, 2003 to 2007/8*, December 2002, p. 25; and the Australian Competition and Consumer Commission, *Final Decision, GasNet Australia access arrangement revisions for the Principal Transmission System*, November 2002, p. 95.

[36] Queensland Competition Authority, *Cost of debt estimation methodology: final decision,* August 2014, p. ii.

152. The QCA found that the 0.125 per cent figure was based on figures provided to the ACCC by Westpac in 2002.[37] This figure was discussed in the Allen Consulting Group's report in 2004, which noted that an allowance of 0.125 per cent was likely to have been overstated. Specifically, Allen Consulting Group stated that:

- The ACCC had inappropriately included a dealer swap margin in 2004, resulting in a double count.[38]
- Without a swap margin, the ACCC's estimate would have been about 0.075 per cent (which was closer to other estimates sourced by the ACCC from banks at the time).[39]

153. The QCA had concerns about the inclusion of the swap margin and the age of the 0.125 per cent estimate. It engaged PwC to prepare updated advice on debt-raising costs. PwC found that debt-raising costs were within the range of 0.09 to 0.108 per cent. PwC's method used the same cost categories identified by Allen Consulting Group in 2004.[40]

154. The ERA was not aware of any new alternatives to the Allen Consulting Group method. Other estimates of debt-raising costs – including Deloitte's 2010 estimate,[41] PwC's' 2011[42] and 2013[43] estimates, and the ERA's own estimate in 2013[44] – have adopted essentially the same approach used by the Allen Consulting Group. The approach set out in the Allen Consulting Group's 2004 study was still relevant and fit-for-purpose. This approach was robust and was adopted by many Australian regulators over the last 10 years.

155. Therefore, a debt-raising cost allowance of 0.100 per cent per annum was appropriate. This falls within the range provided in the 2013 PwC study, is comparable with estimates now used by the ACCC and QCA and is slightly higher than the most recent estimate adopted by the Australian Energy Regulator. This allowance does not include the swap margin.

156. For the draft determination, the ERA applied an allowance of 0.100 per cent for debt-raising costs.

[37] Allen Consulting Group, *Debt and equity raising transaction costs: Final report to ACCC*, December 2004, p. 18.

[38] Allen Consulting Group, *Debt and equity raising transaction costs: Final report to ACCC*, December 2004, p. 28.

[39] Allen Consulting Group, *Debt and equity raising transaction costs: Final report to ACCC*, December 2004, p. xvii.

[40] PwC, *Debt and Equity Raising Costs: Report for Powerlink Queensland (Appendix K)*, 2011, p. 20.

[41] Deloitte, *Envestra Limited: Debt Financing Costs*, September 2010, p. 4.

[42] PwC, *Debt and Equity Raising Costs: Report for Powerlink Queensland (Appendix K)*, 2011, p. 20.

[43] PwC, *A cost of debt methodology for businesses regulated by the Queensland Competition Authority*, June 2013.

[44] ERA, *Explanatory Statement for the Rate of Return Guidelines*, 16 December 2013, p. 202.

Debt hedging costs

157. In the draft determination, the ERA did not consider that an allowance for hedging costs was warranted for the rail WACC.[45]

- As the rail regulatory horizon is long-term, rail firms have more certainty about the future and can enter into longer-term funding arrangements, which reduces the need for an efficient entity to hedge. The interest rate risk of the open-ended term of debt is adequately compensated for by using a 10-year term for the regulated risk-free rate.[46]

- Unlike some other regulated industries, rail businesses are not subject to periodic (for example, five-year) regulatory resets of the WACC. There is therefore no need to hedge this risk.

7.4.3 Public submissions

158. No public submissions were received on debt raising costs in response to the draft determination.

7.4.4 Final determination

159. For the final determination, the ERA applies an allowance of 0.100 per cent for debt-raising costs.

160. This allowance for debt-raising costs will remain fixed until the next rail WACC method review.

161. For the final determination, the ERA does not consider that an allowance for hedging costs is warranted for the rail WACC.

[45] Hedging costs relate to the costs involved in undertaking interest rate swaps to hedge the periodic resets of the regulated 'risk free rate'.

[46] See page 172, 2015 Decision.

8 Cost of equity

8.1 Cost of equity approach

8.1.1 Background

162. The cost of equity is the return that investors require from a firm to compensate them for the risk they take by investing their capital.

163. There are no readily observable proxies for the expected return on equity. While estimates of the cost of debt can be obtained by observing debt instruments, financial markets do not provide a directly observable proxy for the cost of equity, for either individual firms or the market as a whole.

164. Estimating a forward-looking return on equity sufficient to enable regulated firms 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.

165. The model most used by Australian regulators for quantifying the return on equity and associated risk has been the Sharpe Lintner CAPM.

166. This form 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 component reflecting the risk premium that investors would require over the risk free rate:

$$R_i = R_f + \beta_i \left(R_m - R_f \right) \qquad \text{(equation 6)}$$

where:

R_i is the required rate of return on equity for the asset, firm or industry in question

R_f is the risk free rate

β_i is the equity beta that describes how a particular portfolio i will follow the market which is defined as $\beta_i = \text{cov}\left(R_i, R_m\right) / \text{var}\left(R_m\right)$

$\left(R_m - R_f\right)$ is the market risk premium.

8.1.2 Draft determination

167. To date, Australian regulators have used the Sharpe Lintner CAPM to quantify the return on equity and associated risk.

168. Other asset pricing models in the CAPM family build on the standard Sharpe Lintner CAPM,[47] and include:

- the Black and Empirical CAPM
- the Consumption CAPM
- the Inter-temporal CAPM.

169. There is also an extensive range of other models that seek to estimate the return on equity, including the:

- Arbitrage Pricing Theory family of models
- Fama-French Three-Factor Model and its extensions
- Dividend Growth Model family (both single-stage and multi-stage)
- Residual Income Model
- Market Premium approaches
- Build-up Method.

170. In addition, there are approaches that are not based on modelling, but rather on available data from a range of comparators or analyst reports. These include:

- estimated market returns on comparable businesses
- broker reports and the Dividend Yield approach.

171. The ERA reviewed these asset pricing approaches and considered that only the Sharpe Lintner CAPM model was relevant for informing the estimation of the prevailing return on equity for the regulated firms.

172. In past rail determinations, the ERA predominately relied on the Sharpe Linter CAPM for the estimate of the cost of equity. This was also consistent with the ERA's recent regulatory practice for electricity and gas.

173. The Sharpe Lintner CAPM remains the dominant asset pricing model used to estimate the return on equity.[48]

174. In 2016, the Australian Competition Tribunal found that the Australian Energy Regulator (AER) had not erred in applying the Sharpe Lintner CAPM.[49]

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47 Detailed discussions on models for estimating the return on equity can be found at:
ERA, *Explanatory Statement for the Draft Rate of Return Guidelines,* Appendix 11, 2013, pp. 260 -268.

48 AER, *TasNetworks final decision 2017-19 | Attachment 3: Rate of return*, April 2017, p. 3-170.

49 Australian Competition Tribunal, 2012, *Application by Public Interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1*, 26 February 2016, paragraph 735.

175. In making its case for the use of the Sharpe Lintner CAPM, the AER said that it:[50]

- Was reflective of economic and finance principles and market information.
- Was fit-for-purpose as it was developed for estimating the cost of capital.
- Could be implemented in accordance with good practice.
- Was not unduly sensitive to errors in inputs or arbitrary filtering.
- Used input data that was credible, verifiable, comparable, timely and clearly sourced.
- Was sufficiently flexible to allow for changing market conditions and new information to be reflected in regulatory outcomes, as appropriate.

176. The ERA gave full weight to the Sharpe Lintner CAPM when estimating the return on equity.

177. For the draft determination, the ERA determined a single point estimate for the return on equity using the Sharpe Lintner CAPM.

178. To estimate the return on equity, the ERA separately estimated:

- the risk free rate
- the equity beta
- the market risk premium.

8.1.3 Public submissions

179. No public submissions were received on the cost of equity approach in response to the draft determination.

8.1.4 Final determination

180. For this final determination, the ERA has given the Sharpe Lintner CAPM full weight when estimating the return on equity. The ERA will determine a single point estimate for the return on equity using the Sharpe Lintner CAPM.

181. For this final determination, the ERA will separately estimate the following three parameters to estimate the return on equity, including:

- the risk free rate
- the equity beta
- the market risk premium.

[50] AER, *TasNetworks final decision 2017-19* | *Attachment 3: Rate of return*, April 2017, p. 3-169.

8.2 Market risk premium

8.2.1 Background

182. The ERA uses the Sharpe Lintner CAPM to estimate the return on equity. The market risk premium is a parameter of the Sharpe Lintner CAPM.

183. The market risk premium is the expected rate of return over and above the risk free rate that investors require to invest in a fully-diversified portfolio. *Ex ante*, investors always require a rate of return above the risk free rate to invest and so the expected market risk premium is always positive. *Ex post*, the realised return to the market portfolio may be negative; that is the nature of risk. To establish the cost of capital, it is the *ex ante* market premium that is relevant.

184. The market risk premium compensates an investor for the systematic risk of investing in a fully diversified portfolio. Systematic risk is risk that cannot be diversified away by investors because it affects all firms in the market.[51] Therefore, the market risk premium represents an investor's required return, over and above the risk free rate of return, on a fully diversified portfolio of assets. This is a forward-looking concept.

185. The market risk premium is calculated as follows:

$$MRP = R_M - R_F \qquad \text{(equation 7)}$$

where:

R_M is the expected market return on equity observed in the Australian stock market

R_F is the 10-year risk free rate of return.

186. 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. The market risk premium cannot be directly observed because it depends on investor expectations at the time of investment. In order to set the return on equity, the market risk premium needs to be estimated for a future time period.

187. For rail networks, the ERA's forward-looking market risk premium is estimated for a 10-year period, consistent with the long lives of rail networks and the regulatory framework.

8.2.2 Draft determination

188. The ERA's draft determination considered the market risk premium given available information and public submissions.

[51] The foundation of the Sharpe Lintner CAPM is the proposition that adding an asset to a portfolio reduces risk via the diversification effect but not beyond the risks that the assets in a portfolio share in common, that is, their systematic risk. At the limit, when one has invested in all available assets in the market portfolio, there is only systematic risk left. An important assumption of the CAPM is that assets are priced as though it is only their system risk that is relevant to investors.

Historic market risk premium

189. The historic market risk premium method calculates the average of a series of annual market risk premium observations.

190. The market risk premium is calculated for each calendar year. There are currently 134 annual Australian market risk premium 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.

191. The ERA recognised that there were mixed views as to the best averaging technique to apply when estimating the historic market risk premium.

192. Blume's 1974 paper helped establish some accepted findings regarding averaging.[52] Blume showed that:

- Compounding the arithmetic average of one period returns gave an upwardly biased estimate of expected return over N periods.
- Compounding the geometric average of one period returns underestimated the expected return over N periods when the sample period T exceeds N.
- An unbiased estimate of the expected N period returns lay between the compounded value of the arithmetic mean and the geometric mean.

193. Experts have proposed other methods to combine the geometric and arithmetic averages to give an approximately unbiased estimate of expected returns.[53] [54]

194. Indro and Lee extended Blume's analysis.[55] Indro and Lee:

- Confirmed Blume's finding that biases existed in the use of arithmetic and geometric averages.
- Compared the bias and efficiency (magnitude of the standard error) for the arithmetic average, geometric average, Blume's weighted average and the overlapped unbiased estimator.
- Found that biases tended to be exacerbated in the presence of autocorrelation in returns.
- Found that bias arising from the use of the arithmetic average increased as the investment horizon lengthened and as the volatility of the returns increased.

[52] Blume, M., 'Unbiased Estimators of Long-Run Expected Rates of Return', *Journal of the American Statistical Association*, vol. 69, 1974, pp. 634-638.

[53] Blume, M., 'Unbiased Estimators of Long-Run Expected Rates of Return', *Journal of the American Statistical Association*, vol. 69, 1974, pp. 634-638.

[54] Jacquier, E., Kane, A. and Marcus, A., 'Geometric or Arithmetic Mean: A Reconsideration', *Financial Analysts Journal,* vol 59, 2003, pp. 46-53.

[55] Indro, D. and Lee, W. 'Biases in arithmetic and geometric averages as estimates of long-run expected returns and risk premia', *Financial Management*, vol 26, 1997, pp. 81–90.

- Found that bias arising from the geometric average increased as volatility of returns increased.

195. In 2013 Lally produced a report that detailed that the arithmetic mean was consistent with the "present value principle".[56] Lally found that an arithmetic mean was applied to a discounting model.

196. However, the ERA's concern was how best to estimate a market risk premium. An often-overlooked presumption is that the forecaster knows the true values of the statistical parameters. In practice these are estimated, and even using the best estimation techniques, the estimators are subject to sampling error. It is this variability of returns, or sampling error, that causes a level of bias in both arithmetic and geometric means. Therefore, to determine a forward estimate of the market risk premium, one must recognise these biases.

197. The report prepared for the AER by McKenzie and Partington argued that the market risk premium was measured with a standard error and that there was a finite sample of returns for the stock market and the stocks.[57] Consistent with a study by Blume, McKenzie and Partington considered that: [58, 59]

- First, when compounding the arithmetic mean over time, it was the sampling error in the measurement of the arithmetic mean return that caused the upward bias in the expected return.

- Second, with a finite sample of returns, there was an upward bias when the arithmetic average was compounded over more than one period.

198. McKenzie and Partington also used findings from various academic studies to support their view that the unbiased estimator of the market risk premium lay between the arithmetic average and the geometric average. For example, they cited Indro and Lee who concluded that arithmetic returns were upwardly biased and geometric returns were downwardly biased,[60] and Jacquier, Kane and Marcus, who reached the same conclusion.[61]

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56 Lally, M., *Review of the AER's Methodology for the Risk Free Rate and the Market Risk Premium*, March 2013, p. 40.

57 McKenzie, M. and Partington, G., *Supplementary report on the equity market risk premium, a report to the AER on behalf of the Securities Industry Research Centre of Asia-Pacific (SIRCA) Limited*, February 2012, p. 6.

58 Blume, M., 'Unbiased Estimators of Long-Run Expected Rates of Return', *Journal of the American Statistical Association*, vol. 69, 1974, pp. 634-638.

59 McKenzie, M. and Partington, G., *Supplementary report on the equity market risk premium, a report to the AER on behalf of the Securities Industry Research Centre of Asia-Pacific (SIRCA) Limited*, February 2012, pp. 5-6.

60 Indro, D. and Lee, W., 'Biases in arithmetic and geometric averages as estimates of long-run expected returns and risk premia', *Financial Management*, vol 26, 1997, pp. 81–90.

61 Jacquier, E., Kane, A. and Marcus, A., 'Geometric or Arithmetic Mean: A Reconsideration', *Financial Analysts Journal,* vol 59, 2003, pp. 46-53.

199. McKenzie and Partington considered that the strength of the estimator of the historic market risk premium should also be taken into consideration, together with its unbiasedness as previously discussed.[62] Strong estimators have lower standard errors and so are more precise. McKenzie and Partington noted findings from Jacquier, Kane and Marcus that compounding using the estimated arithmetic average return gave results that were not only upwardly biased, but also highly inefficient.[63]

200. McKenzie and Partington concluded that:[64]

> In our opinion there is no indisputable single best estimator for long run returns. The widespread current practice is to use unadjusted geometric and arithmetic averages. Given the current state of knowledge, we see no strong case to depart from this common practice and recommend that the use of both of these metrics, tempered by an understanding of their inherent biases.

201. In response to public submissions to the AER's 2018 draft guidelines, Partington and Satchell provided further advice on the averaging method.[65] Partington and Satchell said that it was clear that some weight should be attached to the geometric return.[66]

202. Partington and Satchell's advice on the averaging method can be summarised as follows:

- The AER's objective is to determine the rate of return that investors expect in equilibrium, and investors do compound returns. Whether or not the AER compounds returns is not a relevant issue. [67]
- Since the unbiased estimate of the expected return for a long-term investment is bounded by the arithmetic and geometric averages, both are relevant to the determination of the market risk premium for a long horizon investment.[68]
- Some weight should be attached to the geometric return and that weight should be greater the more the concern for accuracy relative to unbiasedness.[69]
- Partington did not propose a weight and considered a regulator inevitably needs to exercise judgement in making this determination.[70]

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62 McKenzie, M. and Partington, G., *Supplementary report on the equity market risk premium, a report to the AER on behalf of the Securities Industry Research Centre of Asia-Pacific (SIRCA) Limited*, February 2012.

63 Jacquier, E., Kane, A. and Marcus, A., 'Geometric or Arithmetic Mean: A Reconsideration', *Financial Analysts Journal*, vol 59, 2003, pp. 46-53.

64 McKenzie, M. and Partington, G., *Supplementary report on the equity market risk premium, a report to the AER on behalf of the Securities Industry Research Centre of Asia-Pacific (SIRCA) Limited*, February 2012, pp. 8-9.

65 Partington, G. and Satchell, S., *Report to the AER: Discussion of Submissions on the Draft 2018 Guideline,* November 2018, pp. 29-34.

66 Partington, G. and Satchell, S., *Report to the AER: Discussion of Submissions on the Draft 2018 Guideline,* November 2018, p. 34.

67 Partington, G. and Satchell, S., *Report to the AER: Discussion of Submissions on the Draft 2018 Guideline,* November 2018, p. 30.

68 Partington, G. and Satchell, S., *Report to the AER: Discussion of Submissions on the Draft 2018 Guideline,* November 2018, p. 30.

69 Partington, G. and Satchell, S., *Report to the AER: Discussion of Submissions on the Draft 2018 Guideline,* November 2018, p. 34.

70 Partington, G. and Satchell, S., *Report to the AER: Discussion of Submissions on the Draft 2018 Guideline,* November 2018, p. 34.

203. In light of the above information, the ERA considered approaches to weighting the arithmetic mean and the geometric mean. As the ERA used multiple sampling periods and considered that investors may have multiple forecast horizons, no one weighting method was preferred.

204. The ERA considered that an unbiased estimate of the historical market risk premium was likely to be somewhere between the geometric average and the arithmetic average.

205. In its draft determination, the ERA sought to minimise any error with over-reliance on one type of average and supported the use of both the arithmetic and geometric averages. This approach recognised that:

- When compounding the arithmetic averages over time, sampling error can cause an upward bias.
- Geometric average can understate returns as it is based on a constant compounding, which does not account for actual variability of returns over time.
- Given the volatility of returns over time, an investor may consider different investment horizons.
- An unbiased estimate of the historical market risk premium is likely to be somewhere between the geometric average and the arithmetic average.

206. The ERA, therefore, sought to minimise any error with over-reliance on one of the two types of average by continuing the even weighting of the arithmetic and geometric means.

207. In the draft determination, the historical market risk premium estimate was updated.

208. The following table details the ERA's revised estimates of the historic market risk premium as at December 2017. Consistent with the long-term approach in rail, the market risk premium is calculated with a 10-year risk free rate.

Table 13 Updated estimates of the historic market risk premium, December 2017 (%)

	Arithmetic			Geometric		
	BHM	NERA	Average	BHM	NERA	Average
1883-2017	6.29	6.65	**6.67**	4.96	5.30	**5.13**
1937-2017	6.01	5.96	**5.99**	4.19	4.14	**4.17**
1958-2017	6.51	6.51	**6.51**	4.21	4.21	**4.21**
1980-2017	6.44	6.44	**6.44**	4.24	4.24	**4.24**
1988-2017	6.01	6.01	**6.04**	4.48	4.48	**4.48**

Source: ERA Analysis

209. These estimates suggested a downward trend in the market risk premium. The AER also found evidence that suggested a downward trend in the realised market risk premium.[71]

[71] AER, *Draft rate of return guidelines – explanatory statement,* July 2018, p. 240.

210. The ERA took the average of the lowest arithmetic mean (5.99 per cent) and the highest geometric mean (5.13 per cent) to develop an estimate of the historic market risk premium of 5.6 per cent.

Wright approach

211. The Wright approach is an alternative specification of the Sharpe Lintner CAPM. In the Wright approach, the market risk premium is not an independent parameter, but is defined as the difference between the return on equity estimate and the prevailing risk free rate. The relevance of the Wright approach depends on whether there is an inverse relationship between the market risk premium and the risk free rate.

212. There have been diverging views on the role of the Wright approach.

213. In the 2015 rail WACC decision, the ERA considered that the Wright estimate provided a strong indicator of the likely return on equity for the next 50 years, given the statistical evidence at the time.

214. The statistical evidence that supported the use of the Wright approach was the ERA's analysis of the long-run average market return on equity, the yield on bonds and the market risk premium.[72] The ERA analysis used the Dickey-Fuller statistical test to test for a random walk and draw conclusions on the stationarity of the long-term data.[73, 74] The results:

- Found the market return on equity was stationary (not a random walk).
- Found that yields on bills and bonds were non-stationary (a random walk).
- Found mixed evidence on a stationary market risk premium, with it probably being non-stationary (a random walk).
- Provided empirical support for the Wright approach to establish an upper bound of a market risk premium range.

215. This analysis informed the ERA's position on the Wright approach for subsequent decisions made by the ERA.

216. The ERA subsequently considered new information from a Partington and Satchell review of the ERA's statistical analysis.[75] The Partington and Satchell analysis raised the following concerns with the ERA's analysis:

- Following a random walk is not the only notion of non-stationarity. For example, a process of market evolution will not be a random walk but will be non-stationary.

[72] ERA, *Appendices to the Explanatory Statement for the Rate of Return Guidelines, Appendix 16*, December 2013.

[73] The Dickey-Fuller statistical test is used to establish whether a time series is non-stationary.

[74] A random walk is where changes in a variable follow no discernible pattern or trend, that is, the path of a variable consists of a succession of random steps.

[75] Partington, G. and Satchell, S., *Report to the AER: Discussion of estimates of the return on equity*, April 2017.

- The non-stationary result for yields on bills and bonds may have been the result of very high inflation from 1973 to 1986. Had the analysis used real yields, the results may have been stationary.

- The analysis may have been better done on levels of prices rather than on returns. Partington and Satchell noted that, except in very unusual circumstances, returns were stationary. Prices typically behave like random walks. Therefore, it is better to test the linear combinations of random walk variables and whether they are co-integrated (that is, with the resulting error term being stationary).

- The ERA analysis was not supportive of the Wright approach.

217. Partington and Satchell advised that they were unconvinced by the Wright approach for estimating the market risk premium and recommended that it be given little weight. The Wright CAPM has no "well accepted theoretical support", "does not seem to be much used, if at all, in practice" and "runs contrary to the well accepted view that asset prices are inversely related to interest rates". [76]

218. Partington and Satchell have expressed concern regarding the use of the Wright model to estimate the market risk premium.

> We feel that the Wright approach has no support based on any clear evidence in the Australian context.[77]

219. Furthermore, the AER stated that it did "not agree with the underlying premise of the Wright CAPM that there is a clear inverse relationship between movements in the risk free rate and market risk premium. Consequently, we place limited reliance on the Wright approach."[78]

220. Synergies' submission to the consultation paper argued that the Wright approach should continue to be used and recommended that equal weight be placed on it compared to the historic and dividend growth model approaches.[79]

- Synergies argued that support of the Wright approach was not conditional on the stationary test. However, Synergies did not provide any statistical evidence of the direct relationship been the market risk premium and the risk free rate, or that the return on equity had remained unchanged.

[76] Partington, G. and Satchell, S., *Report to the AER: Cost of equity issues–2016 electricity and gas determinations*, April 2016, p. 31.

[77] Partington, G. and Satchell, S., *Report to the AER: Discussion of estimates of the return on equity*, April 2017, p. 28.

[78] AER, *Final decision: TasNetworks distribution determination 2017-19, Attachment 3 – Rate of return*, April 2017, pp. 3-98, 3-211.

[79] Synergies Economic Consulting, *2018 WACC methodology review for WA railway networks*, June 2018, pp. 40-44.

- Synergies provided some examples of practitioners' comments that it said supported the use of the Wright approach. One of these examples was a 2015 speech from the Governor of the RBA, where the Governor stated that, post-crisis, earnings yields on listed companies seemed to have remained unchanged. However, this analysis inappropriately used the earnings-to-price ratio in place of the required total return on equity. Other quotes detailed that there was no direct correlation between the risk free rate and the return on equity. However, this did not imply a relationship between interest rates and the market risk premium, and therefore did not necessarily support the Wright approach.

221. The ERA considered existing and new evidence to assess the reasonableness of using the Wright approach to estimate the market risk premium. This included expert views, public submissions and considerations that address the Wright approach in the AER's Draft Rate of Return Guidelines.[80]

222. On the basis of all available information, the following information raised concern with the continued use of the Wright approach:

- The Partington and Satchell review of the ERA's past statistical analysis on the stationarity of the return on equity, the market risk premium and the risk free rate found that the analysis did not support the Wright approach.[81]

- Partington and Satchell expressed concern regarding the use of the Wright model in the estimation of the market risk premium.[82]

- There was concern with the "underlying premise of the Wright CAPM that there is a clear inverse relationship between movements in the risk free rate and market risk premium." [83]

- There was lack of support for the use of the Wright approach from the AER's concurrent evidence session.[84]

- ATCO's later submission on Western Power's access arrangement chose not to challenge the ERA's reasoning for disregarding the Wright estimate.[85]

- There was no estimable inverse relationship between the market risk premium and the risk free rate.[86]

[80] AER, *Draft Rate of Return Guidelines – Explanatory Statement,* July 2018.

[81] Partington, G. and Satchell, S., *Report to the AER: Discussion of estimates of the return on equity*, April 2017.

[82] Partington, G. and Satchell, S., *Report to the AER: Discussion of estimates of the return on equity*, April 2017, p. 28.

[83] AER, *Final decision: TasNetworks distribution determination 2017-19, Attachment 3 – Rate of return*, April 2017, pp. 3-98, 3-211.

[84] AER, *Second Concurrent Evidence Session*, April 2018, p. 69.

[85] ATCO, *Re: New Rate of Return Information – Western Power Network Access Arrangement – 2017/18 to 2021/22*, August 2018, p. 4.

[86] AER, *Draft rate of return guidelines – explanatory statement,* July 2018, p. 204.

- The AER considered that the model had no theoretical basis in Australia and was not an appropriate tool for regulatory use, nor was it used by market practitioners.[87]

223. Based on this information, the ERA considered that theoretical and empirical concerns exist with the Wright approach.

224. In the draft determination the ERA did not consider the Wright approach when estimating the market risk premium.

Dividend growth model approach

225. The dividend growth model method examines the forecast future dividends of businesses and estimates the return on equity that makes these dividends consistent with the market valuation of those businesses. The dividend growth model uses forecast dividend growth, forecast future growth rates, current share prices and historical returns on equity in order to estimate the market risk premium. This forward-looking discount rate is the implied market return on equity.

226. In past determinations, the ERA has calculated a range for the dividend growth model estimates of the market risk premium from:

- the ERA's two-stage dividend growth model
- recent dividend growth model studies.

227. As fewer dividend growth model studies are available, the ERA simplified the calculation of the dividend growth model estimate through relying on its own estimate.

228. The ERA's preferred construction of the dividend growth model was the two-stage dividend growth model set out in the Dampier to Bunbury Natural Gas Pipeline (DBNGP) decision.[88] The two-stage model assumes that dividends grow at the long-term growth rate following the dividend forecast period. The ERA deducted the on-the-day estimate of the 10-year risk free rate from the return on equity produced by the dividend growth model.

229. The ERA's two-stage dividend growth model used a point estimate of 4.6 per cent for the long-term growth rate of nominal dividends per share. This rate was informed by the analysis of Lally.[89]

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[87] AER, *Draft rate of return guidelines – explanatory statement,* July 2018, p. 234.

Partington, G. and Satchell, S., *Cost of Equity issues 2016 Electricity and Gas Determinations,* April 2016, pp. 30-31.

Partington, G. and Satchell, S., *Report to the AER*, May 2018, pp. 34-35.

AER, *Draft decision - Multinet Gas access arrangement 2018-22, Attachment 3 - Rate of return*, p. 220.

AER analysis of independent valuation reports for the 2018 rate of return guideline review also indicated no reports appeared to use the Wright CAPM.

[88] ERA, *Final decision on the 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. 115.

[89] Lally, M., *Review of the AER's proposed dividend growth model*, December 2013, p. 14.

230. The ERA considered that the two-stage dividend growth model provided for a simple and reasonable approach:

- The three-stage model is an added complication that does not add much value. In addition, as detailed by Partington, there is significant uncertainty about the optimal construction of the three-stage model and its transition pattern for dividends.[90]
- With a growth rate of 4.6 per cent, the two-stage dividend growth model produces slightly higher results than the three-stage model.[91]
- The extent to which any weight should be applied to the dividend growth model further decreases the small difference between the two-stage and three-stage models.

231. On this basis, to the extent that any weight should be applied to the dividend growth model, the ERA used the two-stage dividend growth model, which produced an estimate of 7.2 per cent as at October 2018.

232. The ERA considered all available information to assess the reasonableness of using the dividend growth model approach to estimate the market risk premium. This included consideration of expert views, public submissions and consideration of the dividend growth model approach in the AER's Rate of Return Guidelines.[92]

233. On the basis of all available information, there were concerns with the dividend growth model approach:

- The dividend growth model method has the benefit of being forward-looking and takes the current economic outlook into account through dividend growth expectations, but is unreliable on its own.[93]
- McKenzie and Partington noted the sensitivity of the model to assumptions and input values:[94]

> Clearly valuation model estimates are sensitive to the assumed growth rate and a major challenge with valuation models is determining the long run expected growth rate. There is no consensus on this rate and all sorts of assumptions are used: the growth rate in GDP; the inflation rate; the interest rate; and so on. A potential error in forming long run growth estimates is to forget that this growth in part comes about because of injections of new equity capital by shareholders. Without allowing for this injection of capital, growth rates will be overstated and in the dividend growth model this leads to an overestimate of the market risk premium.

[90] Partington, G., *Report to the AER: Return on equity (Updated)*, April 2015, pp. 26, 52.

[91] AER, *Final decision: TasNetworks distribution determination 2017-19, Attachment 3 – Rate of return*, April 2017, p. 3-222.

[92] AER, *Draft Rate of Return Guidelines – Explanatory Statement,* July 2018.

[93] McKenzie, M. and Partington, G., *Report to the AER – Supplementary report on the equity market risk premium*, February 2012, p. 14.

[94] McKenzie, M. and Partington, G., *Equity market risk premium*, December 2011, p. 25.

- Partington and Satchell's review of the role of the dividend growth model to estimate the market risk premium raised a number of concerns.[95] Partington and Satchell considered it very unlikely that the dividend growth model would produce a forward-looking market risk premium commensurate with the prevailing conditions in the market for funds.[96]

- The AER analysed the historical results from its construction of the dividend growth model and found that there was a large negative correlation between the market risk premium estimates from the dividend growth model and the risk free rate. This means that the dividend growth model implicitly assumes a stable return on equity, which is inconsistent with the view that there is a lack of support for an inverse relationship between the risk free rate and the market risk premium.[97]

- The AER stated that the dividend growth model had some merit as a theoretical model but that concerns about inputs, biases and sensitivities have limited its use.[98]

- Given the concerns with the dividend growth model, Partington and Satchell considered that it was not appropriate to apply equal weights to the historic market risk premium and the dividend growth model.[99]

- Furthermore, the AER did not propose to use the dividend growth model to directly inform the market risk premium estimate.[100]

234. Based on available information, the ERA considered that the dividend growth model had the following weaknesses:

- There was no clear agreement among experts as to the best form for the dividend growth model, or its inputs.

- The dividend growth model was sensitive to its assumptions.

- Forecasts of future earnings and dividends were inaccurate over more than two years.

- The dividend growth model was subject to upward bias from the smoothed or sticky nature of dividends.

- Biases in analyst forecasts can lead to biased dividend growth model forecasts of the market risk premium.

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95 Partington, G. and Satchell, S., *Report to the AER: Discussion of Estimates of the Return on Equity*, April 2017.

96 Partington, G. and Satchell, S., *Report to the AER: Discussion of Estimates of the Return on Equity*, April 2017, p. 25.

Partington, G. and Satchell, S., *Report to the AER: Allowed rate of return 2018 Guideline review*, May 2018, p. 33;

97 AER, *Draft rate of return guidelines – explanatory statement,* July 2018, p. 221.

98 AER, *Draft rate of return guidelines – explanatory statement,* July 2018, p. 235.

99 Partington, G. and Satchell, S., *Report to the AER: Discussion of Estimates of the Return on Equity*, April 2017, p. 27.

100 AER, *Draft rate of return guidelines – explanatory statement,* July 2018, p. 236.

- The dividend growth model was likely to be upwardly biased when interest rates are low.

- The dividend growth model estimates provide a single discount rate, which equates the present value of the future infinite dividend stream with the observed share price.

235. ATCO's submission on the ERA's draft decision on Western Power's most recent proposed revised access arrangement referred to an ERA rail decision from October 2017 that included a market risk premium determined by effectively giving 100 per cent weight to the dividend growth model. The ERA noted that this rail decision was the application of a past rail method, and not a review of the market risk premium method.

236. The ERA recognised that it had past concerns with the use of the dividend growth model and noted that ATCO argued that some of the ERA's concerns were not new and therefore it should not adjust its view. However, new information, submissions and further advice over the course of the ERA's rate of return reviews[101] gave the ERA cause to give greater weight to these weaknesses of the dividend growth model.

237. At any point in time, the ERA's estimation of the market risk premium will need to be informed by a range of relevant material. The relative contributions of different estimation methods for the market risk premium should be conditioned by their quality, including the potential to introduce bias. The averaging over different estimation methods for the market risk premium should be informed by the quality of the estimates used and the extent to which the estimates are unbiased.

238. Based on this information, the ERA had diminished confidence in the dividend growth model and considered that it was reasonable to place less reliance on the dividend growth model, relative to the historic market premium.

Conditioning variables

239. In its determinations for electricity and gas, the ERA adopted forward-looking indicators of market conditions for the next five years in order to select a point estimate within the range of the market risk premium. These indicators included:

- dividend yields on the All Ordinaries Index

- interest rate swap spreads

- default spreads

- the Australian Securities Exchange (ASX) 200 volatility index.

240. While these conditioning forward-looking indicators were relevant for gas and electricity, these indicators were of limited relevance for setting the rail WACC. This was because the rate of return for railways regulated under the Code was long term, approaching 50 years. The indicators used for electricity and gas decisions are all shorter term (five years). The ERA therefore considered that the indicators had limited relevance for the rail WACC estimates, and did not take the indicators into account.

[101] Including the Western Power Access Arrangement 20 Sept 2018 and the Gas Rate of Return Guidelines 16 December 2018.

Determining point estimate

241. For the purposes of the draft determination, the ERA used the following approach to estimate the market risk premium:

- Placed more reliance on the historic market premium, relative to the dividend growth model. The historic market premium is a simple and well-accepted method for calculating the market risk premium using historical data. Historical averages of the market premium are widely used by financial practitioners and regulators in Australia. The ERA considered historical averages provided the best source of evidence available to estimate the market risk premium.

- Placed less reliance on the dividend growth model, relative to the historic market premium. While the dividend growth model has the benefit of taking the current economic outlook into account, it is unreliable on its own. The dividend growth model suffers from weaknesses including the form of the model, its input assumptions, its sensitivity to assumptions and its upward bias.

- Determined a final point estimate of the market risk premium by using its regulatory judgement considering the relative merits of all relevant material.

242. The final point estimate of the market risk premium was rounded to one decimal point.

243. The market risk premium estimated for the rail rate of return was different to that estimated by the ERA for gas or electricity. While the method for calculating the market risk premium for rail was similar to that used by the ERA for gas and electricity, the use of the 10-year risk free rate in rail meant that market risk premiums were not directly comparable.

244. To determine the final point estimate of the market risk premium adopted in this rail WACC draft determination:

- Updated analysis indicated that the best estimate of the market risk premium using historical data on market risk premium was 5.6 per cent as at December 2017.

- Updated analysis indicated that the best estimate of the market risk premium using its two-stage dividend growth model was 7.2 per cent as at October 2018.

- Regulatory discretion was used to select the final point estimate of the market risk premium from the historical data method and the dividend growth model method with the view that estimates of the market risk premium from historical data were given a greater weight than estimates from the dividend growth model.

245. In summary, on the basis of all available information, together with its regulatory discretion, the ERA considered that an estimate of the market risk premium of 5.9 per cent was consistent with the easing of risk conditions in Australia, and with the diminished confidence in the robustness of dividend growth model estimates.

246. For the draft determination, the ERA adopted a market risk premium of 5.9 per cent.

8.2.3 Public submissions

247. Arc Instructure's submission discussed the market risk premium.

248. Arc Infrastructure submitted that the ERA should have due regard to the Wright approach. Arc Infrastructure considered that the ERA had previously used the Wright approach and the QCA adopted the approach.[102]

8.2.4 Final determination

Wright approach

249. The ERA has considered existing and new evidence to assess the reasonableness of using the Wright approach to estimate the market risk premium. This included expert views, public submissions and the AER's Rate of Return Guidelines.

250. On the basis of all available information, the following information raises concern with the continued use of the Wright approach:

- The Partington and Satchell review of the ERA's past statistical analysis on the stationarity of the return on equity, the market risk premium and the risk free rate found that the analysis did not support the Wright approach.[103]
- Partington and Satchell expressed concern regarding the use of the Wright model in the estimation of the market risk premium.[104]
- There was concern with the "underlying premise of the Wright CAPM that there is a clear inverse relationship between movements in the risk free rate and market risk premium." [105]
- There was lack of support for the use of the Wright approach from the AER's concurrent evidence session.[106]
- There was no estimable inverse relationship between the market risk premium and the risk free rate.[107]
- There is some statistical evidence that is more supportive of the stability of the market risk premium than of the stability of the (real) cost of equity.[108]

[102] Arc Infrastructure, *WACC Review – Response to Draft Determination – 2018 Weighted Average Cost of Capital,* 31 May 2019, p. 4.

[103] Partington, G. and Satchell, S., *Report to the AER: Discussion of estimates of the return on equity*, April 2017.

[104] Partington, G. and Satchell, S., *Report to the AER: Discussion of estimates of the return on equity*, April 2017, p. 28.

[105] AER, *Final decision: TasNetworks distribution determination 2017-19, Attachment 3 – Rate of return*, April 2017, pp. 3-98, 3-211.

[106] AER, *Second Concurrent Evidence Session*, April 2018, p. 69.

[107] AER, *Draft rate of return guidelines – explanatory statement,* July 2018, p. 204.

[108] Queensland Competition Authority, *Aurizon Network's 2017 draft access undertaking - Appendices*, December 2018, p. 68.

- The AER considered that the model had no theoretical basis in Australia and was not an appropriate tool for regulatory use, nor was it used by market practitioners.[109]

251. Based on this information, the ERA continues to consider that theoretical and empirical concerns exist with the Wright approach.

252. For the final determination the ERA does not consider the Wright approach when estimating the market risk premium.

Determining the point estimate

253. For the purposes of the final determination, the ERA will continue to use the following approach to estimate the market risk premium:

- Place more reliance on the historic market premium, relative to the dividend growth model. The historic market premium is a simple and well-accepted method for calculating the market risk premium using historical data. Historical averages of the market premium are widely used by financial practitioners and regulators in Australia. The ERA considers that historical averages provide the best source of evidence available to estimate the market risk premium.

- Place less reliance on the dividend growth model, relative to the historic market premium. While the dividend growth model has the benefit of taking the current economic outlook into account, it is unreliable on its own. The dividend growth model suffers from weaknesses including the form of the model, its input assumptions, its sensitivity to assumptions and its upward bias.

- Determine a final point estimate of the market risk premium by using its regulatory judgement considering the relative merits of all relevant material.

254. The final point estimate of the market risk premium will be rounded to one decimal point.

255. To determine the final point estimate of the market risk premium adopted in this rail WACC final determination:

- Analysis indicates that the best estimate of the market risk premium using historical data on market risk premium was 5.6 per cent at December 2017.

- Analysis indicates that the best estimate of the market risk premium using its two-stage dividend growth model was 7.2 per cent at October 2018.

- Regulatory discretion is used to select the final point estimate of the market risk premium from the historical data method and the dividend growth model method with the view that estimates of the market risk premium from historical data were given a greater weight than estimates from the dividend growth model.

[109] AER, *Draft rate of return guidelines – explanatory statement,* July 2018, p. 234.
Partington, G. and Satchell, S., *Cost of Equity issues 2016 Electricity and Gas Determinations,* April 2016, pp. 30-31.
Partington, G. and Satchell, S., *Report to the AER*, May 2018, pp. 34-35.
AER, *Draft decision - Multinet Gas access arrangement 2018-22, Attachment 3 - Rate of return*, p. 220.
AER analysis of independent valuation reports for the 2018 rate of return guideline review also indicated no reports appeared to use the Wright CAPM.

256. In summary, on the basis of all available information, together with its regulatory discretion, the ERA considers that an estimate of the market risk premium of 5.9 per cent is consistent with the easing of risk conditions in Australia, and with the diminished confidence in the robustness of dividend growth model estimates.

257. For the final determination, the ERA has adopted a market risk premium of 5.9 per cent.

258. This market risk premium will remain fixed until the next rail WACC method review.

8.3 Equity beta

8.3.1 Background

259. Equity beta is the 'slope' parameter β_i in the Sharpe Lintner CAPM. The slope parameter β_i 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.

$$R_e = R_f + \beta_e \left(R_m - R_f \right) \qquad \text{(equation 8)}$$

where:

R_e is the required rate of return on equity for the asset, firm or industry in question

R_f is the risk-free rate

β_e is the equity beta that describes how a particular portfolio i will follow the market which is defined as: $\beta_e = \text{cov}\left(r_i, r_M\right) / \text{var}\left(r_M\right)$

$\left(R_m - R_f\right)$ is the market risk premium, the MRP.

260. The risk of an asset is typically thought of as the variance in asset returns. This variance is a measure of the total risk of an asset. Total risk consists of systematic and non-systematic risk. Systematic risk is that part of total risk in a firm's returns that stems from the economy and markets more broadly. Systematic risk cannot be easily eliminated through diversification. Non-systematic risk is the risk stemming from unique attributes of the firm, which may be eliminated by an investor through diversification. For this reason, only systematic risk is compensated in the return on equity.

261. The equity beta is a parameter that measures the systematic risk of a security or a portfolio in comparison to the market as a whole.

262. Two risk factors are generally considered to affect the value of equity beta for a particular firm:

- The type of business, and associated capital assets, that the firm operates measured by asset or un-levered beta.
- The amount of financial leverage (gearing) employed by the firm, which levers or amplifies the asset beta to arrive at equity beta.

8.3.2 Draft determination

Beta estimation method

263. Consistent with the ERA's practice of determining an appropriate beta for regulated businesses in electricity, gas, water and rail, the ERA considered that empirical evidence must be used to inform its judgment for equity beta.

264. For the purposes of calculating rail equity betas, the ERA continued to:

- Use the methods set out in Henry's advice to the ACCC in 2009 to define the equity beta estimation approach. [110] [111]
- Employ the following methods to calculate beta:
  - the Least Absolute Deviations (LAD) method
  - the Ordinary Least Squares (OLS) method
  - the Maximum Likelihood Robust (MM) method
  - the Theil-Sen (T-S) method.
- Use the Brealey-Myers formula to de-lever and re-lever betas.[112]
- Apply its regulatory discretion when assessing beta estimates and determining final equity beta estimates.

265. The ERA noted that for rail there was a lack of comparable Australian companies. As a consequence, and consistent with its 2015 rail WACC approach, the ERA relied on overseas railway network operators in order to form the benchmark samples to estimate equity beta for the Public Transport Authority, Arc Infrastructure and Pilbara Railways.

266. For the 2018 rail WACC review, the ERA used weekly data for the 10-year data period from 1 January 2009 to 31 December 2018. This was consistent with the long lives of rail assets and the Western Australian regulatory rail framework.

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[110] Henry, O., *Estimation Beta: Advice Submitted to the Australian Competition and Consumer Commission*, April 2009.

[111] Henry, O., *Estimating Beta: An update*, April 2014.

[112] The Brealey-Myers formula are used to de-lever and re-lever betas. All equity betas are de-levered using the sample firm's average gearing ratio. These asset betas are then re-levered by the benchmark gearing.

$$\beta_a = \frac{E}{(D+E)}\beta_e$$

where:

β_a is the asset beta

β_e is the equity beta

E is the value of debt

D is the value of equity.

267. The asset betas for the three benchmark samples are presented below.

Public Transport Authority empirical estimates

268. The ERA continued the Public Transport Authority's benchmark sample for the purposes of estimating equity beta.

269. Macquarie Atlas Roads became Atlas Arteria after splitting from Macquarie. In this analysis, the new name together with its new Bloomberg's ticker were used.

270. For the 10-year period from 1 January 2009 to 31 December 2018, estimated asset betas for benchmark sample firms for the Public Transport Authority are presented in Table 14.

Table 14 Estimated asset betas for Public Transport Authority benchmark sample, January 2009 – December 2018

Name	Country	Industry	Estimates of asset beta				
			OLS	LAD	MM	Theil Sen	Average
Vinci SA	France	Toll roads	0.56	0.60	0.58	0.57	0.58
Abertis Infraestructuras S.A	Spain	Toll roads	0.32	0.30	0.31	0.29	0.31
Atlantia SPA	Italy	Toll roads	0.34	0.34	0.34	0.33	0.34
European average							**0.41**
Atlas Arteria	Australia	Toll roads	0.45	0.40	0.41	0.40	0.42
Transurban Group	Australia	Toll roads	0.29	0.27	0.26	0.27	0.28
Australian average							**0.35**
Average of the benchmark sample							**0.38**

Source: ERA analysis with data from Bloomberg

271. The Public Transport Authority's benchmark sample produced the following estimates of the asset beta:

- a mean of 0.38
- a range of 0.26 to 0.60.

272. The systematic risk present in the benchmark sample above was expected to be higher than that of the Public Transport Authority rail network. The Public Transport Authority rail network primarily transports passengers via rail across the Perth metropolitan area and its systematic risk is likely to be far lower than that of a toll road company.

273. In addition, the comparator company Vinci SA was a diversified business providing other services and owning and operating other types of assets. Vinci SA's systematic risk was likely to be higher than that of the Public Transport Authority network.

274. Consistent with its 2015 rail WACC review, the ERA used its discretion to select a relevant asset beta at the lower end of the empirically derived estimated range.

275. Therefore, it was appropriate to maintain the Public Transport Authority's asset beta at 0.3.

Arc Infrastructure empirical estimates

276. The ERA continued the Arc Infrastructure benchmark sample for the purposes of estimating equity beta.

277. For the 10-year period from 1 January 2009 to 31 December 2018, estimated asset betas for benchmark sample firms for Arc Infrastructure are presented in Table 15.

Table 15 Estimated asset betas for Arc Infrastructure benchmark sample, January 2009 – December 2018

Name	Country	Industry	Estimates of asset beta				
			OLS	LAD	MM	Theil Sen	Average
Genesee & Wyoming Inc.	US	Rail freight	1.09	1.02	1.04	1.06	1.05
Union Pacific Corporation	US	Rail freight	1.00	0.98	0.97	0.99	0.99
Norfolk Southern Corporation	US	Rail freight	0.97	0.93	0.94	0.96	0.95
Kansas City Southern	US	Rail freight	1.12	1.11	1.11	1.11	1.11
CSX Corporation	US	Freight	1.05	1.03	1.02	1.03	1.03
United States average							**1.03**
Canadian Pacific Railway	Canada	Rail freight	0.88	0.79	0.84	0.83	0.84
Canadian National Railway	Canada	Rail freight	0.73	0.72	0.73	0.71	0.72
Canadian average							**0.78**
Aurizon Holdings	Australia	Freight	0.60	0.64	0.64	0.64	0.63
Toll Holdings Limited	Australia	Freight	0.66	0.36	0.48	0.46	0.49
Asciano Limited	Australia	Rail freight	0.64	0.44	0.43	0.42	0.48
Australian average							**0.53**
Port of Tauranga	New Zealand	Ports and cargo	0.33	0.48	0.50	0.46	0.44
New Zealand average							**0.44**
Average of the benchmark sample							**0.70**

Source: ERA analysis with data from Bloomberg

278. Arc Infrastructure's benchmark sample produced the following asset beta results:

- a mean of 0.70
- a range of 0.33 to 1.12.

279. In its 2015 rail WACC review, to assess Arc Infrastructure's asset beta of 0.7:

- Aurizon was potentially the best comparable company to the Arc Infrastructure network, given that it operated in Australia and transported a similar mix of bulk commodities and general freight. However, there were differences between the networks, particularly the reliance of Arc Infrastructure on local grain supply.

- Other Australian firms in the Arc Infrastructure benchmark sample were non-rail comparators Toll and Asciano. The ERA considered that non-rail operators were a less valid proxy company compared to the rail operators. That said, these comparators either incorporated rail operations (Asciano) or operated in similar markets for transport services (Toll).

- For overseas rail operators, the ERA argued they would possess a higher level of systematic risk, relative to an Australian railway operator, given that American and Canadian railway operators were expected to face higher degrees of competition from alternative forms of transportation such as roads.

- For the New Zealand port comparator, it was expected that it would have a lower level of systematic risk, given the diverse nature of port operations covering road, rail and shipping.

280. Synergies provided a detailed submission on beta in response to the ERA's rail WACC consultation paper. Synergies' qualitative risk analysis was to decouple the link between Arc Infrastructure and Aurizon. Synergies argued that there were considerable differences between the two firms and recommended an asset beta for Arc Infrastructure of 0.75, if not higher.

281. The ERA considered that Arc Infrastructure and Aurizon had different risk profiles and it may not be reasonable to assume the two firms' asset betas were the same.

282. However, Synergies qualitative analysis did not provide additional evidence of the best approach on which the equity beta for Arc Infrastructure can be estimated. The ERA continued to consider that a beta estimate for Arc Infrastructure is best determined using a benchmark sample.

283. The benchmark sample includes Aurizon, which is the only listed Australian railway. However, the benchmark sample does not solely rely on Aurizon. Therefore, to estimate Arc Infrastructure's beta the ERA considered all available information from the benchmark sample.

284. In summary, in considering Arc Infrastructure's asset beta for the 2018 rail WACC review draft determination the ERA considered that:

- The Aurizon network was not a directly comparable company to Arc Infrastructure. There were differences in the operations of the businesses which meant that it was likely that the Aurizon network would have a lower risk than that of the Arc Infrastructure network. Therefore, while Aurizon may have some value as a comparator, it was likely that Arc Infrastructure's asset beta would be higher.

- There was some value in the comparators Toll (which operated in similar markets) and Asciano (which incorporated rail operations).

- Overseas rail operators would possess a higher level of systematic risk, relative to an Australian railway operator.

- The New Zealand port comparator would have a lower level of systematic risk.

285. The 2018 average estimate across regions for Arc Infrastructure's benchmark sample was 0.70.

286. On balance, the ERA used its discretion to select a relevant asset beta close to the benchmark sample average across regions but higher than that of Aurizon.

287. Therefore, consistent with its 2015 rail WACC review, for the draft determination that it was appropriate to maintain Arc Infrastructure's asset beta at 0.7.

Pilbara Railways empirical estimates

288. The ERA continued the Pilbara Railways' benchmark sample for the purposes of estimating equity beta.

289. For the 10-year period from 1 January 2009 to 31 December 2018, estimated asset betas for benchmark sample firms for the Pilbara Railways are presented in Table 16.

Table 16 Estimated asset betas for Pilbara Railways' benchmark sample, January 2009 – December 2018

Name	Country	Industry	Estimates of asset beta				
			OLS	LAD	MM	Theil Sen	Average
Genesee & Wyoming Inc.	US	Rail freight	1.09	1.02	1.04	1.06	1.05
Union Pacific Corporation	US	Rail freight	1.00	0.98	0.97	0.99	0.99
Norfolk Southern Corporation	US	Rail freight	0.97	0.93	0.94	0.96	0.95
Kansas City Southern	US	Rail freight	1.12	1.11	1.11	1.11	1.11
CSX Corporation	US	Freight	1.05	1.03	1.02	1.03	1.03
United States average							**1.03**
Canadian Pacific Railway	Canada	Rail freight	0.88	0.79	0.84	0.83	0.83
Canadian National Railway	Canada	Rail freight	0.73	0.72	0.73	0.71	0.72
Canadian average							**0.78**
Average of the benchmark sample							**0.90**

Source: ERA analysis with data from Bloomberg.

290. The Pilbara Railways' benchmark sample produced the following asset beta results:

- a mean of 0.90
- a range of 0.71 to 1.12.

291. In its 2015 rail WACC review, to assess the Pilbara Railways' asset beta of 1.05:

- An appropriate asset beta for the Pilbara Railways would be higher than that of the average overseas comparator rail networks, given the importance of general freight for the overseas networks.
- The Pilbara Railways were likely to have a higher level of risk than an intermodal or general freight railway as the Pilbara Railways were single commodity railways in a remote location that exclusively served mining-related export demand.

- Genesee & Wyoming was the best (albeit imperfect) comparator for the Pilbara Railways. Genesee & Wyoming was likely to be the best comparator for a short-line railway and had characteristics that were sensitive to overseas markets.[113]

- Aurizon provided a comparator for the Pilbara Railways, given that it operated in Australia and was reliant on transporting export commodities to coastal ports. However, the ERA considered that the Pilbara Railways were likely to face a higher risk of operation and investment in comparison with Aurizon. Aurizon's revenue cap distinguished it from railroads in the US and Canada.

292. To consider the Pilbara Railways' asset beta for the 2018 rail WACC draft determination:

- The ERA maintained its position that Genesee & Wyoming was likely to be the best comparator in the benchmark sample for the Pilbara Railways.

- The ERA considered that Aurizon was not a direct comparator for the Pilbara Railways.

- The ERA noted that the beta for Genesee & Wyoming and the average benchmark sample has reduced slightly.

293. On balance, the ERA used its discretion to select a relevant asset beta for the Pilbara Railways that placed the most weight on the Genesee & Wyoming estimate.

294. Therefore, it was appropriate to set the Pilbara Railways' asset beta at 1.00.

The ERA's beta determination

295. The ERA determined the following 2018 betas for the draft determination:

- The Public Transport Authority – an asset beta of 0.3, combined with estimated gearing of 50 per cent, which gives an equity beta of 0.6.

- Arc Infrastructure – an asset beta of 0.70, combined with estimated gearing of 25 per cent, which gives an equity beta of 0.9.

- Pilbara Railways – an asset beta of 1.00, combined with estimated gearing of 20 per cent, which gives an equity beta of 1.3.

[113] The short-line railways are the railway companies operating over a relatively short distance in comparison with national railway networks.

8.3.3 Public submissions

296. No public submissions were received on the equity beta in response to the draft determination.

8.3.4 Final determination

297. For the final determination, the ERA maintains its approach to estimating beta detailed in the draft determination.

298. For the 2018 rail WACC review, the ERA determines the following betas for the final determination:

- The Public Transport Authority – an asset beta of 0.3, combined with estimated gearing of 50 per cent, which gives an equity beta of 0.6.
- Arc Infrastructure – an asset beta of 0.70, combined with estimated gearing of 25 per cent, which gives an equity beta of 0.9.
- Pilbara Railways – an asset beta of 1.00, combined with estimated gearing of 20 per cent, which gives an equity beta of 1.3.

299. Equity betas will remain fixed until the next rail WACC method review.

9 Value of imputation credits (gamma)

9.1 Background

300. The imputation tax system prevents corporate profits from being taxed twice. Prior to the introduction of imputation on 1 July 1987, company profits were taxed once at the corporate level and again at the dividend recipient level (for example, as personal income tax). Under the Australian imputation tax system, franking credits are distributed to investors at the time that dividends are paid and provide an offset to those investors' taxation liabilities.

301. The gamma parameter accounts for the reduction in the effective corporate taxation that arises from the distribution of franking credits to investors. Generally, investors who are able to use franking credits will accept a lower required rate of return, before personal tax, on an investment that has franking credits, compared with an investment that has similar risk and no franking credits.

302. The ERA uses the Officer framework to adjust the WACC to incorporate the value of imputation credits.[114] This provides a framework for calculation of a nominal pre-tax WACC, as follows:

$$WACC_{nom} = R^{e}_{post} * \frac{1}{(1-T*(1-\gamma))} * \frac{E}{V} + R^{d}_{pre} * \frac{D}{V} \qquad \text{(equation 9)}$$

where:

$WACC_{nom}$	is the nominal pre-tax weighted average cost of capital
R^{e}_{post}	is the post-tax rate of return on equity, or cost of equity
R^{d}_{pre}	is the pre-tax rate of return on debt, or the cost of debt
T	is the tax rate
γ	is the value of imputation credits (gamma)
E/V	is the proportion of equity in the total financing (comprising equity and debt)
D/V	is the proportion of debt in the total financing.

303. Gamma is commonly estimated through the Monkhouse formula as the product of the distribution rate and the utilisation rate, as follows: [115]

gamma = distribution rate x utilisation rate (equation 10)

[114] Officer, B., *The cost of capital of a company under an imputation tax system*, Accounting and Finance, May 1994.

[115] Monkhouse, P., *The Valuation of Projects under a Dividend Imputation Tax System*, *Accounting and Finance 36*, 1996, pp. 185-212.

304. The distribution rate represents the proportion of imputation credits created that is expected to be distributed to investors.

305. The distribution of franking credits differs amongst companies, 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 value of gamma required for use in the rail WACC is difficult to identify.

306. The utilisation rate is the weighted average of the utilisation rates of individual investors, with investors able to fully use the credits having a rate of 1 and those unable to use them having a rate of zero.

9.2 Draft determination

307. In the draft determination, the ERA considered its approach to gamma given:

- The finalisation of limited merits and court reviews of gamma.
- New developments in gamma identified during the ERA's recent considerations for the gas rate of return guidelines and Western Power's final access arrangement decision.[116] [117]
- Clarification from the ATO on the use of its data for the purpose of estimating gamma. [118] [119] [120]
- Public submissions received by the ERA on gamma associated with its electricity, gas and rail determinations.
- New advice from Lally on gamma.[121] [122] [123]

[116] ERA, *Explanatory Statement for the Rate of Return Guidelines,* 18 December 2018.

[117] ERA, *Final Decision on Proposed Revisions to the Access Arrangement for the Western Power Network – Appendix 5 Return on Regulated Capital Base,* 20 September 2018.

[118] ATO note to the AER regarding imputation. Available at: https://www.aer.gov.au/system/files/ATO%20Note%20to%20AER%20regarding%20imputation%20-%209%20May%202018.pdf

[119] AER minute on meeting with ATO. Available at: https://www.aer.gov.au/system/files/AER%20-%20Minute%20of%2021%20June%202018%20meeting%20with%20ATO%20and%20comments%20on%20ENA%20summary%20-%205%20July%202018_1.DOCX

[120] AER minute on meeting with ATO. Available at: https://www.aer.gov.au/system/files/ATO%20Note%20-%20Clarification%20of%20points%20in%20previous%20ATO%20note%20dated%209%20May%202018%20titled%20'ATO%20note%20to%20the%20AER%20regarding%20imputation%27%20-%2014%20September%202018.pdf

[121] Lally, M., *Review of gamma submission and the ERAWA's views on gamma,* July 2018.

[122] Lally, M., *Estimating the Distribution Rate for Imputation Credits for the Top 50 ASX Companies*, October 2018.

[123] Lally, M., *The Estimation of Gamma: Review of Recent Evidence*, December 2018.

9.2.1 Gamma reviews

308. The estimate of gamma has been the subject of some contention in recent Australian regulatory decisions, with network businesses consistently proposing a gamma value of 0.25, and the ERA and AER setting a value of 0.40.

309. There has been contention about the definition of the value of franking credits.

310. Synergies also took a differing position on the definition of value and argued that gamma was the product of:

- The proportion of tax paid that has been distributed to shareholders as franking credits (the distribution rate).
- The value the marginal investor places on $1 of franking credits, which Synergies referred to as the market value of franking credits.

311. The Australian Competition Tribunal has conducted several limited merits reviews on the estimate of gamma under the National Electricity Rules and National Gas Rules, with the following outcomes:

- In February 2016, the Tribunal found in favour of the New South Wales networks Ausgrid, Endeavour Energy and Essential Energy that gamma should be 0.25. In March 2016, the AER applied to the Federal Court for judicial review of the Tribunal decisions to set aside the New South Wales and Australian Capital Territory electricity and gas distribution network revenue determinations. In May 2017, the full Federal Court upheld the AER's appeal in respect of the Tribunal's construction of the rules regarding gamma.[124]
- In June 2016, the Tribunal found in favour of ATCO that gamma should be 0.25. At that time there was no final determination of the full Federal Court appeal of the AER decision.
- In October 2016, the Tribunal found in favour of the AER against SA Power Networks, that gamma should be 0.4. SA Power Networks appealed the Tribunal decision to the Federal Court. In January 2018, the full Federal Court affirmed the AER's decision on gamma for a value of 0.4.[125]
- DBNGP appealed the ERA's gamma decision for its access arrangement decision. In July 2018, the Tribunal dismissed the application for merits review.

312. Contemporary Tribunal and Federal Court judicial reviews all upheld the reasoning in the regulator's decision and found no error with the value of 0.4 and how it was derived. This included clarification of the definition of value and gamma and the reasonableness of the use of the utilisation approach.

313. The ERA considered that the recent regulatory decisions and legal reviews were relevant to its considerations on the method of how to estimate gamma for rail. These reviews confirmed the ERA's utilisation approach as appropriate.

[124] Federal Court of Australia, Australian Energy Regulator v Australian Competition Tribunal (No 2) [2017] FCAFC 79, May 2017

[125] Federal Court of Australia, SA Power Networks v Australian Competition Tribunal (No 2) [2018] FCAFC 3, Jan 2018.

9.2.2 Taxation statistics

314. As part of the AER's 2018 review of its rate of return guidelines, it sought clarification from the ATO on the use of tax statistics to estimate gamma.

315. In May 2018, the ATO advised the AER that taxation statistics data should not be used for detailed time series analysis of the imputation system. The ATO recommended that taxation statistics data not be used as the basis of a detailed macro analysis of Australia's imputation system.[126]

316. On 21 June 2018, the AER, ATO, experts and network stakeholders had a meeting to clarify the ATO's note. The minutes for this meeting are available on the AER website.[127] At this meeting, the ATO confirmed its concern with the use of tax statistics in time series analysis for gamma, including that:

- Tax statistics should not be used to reconcile the imputation system.
- Using aggregate data related to the imputation system from taxation statistics (including franking account balance [FAB], net tax amounts, dividends) in a time series analysis does not allow for entries and exits of businesses and therefore this analysis will be flawed.

317. On 14 September 2018, the ATO provided a further note stating that taxation statistics data should not be applied to all aspects of the imputation system.[128]

318. Lally, who also attended the June 2018 meeting, considered that the ATO's September 2018 note stated unequivocally that no ATO data should be used for examining the imputation system.[129]

319. Given the credibility of the ATO data and the opinion expressed by the ATO, the ERA considered that ATO data should not be used to determine gamma.

9.2.3 Lally review

320. To assist with its consideration of gamma, the ERA commissioned Dr Lally to:

- Review public submissions on the ERA's approach to gamma in its draft decision on Western Power's AA4, including detailed consultant reports submitted by ATCO.

[126] ATO note to the AER regarding imputation. Available at: https://www.aer.gov.au/system/files/ATO%20Note%20to%20AER%20regarding%20imputation%20-%209%20May%202018.pdf

[127] AER minute available at: https://www.aer.gov.au/system/files/AER%20-%20Minute%20of%2021%20June%202018%20meeting%20with%20ATO%20and%20comments%20on%20ENA%20summary%20-%205%20July%202018_1.DOCX

[128] Available at: https://www.aer.gov.au/system/files/ATO%20Note%20-%20Clarification%20of%20points%20in%20previous%20ATO%20note%20dated%209%20May%202018%20titled%20'ATO%20note%20to%20the%20AER%20regarding%20imputation%27%20-%2014%20September%202018.pdf

[129] Lally, M., *The Estimation of Gamma: Review of Recent Evidence*, December 2018, p. 6.

- Review the ERA's approach to gamma in its draft gas rate of return guidelines.
- Account for the AER's recent consultation process.
- Express a view on the ERA's approach to gamma in the draft gas rate of return guidelines.

321. The findings from Lally's July 2018 review of gamma are summarised below.[130]

- Lally largely concurred with the ERA's views. The only major exception was the ERA's view that, despite using a domestic version of the CAPM, internal consistency required that the estimate of gamma take account of the presence of foreign investors. Lally took the view that the model was for the domestic CAPM, with no foreign investors. Therefore, the distribution rate should theoretically be one.[131]
- The empirical reality was that the market was partially integrated.[132]
- There was no suitable model that recognised the empirical reality that national equity markets were partially integrated. Lally favoured estimating the cost of equity using a model that assumed complete segregation of national equity markets, and also from one that assumed complete integration of these markets, followed by exercising judgement in choosing between these two boundary values.[133]
- Lally favoured the use of ABS data to estimate the proportion of Australian equities held by local investors.[134]
- Lally disagreed with the three principal propositions from Frontier:[135]
  - The principal drawback with using ATO data to estimate gamma was that it implicitly estimated the distribution rate for the average firm rather than the benchmark efficient entity. In addition, an estimate of the utilisation rate was still required.
  - There were deficiencies in the ABS data but not as large as those in the ATO data. The revision to the ABS data was not a concern and improved the data set.
  - The review addressed Lally's analysis of financial statements:

[130] Lally, M., *Review of gamma submission and the ERAWA's views on gamma,* 25 July 2018.
[131] Lally, M., *Review of gamma submission and the ERAWA's views on gamma,* 25 July 2018, p. 3.
[132] Lally, M., *Review of gamma submission and the ERAWA's views on gamma,* 25 July 2018, p. 3.
[133] Lally, M., *Review of gamma submission and the ERAWA's views on gamma,* 25 July 2018, p. 3.
[134] Lally, M., *Review of gamma submission and the ERAWA's views on gamma,* 25 July 2018, p. 17.
[135] Lally, M., *Review of gamma submission and the ERAWA's views on gamma,* 25 July 2018, p. 3.

- While the 20 companies examined had substantial foreign income and this was not a feature of the benchmark efficient entity, Frontier offered no empirical evidence that this increased the distribution rate. Lally showed that as the proportion of foreign income increased the distribution rate decreased, which was the opposite direction claimed by Frontier. Lally showed that the distribution rate would increase with the removal of firms with high foreign income.

- Lally demonstrated that delay in the transmission of credits from the source companies to ultimate users had an immaterial effect. Lally demonstrated credits trapped in intermediaries did not materially reduce the distribution rate.

- Frontier referred to errors in a previous report by Lally. Frontier ignored later reports from Lally that corrected those errors. In any case, the correction of errors in the distribution rate using financial statement data did not change the estimate of 83 per cent using 2000 to 2013 data and extension of the data to 2017 raised the estimate to 88 per cent.

322. The ERA commissioned further advice from Lally to response to further public submissions on gamma. Lally's further September 2018 advice can be summarised as follows.[136]

- Frontier's detailed concerns with Lally's distribution rate calculation were:
  - The problems with the use of the ATO FAB data applied equally to the franking balance data drawn from the financial statements of the top 20 firms. Therefore, Frontier argued that it was inappropriate to use Lally's approach, which used franking data from financial statements. In response, Lally argued that the problem of firms dropping out of the ATO FAB data did not affect financial statement data from a stable list of companies.
  - The use of financial statement data was subject to the problem that some credits were extinguished within corporate structures without being distributed to shareholders. Lally noted that the examples provided by Frontier for BHP and Rio Tinto were issues involving the utilisation rate for credits rather than the distribution rate. To correct this, BHP and Rio Tinto could be removed from the set of companies, which would have the effect of increasing the distribution rate from 88 per cent to 95 per cent.
  - Some firms have received large tax refunds that decreased their franking balancing, leading to an overestimate of the distribution rate. Lally noted the tax refunds could also lead to underestimation and most refund situations would not lead to errors in the estimate.
- The review reaffirmed that there was no need to use the same set of companies for estimating the utilisation and distribution rates. Lally considered that there was good reason to not do so. For example, one might want to use specific firms to estimate the distribution rate, while at the same time using all firms to estimate the utilisation rate.[137]

[136] Lally, M., *Review of Frontier's Gamma Submissions*, September 2018.

[137] Lally, M., *Review of Frontier's Gamma Submissions*, September 2018, p. 6.

323. In separate advice to the AER, Lally extended his distribution rate analysis from the largest 20 ASX companies to the largest 50 ASX companies.[138] Lally's further analysis can be summarised as follows:

- Estimates of the distribution rate were expanded to the 50 largest ASX firms, using data from their financial statements for the period 2000 to 2017.
- The 50 ASX company sample increased the distribution rate estimate to 89 per cent, compared to 83 per cent from the top 20 ASX companies.[139]
- The estimate of 89 per cent was a lower bound for the distribution rate. The 50 ASX firms included companies with foreign operations and such operations were not relevant for estimating the distribution rate of an Australian energy network business. The effect of foreign operations appeared to be to reduce the distribution rate.[140]

324. Lally also reviewed evidence relating to the estimation of gamma from the AER's Independent Panel, submissions in response to the AER's draft rate of return guidelines, a new note from the ATO, and Frontier's submission to the ERA. Lally's report to the AER can be summarised as follows: [141]

- The ATO's September 2018 note stated unequivocally that no ATO data should be used for examining the imputation system.[142]
- Lally reaffirmed his earlier rebuttals of Frontier's report.
- Foreign operation may have mixed effects on a company's distribution rate. Theoretically, it may reduce tax payments to the ATO and therefore might be expected to increase the distribution rate. However, it may also reduce the firm's dividends, and would exert a downward effect on the distribution rate. Therefore, this issue should be empirically tested.
- Removing foreign ownership increased the distribution rate.
- Lally considered whether an estimate of gamma based on the ATO data for all equity was appropriate. ATO data was highly unsuitable for estimating gamma directly because it covered all firms, which were unsuitable for estimating the distribution rate of the benchmark efficient entity, and also because the ATO data for estimating the utilisation rate (which is additionally required) was highly problematic. Alternative data sources were free of both problems. Therefore, the ATO data should not be used.[143]

[138] Lally, M., *Estimating the Distribution Rate for Imputation Credits for the Top 50 ASX Companies*, October 2018.

[139] Lally, M., *Estimating the Distribution Rate for Imputation Credits for the Top 50 ASX Companies*, October 2018, p. 4.

[140] Lally, M., *Estimating the Distribution Rate for Imputation Credits for the Top 50 ASX Companies*, October 2018, pp. 3-4.

[141] Lally, M., *The Estimation of Gamma: Review of Recent Evidence*, December 2018.

[142] Lally, M., *The Estimation of Gamma: Review of Recent Evidence*, December 2018, p. 6.

[143] Lally, M., *The Estimation of Gamma: Review of Recent Evidence*, December 2018, p. 3.

- Lally considered whether the distribution rate and the utilisation rate should be estimated from the same group of investors and reaffirmed that there was no necessity to do so, and good reason for not doing so.[144]

- The distribution rate should be estimated from financial statement data. This distribution rate should be estimated with a large set of firms (to avoid manipulation of price or revenue cap) and firms should be selected on the basis of market cap (subject to deleting firms with substantial foreign operations).[145]

- The best estimate for the distribution rate for an Australian firm with minimal foreign operations was 0.95 rounded to the nearest 0.05. [146]

- The utilisation rate should be defined as the weighted average over the utilisation rates of all investors in the Australian market. If account was taken of foreign investors, the best estimates came from the ABS data on the proportion of Australian equities owned by local investors.[147]

- The best estimate for the utilisation rate was 0.65 rounded to the nearest 0.05.[148]

Dividend drop off approach

325. In its response to the ERA's rail WACC consultation paper, Synergies did not endorse non-market approaches for estimating gamma and preferred the use of a market-based approach. Synergies argued for the continued use of the dividend drop off approach. Synergies later recommended that gamma be estimated by applying equal weights to the dividend drop off approach and its three other proposed approaches (which included non-market approaches).

326. Dividend drop off studies examine how share prices change on ex-dividend days after distribution of both cash dividends and attached franking credits. It infers the value of distributed imputation credits from market prices. The amount by which the share prices change (on average) is assumed to reflect the value investors place on the cash dividend and imputation credit as separate from the value of the shares.

327. Dividend drop off studies assume perfect capital markets. This assumption implies that there are no transaction costs, no differential taxation between dividends and capital gains and share prices are not subject to any influence other than the distribution of dividends and franking credits. The theory of arbitrage predicts that in this situation, the expected reduction of the share price from cum-dividend day to the ex-dividend day (the price drop off) should equal the gross dividend which includes the value of the cash dividend and the value of the franking credit. However, the assumption of perfect capital markets is unlikely to hold. In addition, given that investors will not fully value the combined package of the gross dividend, the expected price drop-off should be less than that of the face value.[390]

[144] Lally, M., *The Estimation of Gamma: Review of Recent Evidence*, December 2018, p. 8.
[145] Lally, M., *The Estimation of Gamma: Review of Recent Evidence*, December 2018, pp. 3-4.
[146] Lally, M., *The Estimation of Gamma: Review of Recent Evidence*, December 2018, p. 5.
[147] Lally, M., *The Estimation of Gamma: Review of Recent Evidence*, December 2018, p. 5.
[148] Lally, M., *The Estimation of Gamma: Review of Recent Evidence*, December 2018, p. 5.

328. The primary advantage of dividend drop off studies is that they can be used to infer a market value of dividends and imputation credits. However, dividend drop off studies have substantial measurement and estimation issues.

329. A paper by McKenzie and Partington highlighted the imprecision inherent in the dividend drop off method.[149] The authors showed that the drop off ratio can vary considerably, depending on the specification or regression technique applied. As such, they were of the view that it was not appropriate to consider the estimates of utilisation rate from various dividend drop off studies.

330. The estimation issues associated with dividend drop off studies manifest themselves by the lack of consensus in the literature about the estimation of the utilisation rate.

331. There are several reasons why dividend drop off studies may not provide a good estimate of the utilisation rate.

- The utilisation rate is a complex weighted average over all investors, reflecting their relative wealth and risk aversion, and this may not correspond to the market value of the credits (whether estimated by a dividend drop off study or any other market-based method). If the utilisation rate is not defined as the market value of credits, then market studies such as dividend drop off analysis will be of limited relevance.

- Dividend drop off studies only estimate the utilisation rate of just two days – the cum-dividend and the ex-dividend dates. Consequently, they provide an estimate of the utilisation rate with weights that reflect the composition of investors around the cum- and ex-dividend dates – not the weighted average across all points in time. Furthermore, such investors may be quite untypical of investors in general. The market value in these studies is influenced by the marginal investor over those dates, rather than the value attributed across all investors.

- Dividend drop off studies may not accurately separate out the effect of taxation benefits associated with imputation credits on the share price change from the effect of the cash dividend. Multiple statistical models can be used and the results can be quite sensitive to a small number of outlying observations.[150]

- There is considerable evidence of anomalous share price behaviour around ex days, which raises the possibility that any estimate of the utilisation rate from a dividend drop off analysis will simply reflect that anomalous behaviour.[151]

- Estimates of the market value of credits from methods other than dividend drop off studies produced markedly different results, undermining the credibility of such market-based estimates.[152]

[149] McKenzie, M, & Partington, G., (2010), *Selectivity and Sample Bias in Dividend Drop-Off Studies,* Finance and Corporate Governance Conference 2011 Paper, available at SSRN: http://ssrn.com/abstract=1716576 or http://dx.doi.org/10.2139/ssrn.1716576.

[150] Lally, M., *The Estimation of Gamma,* Report for the AER, November 2013, section 3.5.

[151] Lally, M., *The Estimation of Gamma,* Report for the AER, November 2013, section 3.5.

[152] Lally, M., *The Estimation of Gamma,* Report for the AER, November 2013, Table 2.

332. Lally summarises the difficulties with using market-based estimates well.

> …market based estimates are unreliable estimates of the average utilisation rate because they are affected by the actions of tax arbitrageurs, there are very wide range of such results, they are very sensitive to a number of methodological choices, and data around ex-dividend dates are known to be afflicted by anomalous behavior.[153]

333. For these reasons, the ERA placed no weight on the dividend drop off estimates and considered that there is no observable market price for gamma.

9.2.4 Finance theory and market evidence

334. In its response to the ERA's rail WACC consultation paper, Synergies argued that finance theory and market evidence indicated that gamma should be zero:

- Academic studies argued that foreign investors were the marginal price-setting investors and this meant that gamma was equal to zero.
- Synergies reviewed expert valuation reports and found few reports incorporated gamma into the CAPM for their cost of equity calculations.

335. The ERA considered that the utilisation rate was a complex weighted average over all investors and this may not correspond to the market value of the credits or the marginal investor. The marginal investor may be quite atypical of investors in general.

336. Further, Ainsworth, Partington and Warren's analysis did not align with Synergies' position on the marginal investor and a gamma of zero.[154]

> Indeed, whether prices are set by a marginal investor, or by aggregation across investors, is an open question… It is our contention, therefore, that a policy decision should not be based on the assertion that the marginal investor setting prices in the Australian market is an overseas investor. To do so would base policy on an insecure foundation, and risks serious error.

337. The argument that gamma has zero effect on the cost of capital contrasts the significant past evidence put forth by both network businesses (proposing a gamma value of 0.25), and the ERA and AER (setting a value of 0.40).

338. Further, the ERA considered that independent reports were prepared for varying needs, which may not align with the need to set a regulated rate of return.

339. For the draft determination, the ERA did not apply any weight to Synergies' arguments that the finance theory and market evidence suggest gamma is zero.

9.2.5 Estimation of the distribution rate

340. The ERA determines gamma through the Monkhouse formula as the product of the distribution rate and utilisation rate. The distribution rate and utilisation rate are separately estimated.

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[153] Lally, M., *Review of the AER's views on gearing and gamma,* May 2018, p. 18.

[154] Ainsworth, A., Partington, G. and Warren, G., *Do franking credits matter? Exploring the financial implications of dividend imputation*, May 2015.

341. In the draft determination, the ERA gave the distribution rate further consideration in light of new information.

342. The distribution rate represents the proportion of imputation credits generated by a benchmark efficient entity that is expected to be distributed to investors. The ERA considered that the distribution rate was a firm-specific, rather than a market-wide, parameter.

343. The ERA did not use ATO data to determine the distribution rate. This was confirmed by Lally, who, in view of problems with the dividend and franking balance data of the ATO, considered that the best estimate of the distribution rate of the benchmark efficient entity was obtained from financial statement data.[155] The ATO data also was market-wide, meaning it was not reflective of the benchmark efficient entity.

344. Given the credibility of the ATO data and the opinion expressed by the ATO, it was inappropriate to use ATO data to determine the distribution rate.

345. The ERA disagreed with concerns over the use of Lally's distribution rate calculation.

346. The ERA considered that it was not necessary to use the same set of companies for estimating the utilisation and distribution rates.

347. The definition of the benchmark efficient entity is an entity that operates in Australia and has a similar degree of risk as that which applies to the particular regulated entity. To estimate the distribution rate for the benchmark efficient entity, the ERA considered an appropriate approach was to use data from a broader range of companies that were comparable to the benchmark efficient entity in a relevant way.

348. Lally suggested one option was to pick a collection of companies within the same industry as the benchmark efficient entity.[156] For the three rail benchmark efficient entities, it is difficult to construct a data set for such companies, particularly where some benchmark sample firms are overseas entities to which the Australian tax imputation system does not apply.

349. With lack of data, the choice of whether to include certain marginal cases is likely to have a material impact on the resulting estimate.[157]

350. The ERA, therefore, considered that the 50 largest ASX-listed firms was a reasonable set of companies. Data from financial statements was of high quality given it was audited and subject to scrutiny in financial markets. The distribution rate of the top 50 ASX-listed companies captures more information on smaller listed companies and reduces the impact of finance sector concentration in the 20 largest ASX firms.

351. The ERA recognised that foreign operations did affect the distribution rate from the top 50 ASX firms. Lally's further analysis found that the distribution rate increased with the removal of foreign operations.[158] However, the removal of firms with significant foreign operations did not have a material impact on the distribution rate. The ERA considered that this indicated that the distribution rate was at least 0.9.

[155] Lally, M., *Review of Frontier's Gamma Submissions*, September 2018, p. 8.

[156] Lally, M., *Review of the AER's views on gearing and gamma*, 7 May 2018, p. 18.

[157] Lally, M., *Review of the AER's views on gearing and gamma*, 7 May 2018, p. 19.

[158] Lally, M., *The Estimation of Gamma: Review of Recent Evidence*, December 2018, p. 5.

352. Based on the new information discussed above, the ERA considered that it was appropriate to use the distribution rate from the top 50 ASX firms with minimal foreign operations. This provides a distribution rate of 0.9, rounded to one decimal point.

353. For the draft determination, the ERA considered a distribution rate of 0.9 appropriate.

9.2.6 Estimation of the utilisation rate

354. In the draft determination, the ERA gave the utilisation rate further consideration in light of new information.

355. The utilisation rate is the weighted average over the utilisation rates of individual investors, with investors able to fully use the credits having a rate of one and those unable to use them having a rate of zero. The ERA considered that the utilisation rate was a market-wide rather than a firm-wide parameter.

356. To estimate the utilisation rate, the ERA relied on the equity ownership approach to determine the percentage of domestic investors in the Australian equity market.

357. ABS information on equity ownership obtained from the Australian National Accounts can be used to estimate the utilisation rate.[159]

358. When using this ABS data, the ERA refined the equity ownership approach by filtering the national accounts data to focus on the types of equity that was most relevant to the estimation of a market-wide utilisation rate. This data refinement is consistent with the method set out by the AER.[160] 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 the classes of investors that are not eligible to use imputation credits – "the rest of the world".
- Determines the share of equity held by domestic private investors eligible to use imputation credits as a proportion of the equity held by the eligible and non-eligible private investors in the market.
- Excludes government-held equity from the calculation of the domestic ownership share.

359. Based on updated ABS data, all (listed and unlisted) equity suggests a range for the utilisation rate of between 0.6 to 0.7.[161]

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[159] Australian Bureau of Statistics, Australian National Accounts: Finance and Wealth, Catalogue 5232.0, Tables 47 and 48.

[160] AER, *TasNetwork Access Arrangement 2017-19, Attachment 4 – Value of Imputation credits*, p. 161.

[161] ABS, Technical Notes on significant quality assurance work undertaken for the historical revision through review of complication methods and through source data, September 2017 http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/5232.0Technical+Note1Sep%202017

360. The most recent March 2018 quarter's ABS equity ownership data showed a utilisation rate for all equity of 0.65. The average of domestic equity ownership rate over 120 quarterly observations since the introduction of imputation tax system in June 1988 was 0.63.

361. Given estimation accuracy, the ERA rounded to one decimal place. Therefore, the ERA applied a utilisation rate of 0.6.

362. For the draft determination, the ERA determined a utilisation rate of 0.6.

9.2.7 Estimation of gamma

363. The ERA continued to determine gamma through the Monkhouse formula as the product of the distribution rate and utilisation rate.[162]

364. For the draft determination, the ERA applied a gamma of 0.5.

9.3 Public submissions

365. In its response to the draft determination, Arc Infrastructure submitted that the ERA should adopt a gamma value of 0.4.[163] Arc Infrastructure considered that: [164]

- There was no evidence that the distribution rate had markedly increased in recent years.
- The ERA's assumption that a company would distribute all franking credits was not consistent with commercial reality.
- The perceived deficiencies in the ATO data were not so significant that the ERA should abandon using the data.
- Estimates from the dividend drop off approach should be considered.
- Gamma should be calculated consistently with the ERA's past practice and consistently with other Australian regulators.
- The distribution rate should remain at 0.7 and gamma of 0.4.

[162] The Monkhouse formula is expressed as: gamma = distribution rate x utilisation rate

Monkhouse, P., *The Valuation of Projects under a Dividend Imputation Tax System*, *Accounting and Finance 36*, 1996, pp. 185-212.

[163] Arc Infrastructure, *WACC Review – Response to Draft Determination – 2018 Weighted Average Cost of Capital,* 31 May 2019, p. 5.

[164] Arc Infrastructure, *WACC Review – Response to Draft Determination – 2018 Weighted Average Cost of Capital,* 31 May 2019, p. 5.

9.4 Final determination

366. The ERA has reviewed Arc Infrastructure's comments on gamma. The submission presented similar information to that provided by Synergies in response to the consultation paper.

367. Over the course of its review of electricity, gas and rail rates of return, the ERA has given much consideration to gamma to reflect the new body of evidence on the matter.

368. The ERA considers that it is necessary to update the past gamma approach used in rail as:

- Contemporary Tribunal and Federal Court judicial reviews support the use of the utilisation approach.
- ATO data should not be applied to all aspects of the imputation system. This was confirmed by the opinions expressed by the ATO.
- New reports and analysis provided by Dr Lally presents new methods and numbers to inform improved calculations of gamma.
- There is no observable market price for gamma. This includes the dividend drop off approach which is flawed and produces unreliable estimates.

369. The rail WACC draft determination approach to gamma was:

- Consistent with the ERA's practice as detailed in its 2018 gas rate of return guidelines, which has been applied to current gas access arrangements.[165]
- Generally consistent with the AER's practice detailed in its 2018 rate of return instrument, which has been applied to current gas access arrangements, though the AER uses the higher rate of 0.585.[166]

370. For the final determination, consistent with the draft determination, the ERA will determine gamma through the following approach:

- Gamma will be determined through the Monkhouse formula as the product of the distribution rate and utilisation rate. The distribution rate and utilisation rate are separately estimated.
- The distribution rate represents the proportion of imputation credits generated by a benchmark efficient entity that is expected to be distributed to investors. The ERA considers that the distribution rate is a firm-specific rather than a market-wide parameter.
- To estimate the distribution rate, the ERA relies on 0.9 for the distribution rate from financial reports of the 50 largest ASX-listed firms.

[165] ERA, *Final Rate of Return Guidelines (2018)*, December 2018.

[166] AER, *Rate of return instrument*, December 2018.

- The ERA considers that the distribution rate is at least 0.9. Lally found that the distribution rate may be slightly higher with the removal of foreign operations.[167]

- The utilisation rate is the weighted average over the utilisation rates of individual investors, with investors able to fully use the credits having a rate of one and those unable to use them having a rate of zero. The ERA considers that the utilisation rate is a market-wide rather than a firm-specific parameter.

- To estimate the utilisation rate, the ERA relies on the equity ownership approach to determine the percentage of domestic investors in the Australian equity market. The utilisation rate is estimated for all Australian equity from the national accounts of the ABS. The ERA considers that a utilisation rate of 0.60 is appropriate.

371. For this final determination, the ERA adopts a gamma of 0.5, being the product between the distribution rate of 0.9 and a utilisation rate of 0.6.

372. Gamma will remain fixed until the next rail WACC method review.

[167] Lally, M., *The Estimation of Gamma: Review of Recent Evidence,* December 2018

10 Inflation

10.1 Background

373. Inflation is the rate of change in the general level of prices of goods and services.

374. Forecast inflation can be used to translate the nominal WACC to a real WACC.

375. A nominal rate of return incorporates the real rate of return, compounded with a rate that reflects expectations of inflation. The ERA will use a nominal vanilla rate of return for its decisions.

10.2 Draft determination

376. To calculate forecast inflation for rail the ERA used the Fisher equation and the observed yields of:[168]

- 10-year Commonwealth Government Securities, which reflect a market-based estimate of the nominal risk free rate.
- 10-year indexed Treasury bonds, which reflect a market-based estimate of a real risk free rate.[169]

377. This approach is known as the Treasury bond implied inflation approach and is based on the premise that the yield on Commonwealth Government Securities and the yield on Treasury bonds differ by an inflation component. This can be expressed in the equation below:

$$\pi = \frac{(1+R_f)}{(1+R_{Rf})} - 1 \qquad \text{(equation 11)}$$

where

π is the expected inflation rate

R_f is the 10-year nominal risk free rate of return estimated on Treasury Bonds

R_{Rf} is the 10-year real risk free rate of return estimated on Treasury indexed bonds.

378. The ERA estimated the expected inflation rate consistent with the estimate of the risk free rate and adopted an averaging period of 40 business days at 30 June.

379. For the draft determination, the ERA considered that the Treasury bond implied inflation approach was appropriate.

380. For the draft determination, the ERA estimates a forecast inflation rate of 1.95 per cent at 30 June 2018.

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[168] The formal Fisher equation is: $1+i=(1+r)(1+\pi^e)$

where: *i* is the nominal interest rate, *r* is the real interest rate and π^e is the expected inflation rate.

[169] ERA, *Final decision on the 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. 33.

10.3 Public submissions

381. No public submissions were received on inflation in response to the draft determination.

10.4 Final determination

382. The ERA maintains its position on inflation from the draft determination.

383. The ERA considers that it is appropriate to use the Treasury bond implied inflation approach for the purpose of estimating inflation for rail networks.

384. For this final determination, the ERA estimates a forecast inflation rate of:

- 1.95 per cent at 30 June 2018
- 1.46 per cent at 30 June 2019.

11 Final determination on rail rate of return

385. Taking into account the information provided through public submissions and other available information, the ERA has reviewed the rail WACC approach. The considerations of the ERA are set out in the preceding chapters.

386. Based upon the assessment of each rate of return parameter, the point estimates for each parameter that may reasonably be applied to Western Australian railways are detailed in Table 17 and Table 18.

387. For the final determination, the ERA has determined a nominal rate of return at 30 June 2018 of:

- 5.27 per cent for the Public Transport Authority
- 7.19 per cent for Arc Infrastructure
- 9.36 per cent for the Pilbara Railways.

388. For the final determination, the ERA has determined a nominal rate of return at 30 June 2019 of:

- 4.15 per cent for the Public Transport Authority
- 6.06 per cent for Arc Infrastructure
- 8.32 per cent for the Pilbara Railways.

Table 17 The ERA's final determination for rail WACC for period to 30 June 2018

Parameter	Public Transport Authority	Arc Infrastructure	Pilbara Railways
	2018	**2018**	**2018**
Cost of equity parameters			
Nominal risk free rate (%)	2.76	2.76	2.76
Equity beta	0.60	0.9	1.3
Market risk premium (%)	5.90	5.90	5.90
Nominal after tax return on equity (%)	**6.30**	**8.07**	**10.43**
Cost of debt parameters			
Nominal risk free rate (%)	2.76	2.76	2.76
Benchmark credit rating	A	BBB+	BBB+
Term of debt for debt risk premium	10 years	10 years	10 years
Debt risk premium (%)	1.373	1.687	2.244
Debt issuing costs (%)	0.100	0.100	0.100
Nominal cost of debt (return on debt) (%)	**4.23**	**4.55**	**4.55**
Other parameters			
Debt proportion (gearing) (%)	50	25	20
Forecast inflation rate (%)	1.95	1.95	1.95
Franking credits (gamma) (%)	0.5	0.5	0.5
Corporate tax rate (%)	30	30	30
Weighted Average Cost of Capital			
Nominal after-tax WACC (%)	**5.27**	**7.19**	**9.36**
Real after tax-WACC (%)	**3.25**	**5.14**	**7.27**

Source: ERA analysis

Table 18 The ERA's final determination for rail WACC for period to 30 June 2019

Parameter	Public Transport Authority	Arc Infrastructure	Pilbara Railways
	2019	**2019**	**2019**
Cost of equity parameters			
Nominal risk free rate (%)	1.53	1.53	1.53
Equity beta	0.60	0.9	1.3
Market risk premium (%)	5.90	5.90	5.90
Nominal after tax return on equity (%)	**5.07**	**6.84**	**9.20**
Cost of debt parameters			
Nominal risk free rate (%)	1.53	1.53	1.53
Benchmark credit rating	A	BBB+	BBB+
Term of debt for debt risk premium	10 years	10 years	10 years
Debt risk premium (%)	1.608	2.081	3.167
Debt issuing costs (%)	0.100	0.100	0.100
Nominal cost of debt (return on debt) (%)	**3.24**	**3.71**	**4.80**
Other parameters			
Debt proportion (gearing) (%)	50	25	20
Forecast inflation rate (%)	1.46	1.46	1.46
Franking credits (gamma) (%)	0.5	0.5	0.5
Corporate tax rate (%)	30	30	30
Weighted Average Cost of Capital			
Nominal after-tax WACC (%)	**4.15**	**6.06**	**8.32**
Real after tax-WACC (%)	**2.65**	**4.53**	**6.76**

Source: ERA analysis

Appendix 1 2018 International bond sample

Table 1: Public Transport Authority bond sample as at 30 June 2018

Ticker	Issuer
EK974172 Corp	Rio Tinto Finance USA Ltd
EJ855408 Corp	BHP Billiton Finance USA Ltd
AN129025 Corp	Telstra Corp Ltd
AP811577 Corp	Telstra Corp Ltd
UV827072 Corp	Telstra Corp Ltd
EJ329466 Corp	Rio Tinto Finance USA PLC
EJ038714 Corp	BHP Billiton Finance USA Ltd
AO147640 Corp	SGSP Australia Assets Pty Ltd
EK835349 Corp	Telstra Corp Ltd
EJ855396 Corp	BHP Billiton Finance USA Ltd
EI400709 Corp	Optus Finance Pty Ltd
JK730176 Corp	Telstra Corp Ltd
AR226811 Corp	AusNet Services Holdings Pty Ltd
EH437851 Corp	Rio Tinto Finance USA Ltd
EI873161 Corp	Telstra Corp Ltd
AM402825 Corp	AusNet Services Holdings Pty Ltd
EK315745 Corp	SGSP Australia Assets Pty Ltd
EI881021 Corp	BHP Billiton Finance USA Ltd
DD105676 Corp	BHP Billiton Finance USA Ltd
EI291758 Corp	Telstra Corp Ltd
AO674434 Corp	Victoria Power Networks Finance Pty Ltd
AP198220 Corp	SGSP Australia Assets Pty Ltd
EJ038718 Corp	BHP Billiton Finance USA Ltd
AN149130 Corp	Telstra Corp Ltd
AO500496 Corp	ETSA Utilities Finance Pty Ltd
EI452667 Corp	Rio Tinto Finance USA Ltd
AO757948 Corp	Optus Finance Pty Ltd
EJ095285 Corp	Telstra Corp Ltd
EJ583194 Corp	Telstra Corp Ltd
AQ884088 Corp	United Energy Distribution Pty Ltd
LW938501 Corp	SGSP Australia Assets Pty Ltd
AP489931 Corp	United Energy Distribution Pty Ltd
EI638393 Corp	Telstra Corp Ltd
EI443204 Corp	Telstra Corp Ltd
EJ297361 Corp	Wesfarmers Ltd
EK875768 Corp	BHP Billiton Finance Ltd
EJ251235 Corp	AusNet Services Holdings Pty Ltd

Ticker	Issuer
LW474837 Corp	SGSP Australia Assets Pty Ltd
EK755216 Corp	AusNet Services Holdings Pty Ltd
AN129024 Corp	Telstra Corp Ltd
EJ384977 Corp	SGSP Australia Assets Pty Ltd
EJ101048 Corp	Rio Tinto Finance USA PLC
EJ372241 Corp	BHP Billiton Finance Ltd
EJ651064 Corp	BHP Billiton Finance Ltd
AR408024 Corp	AusNet Services Holdings Pty Ltd
EI601137 Corp	Victoria Power Networks Finance Pty Ltd
EK348922 Corp	AusNet Services Holdings Pty Ltd
AR868580 Corp	Victoria Power Networks Finance Pty Ltd
EJ372136 Corp	BHP Billiton Finance Ltd
EK966481 Corp	Optus Finance Pty Ltd
AR256351 Corp	Nissan Financial Services Australia Pty Ltd
EJ372146 Corp	BHP Billiton Finance Ltd
EK875756 Corp	BHP Billiton Finance Ltd
QZ447553 Corp	United Energy Distribution Pty Ltd
EK523339 Corp	Wesfarmers Ltd
EJ372256 Corp	BHP Billiton Finance Ltd
EJ845780 Corp	Australia Pacific Airports Melbourne Pty Ltd
EJ752521 Corp	AusNet Services Holdings Pty Ltd
AO811495 Corp	ETSA Utilities Finance Pty Ltd
EJ212046 Corp	BHP Billiton Finance Ltd
AS664625 Corp	AusNet Services Holdings Pty Ltd
EI561531 Corp	SGSP Australia Assets Pty Ltd
EK536984 Corp	Australia Pacific Airports Melbourne Pty Ltd
EJ202356 Corp	New Zealand Milk Australasia Pty Ltd
EK104871 Corp	SGSP Australia Assets Pty Ltd
QZ932852 Corp	Australia Pacific Airports Melbourne Pty Ltd
EK898928 Corp	Wesfarmers Ltd
EI601069 Corp	Victoria Power Networks Finance Pty Ltd
EK055444 Corp	AusNet Services Holdings Pty Ltd
UV800801 Corp	Australia Pacific Airports Melbourne Pty Ltd
EI626314 Corp	AusNet Services Holdings Pty Ltd
AS664612 Corp	AusNet Services Holdings Pty Ltd
AS177694 Corp	Victoria Power Networks Finance Pty Ltd
QJ539736 Corp	Australia Pacific Airports Melbourne Pty Ltd
ED104267 Corp	WMC Finance USA Ltd
AQ307077 Corp	ETSA Utilities Finance Pty Ltd
EI902224 Corp	Telstra Corp Ltd

Ticker	Issuer
AR408188 Corp	AusNet Services Holdings Pty Ltd
DD109142 Corp	WMC Finance USA Ltd
EK902477 Corp	Wesfarmers Ltd
EK969853 Corp	Optus Finance Pty Ltd
EI902396 Corp	Telstra Corp Ltd
EJ251460 Corp	AusNet Services Holdings Pty Ltd

Table 2: Arc Infrastructure bond sample as at 30 June 2018

Ticker	Issuer
AS344445 Corp	Ausgrid Finance Pty Ltd
AS179649 Corp	Caltex Australia Ltd
AS197471 Corp	Transurban Queensland Finance Pty Ltd
EK156115 Corp	Sydney Airport Finance Co Pty Ltd
AS533603 Corp	DBNGP Finance Co Pty Ltd
QJ190690 Corp	BHP Billiton Finance Ltd
AN261101 Corp	Coca-Cola Amatil Ltd
AS241348 Corp	Sydney Airport Finance Co Pty Ltd
QJ189681 Corp	BHP Billiton Finance USA Ltd
AO953984 Corp	Transurban Finance Co Pty Ltd
QJ190880 Corp	BHP Billiton Finance Ltd
JV523711 Corp	AusNet Services Holdings Pty Ltd
AS072056 Corp	Ausgrid Finance Pty Ltd
QJ191077 Corp	BHP Billiton Finance Ltd
EJ879888 Corp	Brisbane Airport Corp Pty Ltd
AN751205 Corp	Aurizon Network Pty Ltd
EK415237 Corp	Coca-Cola Amatil Ltd
AS482636 Corp	Amcor Finance USA Inc
AM676513 Corp	Coca-Cola Amatil Ltd
AO547987 Corp	Incitec Pivot Finance LLC
QJ192853 Corp	BHP Billiton Finance USA Ltd
EK468529 Corp	Aurizon Network Pty Ltd
QZ766772 Corp	Transurban Queensland Finance Pty Ltd
AS239645 Corp	Brisbane Airport Corp Pty Ltd
JK876383 Corp	Sydney Airport Finance Co Pty Ltd
AS806819 Corp	Coca-Cola Amatil Ltd
LW832384 Corp	Coca-Cola Amatil Ltd
QZ418350 Corp	Transurban Finance Co Pty Ltd
QJ221786 Corp	Brambles USA Inc
AP725596 Corp	Boral Finance Pty Ltd
EJ889313 Corp	Aurizon Network Pty Ltd
EK911822 Corp	Transurban Finance Co Pty Ltd
AM796866 Corp	APT Pipelines Ltd
LW077755 Corp	Aurizon Network Pty Ltd
EJ390616 Corp	APT Pipelines Ltd
AS071836 Corp	Ausgrid Finance Pty Ltd
EK805514 Corp	APT Pipelines Ltd
EK130688 Corp	Perth Airport Pty Ltd
AP094552 Corp	Newcastle Coal Infrastructure Group Pty Ltd

Ticker	Issuer
AP725619 Corp	Boral Finance Pty Ltd
EJ431710 Corp	CIMIC Finance USA Pty Ltd
AP044525 Corp	Woodside Finance Ltd
EK262202 Corp	Coca-Cola Amatil Ltd
EK805538 Corp	APT Pipelines Ltd
EJ922576 Corp	Coca-Cola Amatil Ltd
AP138040 Corp	Brambles Finance PLC
AQ252535 Corp	Energy Partnership Gas Pty Ltd
EK807821 Corp	APT Pipelines Ltd
EK805526 Corp	APT Pipelines Ltd
EI404435 Corp	Woolworths Group Ltd
LW239378 Corp	QPH Finance Co Pty Ltd
EK315685 Corp	Brambles Finance Ltd
JK849874 Corp	Amcor Finance USA Inc
EJ450801 Corp	APT Pipelines Ltd
EJ596276 Corp	Amcor Ltd/Australia
EK878745 Corp	Sydney Airport Finance Co Pty Ltd
EJ963774 Corp	AquaSure Finance Pty Ltd
QZ870137 Corp	APT Pipelines Ltd
EK465508 Corp	Transurban Finance Co Pty Ltd
EJ406857 Corp	Sydney Airport Finance Co Pty Ltd
EJ861639 Corp	Transurban Finance Co Pty Ltd
EK775847 Corp	Woodside Finance Ltd
EI634847 Corp	Woolworths Group Ltd
QJ413201 Corp	Transurban Finance Co Pty Ltd
QZ372379 Corp	Woodside Finance Ltd
EI421490 Corp	Sydney Airport Finance Co Pty Ltd
EK627931 Corp	Transurban Queensland Finance Pty Ltd
EK642479 Corp	Transurban Queensland Finance Pty Ltd
EI664116 Corp	Woodside Finance Ltd
EK807839 Corp	APT Pipelines Ltd
EI702147 Corp	CIMIC Finance USA Pty Ltd
EI325336 Corp	APT Pipelines Ltd
EK355413 Corp	QPH Finance Co Pty Ltd
EG021985 Corp	Sydney Airport Finance Co Pty Ltd
EJ764636 Corp	QPH Finance Co Pty Ltd
EJ758820 Corp	Perth Airport Pty Ltd
EG064076 Corp	Sydney Airport Finance Co Pty Ltd
UV302700 Corp	DBNGP Finance Co Pty Ltd
EK510724 Corp	DBNGP Finance Co Pty Ltd

Ticker	Issuer
JK936002 Corp	Coca-Cola Amatil Ltd
EI748620 Corp	Coca-Cola Amatil NZ Ltd
EJ271436 Corp	Coca-Cola Amatil Ltd
EI814473 Corp	Coca-Cola Amatil Ltd
UV855167 Corp	Coca-Cola Amatil Ltd
JV320429 Corp	Coca-Cola Amatil Ltd

Table 3: The Pilbara railways bond sample as at 30 June 2018

Ticker	Issuer
AS344445 Corp	Ausgrid Finance Pty Ltd
AS197471 Corp	Transurban Queensland Finance Pty Ltd
AO951980 Corp	Santos Finance Ltd
AS533603 Corp	DBNGP Finance Co Pty Ltd
AS511777 Corp	BlueScope Finance Americas LLC
AN191913 Corp	Pacific National Finance Pty Ltd
QZ512178 Corp	Qantas Airways Ltd
QZ727992 Corp	Qantas Airways Ltd
JV523711 Corp	AusNet Services Holdings Pty Ltd
AS072056 Corp	Ausgrid Finance Pty Ltd
AR620052 Corp	Pacific National Finance Pty Ltd
EJ879888 Corp	Brisbane Airport Corp Pty Ltd
EK907291 Corp	Pacific National Finance Pty Ltd
AS482636 Corp	Amcor Finance USA Inc
AO547987 Corp	Incitec Pivot Finance LLC
QZ766772 Corp	Transurban Queensland Finance Pty Ltd
AS239645 Corp	Brisbane Airport Corp Pty Ltd
AQ107007 Corp	Adani Abbot Point Terminal Pty Ltd
AN441270 Corp	Pacific National Finance Pty Ltd
AP725596 Corp	Boral Finance Pty Ltd
EJ637162 Corp	Origin Energy Finance Ltd
AM796866 Corp	APT Pipelines Ltd
EJ378433 Corp	Newcrest Finance Pty Ltd
EJ390616 Corp	APT Pipelines Ltd
AS071836 Corp	Ausgrid Finance Pty Ltd
EJ859807 Corp	Origin Energy Finance Ltd
EK805514 Corp	APT Pipelines Ltd
EK130688 Corp	Perth Airport Pty Ltd
EJ832440 Corp	Pacific National Finance Pty Ltd
EK311797 Corp	Qantas Airways Ltd
AP094552 Corp	Newcastle Coal Infrastructure Group Pty Ltd
AP725619 Corp	Boral Finance Pty Ltd
EJ431710 Corp	CIMIC Finance USA Pty Ltd
EI870493 Corp	Newcrest Finance Pty Ltd
EK269091 Corp	Qantas Airways Ltd
EK805538 Corp	APT Pipelines Ltd
EK807821 Corp	APT Pipelines Ltd
EK805526 Corp	APT Pipelines Ltd
EI404435 Corp	Woolworths Group Ltd

Ticker	Issuer
LW239378 Corp	QPH Finance Co Pty Ltd
JK849874 Corp	Amcor Finance USA Inc
EJ450801 Corp	APT Pipelines Ltd
EJ596276 Corp	Amcor Ltd/Australia
QZ870137 Corp	APT Pipelines Ltd
EI634847 Corp	Woolworths Group Ltd
EI870349 Corp	Newcrest Finance Pty Ltd
EK627931 Corp	Transurban Queensland Finance Pty Ltd
EI630791 Corp	Pacific National Finance Pty Ltd
EK642479 Corp	Transurban Queensland Finance Pty Ltd
EK807839 Corp	APT Pipelines Ltd
EI409804 Corp	Pacific National Finance Pty Ltd
EI702147 Corp	CIMIC Finance USA Pty Ltd
EI325336 Corp	APT Pipelines Ltd
EJ610528 Corp	Origin Energy Finance Ltd
EI836446 Corp	Origin Energy Finance Ltd
EK355413 Corp	QPH Finance Co Pty Ltd
EJ764636 Corp	QPH Finance Co Pty Ltd
EJ758820 Corp	Perth Airport Pty Ltd
UV302700 Corp	DBNGP Finance Co Pty Ltd
EK510724 Corp	DBNGP Finance Co Pty Ltd

Appendix 2 2019 International bond sample

Table 1: Public Transport Authority bond sample as at 30 June 2019

Ticker	Issuer
AZ151179 Corp	Optus Finance Pty Ltd
EJ855408 Corp	BHP Billiton Finance USA Ltd
EJ855396 Corp	BHP Billiton Finance USA Ltd
EK974172 Corp	Rio Tinto Finance USA Ltd
EJ038714 Corp	BHP Billiton Finance USA Ltd
AO757948 Corp	Optus Finance Pty Ltd
EJ329466 Corp	Rio Tinto Finance USA PLC
EI881021 Corp	BHP Billiton Finance USA Ltd
EI452667 Corp	Rio Tinto Finance USA Ltd
EH437851 Corp	Rio Tinto Finance USA Ltd
EK966481 Corp	Optus Finance Pty Ltd
EJ038718 Corp	BHP Billiton Finance USA Ltd
AU268266 Corp	Optus Finance Pty Ltd
EJ372146 Corp	BHP Billiton Finance Ltd
EK875768 Corp	BHP Billiton Finance Ltd
EJ212046 Corp	BHP Billiton Finance Ltd
EJ372241 Corp	BHP Billiton Finance Ltd
DD105676 Corp	BHP Billiton Finance USA Ltd
EJ101048 Corp	Rio Tinto Finance USA PLC
EJ372256 Corp	BHP Billiton Finance Ltd
EK875756 Corp	BHP Billiton Finance Ltd
EJ651064 Corp	BHP Billiton Finance Ltd
DD109142 Corp	WMC Finance USA Ltd
EK969853 Corp	Optus Finance Pty Ltd
ED104267 Corp	WMC Finance USA Ltd
AX729250 Corp	Telstra Corp Ltd
AN129025 Corp	Telstra Corp Ltd
AM402825 Corp	AusNet Services Holdings Pty Ltd
AO147640 Corp	SGSP Australia Assets Pty Ltd
AR226811 Corp	AusNet Services Holdings Pty Ltd
UV827072 Corp	Telstra Corp Ltd
LW474837 Corp	SGSP Australia Assets Pty Ltd
EK835349 Corp	Telstra Corp Ltd
AS664625 Corp	AusNet Services Holdings Pty Ltd
EJ251235 Corp	AusNet Services Holdings Pty Ltd
EJ384977 Corp	SGSP Australia Assets Pty Ltd
EK536984 Corp	Australia Pacific Airports Melbourne Pty Ltd

Ticker	Issuer
LW938501 Corp	SGSP Australia Assets Pty Ltd
AP811577 Corp	Telstra Corp Ltd
AO674434 Corp	Victoria Power Networks Finance Pty Ltd
AP198220 Corp	SGSP Australia Assets Pty Ltd
EK315745 Corp	SGSP Australia Assets Pty Ltd
EK055444 Corp	AusNet Services Holdings Pty Ltd
EJ297361 Corp	Wesfarmers Ltd
AR868580 Corp	Victoria Power Networks Finance Pty Ltd
AS664612 Corp	AusNet Services Holdings Pty Ltd
JK730176 Corp	Telstra Corp Ltd
EJ095285 Corp	Telstra Corp Ltd
QZ932852 Corp	Australia Pacific Airports Melbourne Pty Ltd
AO500496 Corp	ETSA Utilities Finance Pty Ltd
EJ583194 Corp	Telstra Corp Ltd
EI873161 Corp	Telstra Corp Ltd
EK755216 Corp	AusNet Services Holdings Pty Ltd
AP489931 Corp	United Energy Distribution Pty Ltd
EJ845780 Corp	Australia Pacific Airports Melbourne Pty Ltd
UV800801 Corp	Australia Pacific Airports Melbourne Pty Ltd
EK523339 Corp	Wesfarmers Ltd
QZ447553 Corp	United Energy Distribution Pty Ltd
EI638393 Corp	Telstra Corp Ltd
AO811495 Corp	ETSA Utilities Finance Pty Ltd
QJ539736 Corp	Australia Pacific Airports Melbourne Pty Ltd
EK348922 Corp	AusNet Services Holdings Pty Ltd
EI601069 Corp	Victoria Power Networks Finance Pty Ltd
EJ202356 Corp	New Zealand Milk Australasia Pty Ltd
AS177694 Corp	Victoria Power Networks Finance Pty Ltd
AQ884088 Corp	United Energy Distribution Pty Ltd
AQ307077 Corp	ETSA Utilities Finance Pty Ltd
AR408024 Corp	AusNet Services Holdings Pty Ltd
AS978432 Corp	CSL UK Holdings Ltd
EI601137 Corp	Victoria Power Networks Finance Pty Ltd
EI902396 Corp	Telstra Corp Ltd
EJ251460 Corp	AusNet Services Holdings Pty Ltd
AR408188 Corp	AusNet Services Holdings Pty Ltd
EI902224 Corp	Telstra Corp Ltd
ZS863928 Corp	PACCAR Financial Pty Ltd
AU073091 Corp	PACCAR Financial Pty Ltd

Table 2: Arc Infrastructure bond sample as at 30 June 2019

Ticker	Issuer
AX916607 Corp	Woolworths Group Ltd
AX350089 Corp	Incitec Pivot Ltd
ZS717604 Corp	Amcor Finance USA Inc
JK849874 Corp	Amcor Finance USA Inc
ZS719061 Corp	Amcor Finance USA Inc
AS482636 Corp	Amcor Finance USA Inc
AO547987 Corp	Incitec Pivot Finance LLC
EJ596276 Corp	Amcor Ltd/Australia
JV523711 Corp	AusNet Services Holdings Pty Ltd
EJ859807 Corp	Origin Energy Finance Ltd
AX613734 Corp	APT Pipelines Ltd
EI870493 Corp	Newcrest Finance Pty Ltd
AS072056 Corp	Ausgrid Finance Pty Ltd
AS533603 Corp	DBNGP Finance Co Pty Ltd
EK805514 Corp	APT Pipelines Ltd
EJ378433 Corp	Newcrest Finance Pty Ltd
AZ168212 Corp	Amcor Finance USA Inc
AP725596 Corp	Boral Finance Pty Ltd
EK805538 Corp	APT Pipelines Ltd
EK627931 Corp	Transurban Queensland Finance Pty Ltd
AS239645 Corp	Brisbane Airport Corp Pty Ltd
AS344445 Corp	Ausgrid Finance Pty Ltd
AP094552 Corp	Newcastle Coal Infrastructure Group Pty Ltd
EK807821 Corp	APT Pipelines Ltd
AM796866 Corp	APT Pipelines Ltd
EI870349 Corp	Newcrest Finance Pty Ltd
AS071836 Corp	Ausgrid Finance Pty Ltd
EJ390616 Corp	APT Pipelines Ltd
AP725619 Corp	Boral Finance Pty Ltd
EJ450801 Corp	APT Pipelines Ltd
EK805526 Corp	APT Pipelines Ltd
LW239378 Corp	QPH Finance Co Pty Ltd
QZ766772 Corp	Transurban Queensland Finance Pty Ltd
EK807839 Corp	APT Pipelines Ltd
EK642479 Corp	Transurban Queensland Finance Pty Ltd
EK355413 Corp	QPH Finance Co Pty Ltd
QZ870137 Corp	APT Pipelines Ltd
EI836446 Corp	Origin Energy Finance Ltd
EJ610528 Corp	Origin Energy Finance Ltd

Ticker	Issuer
UV302700 Corp	DBNGP Finance Co Pty Ltd
AS197471 Corp	Transurban Queensland Finance Pty Ltd
ZS562160 Corp	Transurban Finance Co Pty Ltd
QJ190880 Corp	BHP Billiton Finance Ltd
AS179649 Corp	Caltex Australia Ltd
QJ190690 Corp	BHP Billiton Finance Ltd
JK876383 Corp	Sydney Airport Finance Co Pty Ltd
AX393924 Corp	Woodside Finance Ltd
QJ189681 Corp	BHP Billiton Finance USA Ltd
QJ191077 Corp	BHP Billiton Finance Ltd
AN261101 Corp	Coca-Cola Amatil Ltd
AS241348 Corp	Sydney Airport Finance Co Pty Ltd
AN751205 Corp	Aurizon Network Pty Ltd
QZ418350 Corp	Transurban Finance Co Pty Ltd
LW077755 Corp	Aurizon Network Pty Ltd
AP138040 Corp	Brambles Finance PLC
AO953984 Corp	Transurban Finance Co Pty Ltd
AM676513 Corp	Coca-Cola Amatil Ltd
EK468529 Corp	Aurizon Network Pty Ltd
QJ192853 Corp	BHP Billiton Finance USA Ltd
EJ406857 Corp	Sydney Airport Finance Co Pty Ltd
EK911822 Corp	Transurban Finance Co Pty Ltd
EK156115 Corp	Sydney Airport Finance Co Pty Ltd
EK878745 Corp	Sydney Airport Finance Co Pty Ltd
EK315685 Corp	Brambles Finance Ltd
LW832384 Corp	Coca-Cola Amatil Ltd
EK465508 Corp	Transurban Finance Co Pty Ltd
QJ413201 Corp	Transurban Finance Co Pty Ltd
EK415237 Corp	Coca-Cola Amatil Ltd
EK775847 Corp	Woodside Finance Ltd
QZ372379 Corp	Woodside Finance Ltd
AP044525 Corp	Woodside Finance Ltd
AQ252535 Corp	Energy Partnership Gas Pty Ltd
QJ221786 Corp	Brambles USA Inc
AS806819 Corp	Coca-Cola Amatil Ltd
EG021985 Corp	Sydney Airport Finance Co Pty Ltd
EG064076 Corp	Sydney Airport Finance Co Pty Ltd
JV320429 Corp	Coca-Cola Amatil Ltd
EI814473 Corp	Coca-Cola Amatil Ltd
UV855167 Corp	Coca-Cola Amatil Ltd

Ticker	Issuer
EJ271436 Corp	Coca-Cola Amatil Ltd
EI748620 Corp	Coca-Cola Amatil NZ Ltd
JK936002 Corp	Coca-Cola Amatil Ltd

Table 3: The Pilbara railways bond sample as at 30 June 2019

Ticker	Issuer
AX916607 Corp	Woolworths Group Ltd
AX350089 Corp	Incitec Pivot Ltd
ZS717604 Corp	Amcor Finance USA Inc
JK849874 Corp	Amcor Finance USA Inc
ZS719061 Corp	Amcor Finance USA Inc
AS482636 Corp	Amcor Finance USA Inc
AO547987 Corp	Incitec Pivot Finance LLC
EJ596276 Corp	Amcor Ltd/Australia
JV523711 Corp	AusNet Services Holdings Pty Ltd
EJ859807 Corp	Origin Energy Finance Ltd
AX613734 Corp	APT Pipelines Ltd
EI870493 Corp	Newcrest Finance Pty Ltd
AS072056 Corp	Ausgrid Finance Pty Ltd
AS533603 Corp	DBNGP Finance Co Pty Ltd
EK805514 Corp	APT Pipelines Ltd
EJ378433 Corp	Newcrest Finance Pty Ltd
AZ168212 Corp	Amcor Finance USA Inc
AP725596 Corp	Boral Finance Pty Ltd
EK805538 Corp	APT Pipelines Ltd
EK627931 Corp	Transurban Queensland Finance Pty Ltd
AS239645 Corp	Brisbane Airport Corp Pty Ltd
AS344445 Corp	Ausgrid Finance Pty Ltd
AP094552 Corp	Newcastle Coal Infrastructure Group Pty Ltd
EK807821 Corp	APT Pipelines Ltd
AM796866 Corp	APT Pipelines Ltd
EI870349 Corp	Newcrest Finance Pty Ltd
AS071836 Corp	Ausgrid Finance Pty Ltd
EJ390616 Corp	APT Pipelines Ltd
AP725619 Corp	Boral Finance Pty Ltd
EJ450801 Corp	APT Pipelines Ltd
EK805526 Corp	APT Pipelines Ltd
LW239378 Corp	QPH Finance Co Pty Ltd
QZ766772 Corp	Transurban Queensland Finance Pty Ltd
EK807839 Corp	APT Pipelines Ltd
EK642479 Corp	Transurban Queensland Finance Pty Ltd
EK355413 Corp	QPH Finance Co Pty Ltd
QZ870137 Corp	APT Pipelines Ltd
EI836446 Corp	Origin Energy Finance Ltd
EJ610528 Corp	Origin Energy Finance Ltd

Ticker	Issuer
UV302700 Corp	DBNGP Finance Co Pty Ltd
AS197471 Corp	Transurban Queensland Finance Pty Ltd
AX518215 Corp	Santos Finance Ltd
AO951980 Corp	Santos Finance Ltd
AR620052 Corp	Pacific National Finance Pty Ltd
AN191913 Corp	Pacific National Finance Pty Ltd
EK907291 Corp	Pacific National Finance Pty Ltd
AS511777 Corp	BlueScope Finance Americas LLC
AQ107007 Corp	Adani Abbot Point Terminal Pty Ltd
AN441270 Corp	Pacific National Finance Pty Ltd
EJ832440 Corp	Pacific National Finance Pty Ltd
EI630791 Corp	Pacific National Finance Pty Ltd