Issues Paper

Railways (Access) Code 2000: Weighted Average Cost of Capital

WACC Determination – Railway Networks

7 February 2013

Economic Regulation Authority
WESTERN AUSTRALIA

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1 Introduction and background

1.1 Introduction

1. Clause 3 of Schedule 4 of the *Railways (Access) Code 2000* ("**Code**") requires the Economic Regulation Authority ("**ERA**") to make an annual determination of a weighted average cost of capital ("**WACC**") to be applied in the determination of floor and ceiling prices for access to each of:

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

2. The PTA network is the urban passenger network operated by the Public Transport Authority (**PTA**), which is an agency of the Western Australian Government.

3. The TPI network is operated by The Pilbara Infrastructure Pty Ltd (**TPI**) as the owner of the railway network that links Fortescue Metals Group's mines in the Pilbara to TPI's port facilities in Port Hedland.[1]

4. The Brookfield Rail Network is the freight network in the south-west of Western Australia operated by Brookfield Rail (formerly known as WestNet Rail), a wholly-owned subsidiary of Brookfield Infrastructure Partners L.P.

5. The Western Australian rail access regime has some distinguishing features that have implications for the form of the WACC that is applied. The most important of these features is the way in which the asset base (to which the WACC is applied) is determined.

6. Under the Western Australian rail access regime, the asset base is determined by a periodic estimation of the gross replacement value (**GRV**) for the assets, which is defined in clause 2 of Schedule 4 of the Code as:

   > "… the gross replacement value of the railway infrastructure, calculated as the lowest current cost to replace existing assets with assets that have the capacity to provide the level of service that meets the actual and reasonably projected demand and are, if appropriate, modern equivalent assets."

7. The Western Australian rail access regime is the only rail access regime in Australia to use the GRV approach and is the only such regime that the ERA regulates.

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

8. The Western Australian rail access regime is characterised as a forward-looking 'bypass' regime that requires that the maximum amount that a railway owner may recover from access seekers is the costs that the access seekers are avoiding by not building their own infrastructure. In contrast, other access regimes are characterised by infrastructure owners recovering efficiently incurred historical costs.

1.2 Review process

9. The ERA is required to determine, as at 30 June in each year, the WACC for each of the three rail networks and to publish a notice of each such determination in the Government Gazette as soon as practicable after it is made.

10. In addition, clause 3 of Schedule 4 of the Code further requires that, in every fifth year subsequent to 2003, the ERA undertake public consultation prior to determining the WACC values for that year. Consequently, the ERA is required to undertake a public consultation process prior to making its WACC determination for 30 June 2013.

11. The ERA has previously adopted a convention that the method for determining the WACC to apply to railway networks will generally not vary between determinations made every fifth year in conjunction with public consultation, but the parameters based on observable market variables are updated annually, where appropriate.

12. The Code does not restrict methodology changes to the five yearly reviews, but requires only that stakeholders be consulted every five years.

13. The ERA is currently developing rate of return guidelines for gas transmission and distribution networks pursuant to the National Gas Rules, to be finalised by the end of 2013.[2] The ERA considers there is considerable value in harmonising as much as possible the formulation of a method for calculating the rate of return for regulated entities across these two industries. The ERA considers that there is a significant overlap of issues between the required five yearly rail consultation process mentioned above and the development of the gas access rate of return guidelines.

14. The ERA expects to institute changes to the method for calculating rail WACC values from 30 June 2014 and proposes to determine the WACC values for 30 June 2013 separately. Accordingly, the ERA is seeking public comment on:

    - an update of the rail WACC values to apply to regulated railway networks as at 30 June 2013 ("**2013 WACC review"**); and
    - a review of the methods for calculating the rail WACC values to apply from 30 June 2014 (**"2014 method review"**).

15. The ERA has prepared this issues paper, which addresses similar matters to those presented in the gas consultation paper and identifies rail-specific matters, in order to assist stakeholders in providing submissions to the 2014 method review. Stakeholders are also invited to refer to this issues paper in providing submissions to the 2013 WACC review.

[2] A consultation paper related to the gas rate of return guidelines was published on 21 December 2012 - *Consultation Paper – Guidelines for the Rate of Return for Gas Transmission and Distribution Networks,* at http://www.erawa.com.au/cproot/11039/2/20121221%20-%20D101413%20-%20Consultation%20Paper_RoR%20Guidelines_for%20publication.pdf.

16. Stakeholders wishing to make submissions may make a single submission, which clearly distinguishes between matters that are relevant to each process, or may choose to make separate submissions.

17. Table 1 establishes the timelines that the ERA intends to follow in conducting the two public consultation processes.

18. The proposed longer time frame for the 2014 rail WACC method review permits greater opportunity for detailed consideration to be given to relevant issues and the opportunity for subsequent submissions to an ERA draft determination as set out in the timeline below.

Table 1 Indicative Timelines for 2013 WACC Review and 2014 Method Review

Milestone	Date
Publication of the Issues Paper	**7 February 2013**
2013 Rail WACC Review	
Submissions on 2013 WACC Review close	15 March 2013
Publication of Final Determination	**30 June 2013**
2014 Rail WACC Method Review	
Submissions on 2014 Method Review close	15 March 2013
Publication of Draft Determination	June/July 2013
Submissions on Draft Determination close	August/September 2013
Publication of Final Determination	November 2013

1.3 How to make a submission

19. Submissions on any matter raised in this consultation paper should be in both written and electronic form (where possible). Submissions should be marked to the attention of Mr Jeremy Threlfall, and addressed to:

Issues Paper: Consultation on the WACC for regulated railways
Economic Regulation Authority
PO Box 8469
Perth Business Centre
PERTH WA 6849

Email: publicsubmissions@erawa.com.au
Fax: (08) 6557 7900

20. Interested parties are invited to make submissions on:

- the 2013 update of the WACC values for regulated railway networks in Western Australia; by **4:00 pm (WST) on Friday, 15 March 2013**; and
- the review of the methods for calculating the WACC values to apply from 30 June 2014 by **4:00 pm (WST) on Friday, 15 March 2013**.

21. The ERA prefers that all submissions be in an electronic format and be made publicly available so as to facilitate an informed, transparent and robust consultation process. Accordingly, submissions will be treated as public documents and posted on the ERA's website, www.erawa.com.au, unless prior arrangements are made with the ERA to treat the submission, or portions of it, as confidential.

22. The receipt and publication of a submission shall not be taken as indicating that the ERA has knowledge, either actual or constructive, of the contents of a particular submission and, in particular, where the submission, in whole or part, contains information of a confidential nature no duty of confidence will arise for the ERA in these circumstances.

23. Further information regarding this issues paper can be obtained from:

Mr Jeremy Threlfall
Assistant Director, Rail
Economic Regulation Authority
Ph (08) 6557 7900

24. Media enquiries should be directed to:

Mr Richard Taylor
Media Advisor at Riley Mathewson
Ph: 61 8 9381 2144
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2 Objective of the WACC

25. The objective of the *Railways (Access) Act 1998* is to establish a rail access regime that encourages the efficient use of, and investment in, railway facilities. The rail access regime is described in the Code, wherein the means of calculating recoverable cost ceilings are prescribed in Schedule 4.

26. For the purposes of the Code, and as described in clause 2 of Schedule 4 of the Code, the WACC is the interest rate to be used in the calculation of capital costs in the form of an annual cost or annuity for the provision of railway infrastructure.

27. The Code does not prescribe any empirical elements as being necessary in the determination of the WACC for railway networks. Although not defined as such in the Code, the WACC is typically calculated as the weighted average cost of debt and equity funding. These costs are weighted according to the proportions of debt and equity judged to be efficient proportions in the financial structure of railway networks in Western Australia.

28. The WACC is described in clause 2(4)(c) of the Code as the 'target long term weighted average cost of capital appropriate to the railway infrastructure'. This is taken to mean that the calculation of a WACC is to include parameters that are benchmarked against efficient and best industry practice.

29. On this basis, the calculation of an appropriate WACC for railway networks would be based on:

- efficient financing costs; of
- a benchmark efficient entity; with
- a similar degree of risk as the service provider in respect of the provision of infrastructure.

30. The lack of empirical restrictions imposed by the Code has resulted in considerable variation in the content and nature of submissions to the ERA in previous rail WACC determinations.

2.1.1 Criteria for exercise of discretion in determining the WACC

31. It is feasible that sets of alternative methodologies, estimation methods, financial models, market data and other evidence may meet some, but not all, of the specific requirements of the Code set out above. The ERA would therefore need to consider which one of a number of alternative approaches *best* meets the objective. The ERA notes that in the context of the gas rate of return guidelines, the AEMC has stated:[3]

> The role of the [rate of return] objective is to indicate what the regulator should be *seeking* to achieve in the exercise of its discretion. Some stakeholders appear to have understood the objectives as imposing on the regulator a requirement and that failure to comply with this would mean the regulator is in breach of the rules. This is not the case. Although the language of an obligation is used in some objectives, it is not necessarily expected that the substance of the objective will always be fully

[3] Australian Energy Market Commission 2012, *Rule Determination: National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012 National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012*, www.aemc,gov.au, p. 36.

achieved, but rather the regulator should be striving to achieve the objective as fully as possible. Where it is used in rate of return and capex incentives, the objective has primacy over other matters which the regulator is directed to consider.

32. Although the rail Code does not have a similar rate of return objective, it appears reasonable to expect that any rate of return (WACC) objective may be *best* met if the rate of return methodologies that are ultimately adopted, among other things, satisfy certain criteria. These criteria would provide a framework for the exercise of the ERA's regulatory discretion in accepting or rejecting a proposal, and would allow it to inform its reasoning in a structured manner. A good criterion is one that is:

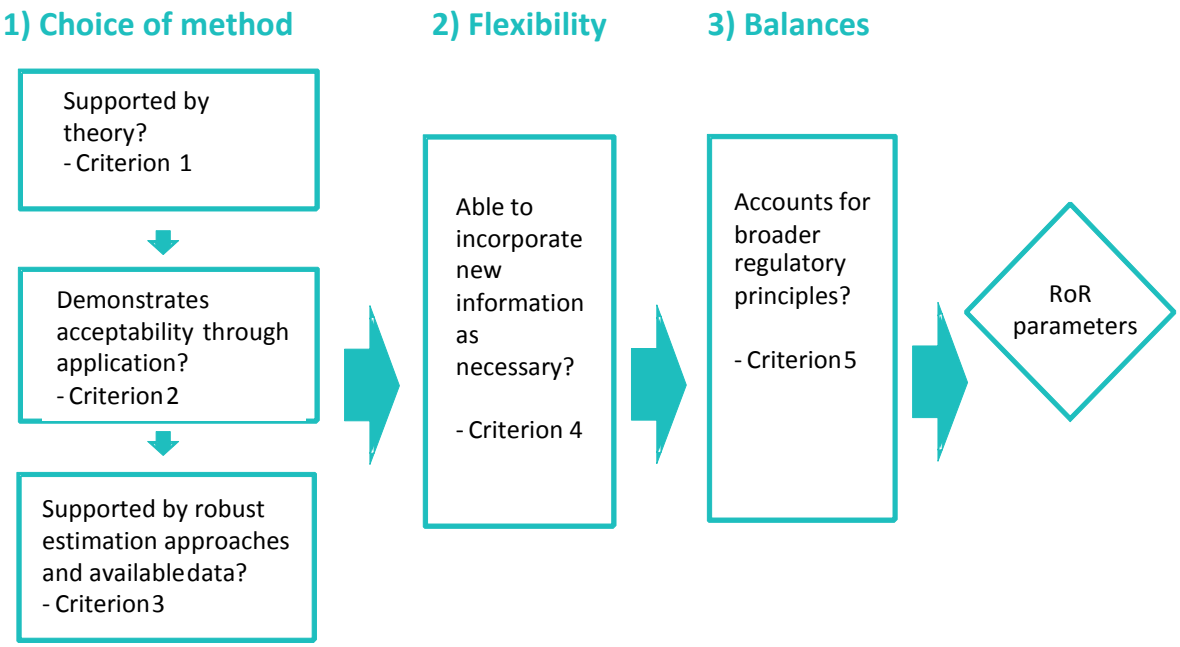
- independent – clear and unambiguous in highlighting a principle on which regulatory judgment might hinge;
- objective – demonstrated by concrete evidence – whether quantitative or qualitative – rather than open to subjective interpretation;
- concise – simple and readily understandable; and
- relevant – incisive, able to expose differences in outcomes.

33. With this in mind, the ERA considers that, in making its regulatory judgments, it will need to take the following separate principles into account when determining the rate of return (WACC) parameters. The methodologies should:

- be supported by theory – as this underpins good regulatory practice;
- have broad acceptability – as this informs the credibility and extent of application in practice;
- be based on robust, transparent estimation approaches, input data and other required information – as the availability of appropriate data and other inputs, internal consistency, and the robustness and repeatability of the ensuing results are an important consideration in accepting any approach;
- be able to take account of new information – as an approach may need to be able to respond to changing market conditions and new evidence, and should do so in a robust manner; and
- reflect broader balancing considerations – as broader regulatory principles may need to be taken into account, which may need to condition the choices supported by the other criteria.

34. These considerations can be organised in terms of the following 'decision' flow chart (Figure 1).

Figure 1 Elements informing regulatory discretion



35. The ERA has drafted a set of criteria that it proposes to apply in determining guidelines for rates of return for gas pipelines.[4] The possible set of criteria adopted for informing each principle in the gas rate of return guidelines consultation paper is summarised in Box 1 below. The number of each criterion is allocated to each element as per Figure 1.

36. These criteria will be finalised in the course of the ERA's current review of the guidelines for the rate of return for gas pipelines.

37. The ERA intends to apply a consistent set of criteria to WACC (or rate of return) determinations for all utility industries.

[4] These criteria have been developed in response to the requirements of the National Gas Rules (Rule 87) in the development of guidelines for Rates of Return. For a discussion of this background, see section 2.1.5 (page 12) of *Consultation Paper – Guidelines for the Rate of Return for Gas Transmission and Distribution Networks.*

BOX 1 CRITERIA FOR ASSESSING THE FORMULATION OF THE WACC

The ERA will assess whether proposals for amending the current WACC calculations meet the following criteria:

1) have a strong theoretical underpinning;
   - recognise that the WACC methodologies ideally should be supported by theory;

2) are well-accepted;
   - acknowledge that approaches that have widespread application and acceptability are more likely to enhance the credibility and acceptability of a decision;

3) are supported by robust, transparent and replicable analysis that is internally consistent and is derived from available, current and credible datasets;
   - are derived from analysis and estimation methods that are transparent and replicable;
   - are derived from analysis and estimation methods that are internally consistent;
   - lead to outcomes from quantitative modelling that are sufficiently robust as to not be sensitive to small changes in the data;
   - recognise that while some approaches may be sound, there may be insufficient data to allow their use, or the available data may be out of date;
   - recognise that arbitrary filtering of data, or adjustment to the data, is undesirable;

4) have the flexibility to reflect changing market conditions and new information as appropriate;
   - recognise the need to deal with uncertainty;
   - give confidence that the WACC will reflect actual conditions prevailing in the market over the relevant timeframe;

5) lead to consistent regulatory decisions across industries, service providers and time;

   recognise the desirability of a common approach to regulation, so as to avoid distortions

38. The ERA is seeking views and supporting information from interested parties on the following issues:

1. *Is it reasonable to consider criteria when evaluating alternative WACC methodologies?*
2. *Are the criteria identified consistent with the objectives of the rail regime? Are there other criteria that might be considered?*

2.2 Efficient financing costs

39. Efficient financing works to allocate finance to its most valued uses over time, at lowest cost. An efficient allocation is determined by the available information on the returns to capital of each allocation, and particularly by the available information on the associated risks.

40. An efficient infrastructure owner is considered to finance its activities through a mix of equity and debt. The concept of efficient financing costs therefore extends to a consideration of efficient allocation of both equity and debt.

2.2.1 Current practices

41. The use of the WACC approach to quantify a 'rate of return' implies that all financing decisions are efficient. The WACC reflects the minimum rate of return that an entity must earn on its existing asset base in order to satisfy its creditors, shareholders and other providers of capital.

2.2.2 Discussion of issues

42. The discreet elements of a WACC calculation are considered in detail in subsequent sections addressing the cost of equity and the cost of debt. Views are sought here on the concept and scope of efficient financing costs.

2.2.3 Issues for consideration

43. The ERA is seeking views and supporting information from interested parties on the following issues:

3. *What constitutes 'efficient financing costs', and how should this inform the approach to estimating the WACC?*
4. *Are there other methods that provide information on efficient financing costs that need to be taken into account?*

2.3 Benchmark efficiency

44. Benchmark efficiency refers to the assumption that a railway owner has structured its finances in order to minimise its cost of capital in a way that is consistent with best practice for the industry.

45. Regulators commonly use a benchmark approach rather than a business specific approach to estimate WACC parameters in order to:

- provide consistency with incentive regulation; and
- ensure that customers are less likely to bear the cost associated with inefficient decisions (e.g. financing structures).

46. All regulators use a benchmark approach when estimating the gearing ratio and the credit rating. The ERA's current practices for estimating the gearing ratio and the credit rating are discussed below.

2.3.1 Current practices

47. The ERA has in its previous determination assumed a gearing of 35 per cent debt to assets for Brookfield Rail and PTA.[5] This was based on the report prepared for the ERA by the Allen Consulting Group.[6] The ERA has adopted a gearing ratio of 30 per cent debt to assets for TPI.

48. Using a benchmarking approach, the ERA has most recently adopted the following credit ratings for railway owners:

- PTA A
- Brookfield Rail BBB+
- TPI BBB-

2.3.2 Discussion of issues

49. Information for benchmarking may not always be available for particular business segments, such as below-rail operations, or may be subject to sampling issues. Consideration therefore needs to be given to whether benchmarks should be based on proxy industry benchmarks, theoretical constructs, or a combination of approaches.

50. There is contention on the issue of whether benchmarking information should be derived from domestic Australian data only, or whether an international set of data is relevant and acceptable. The benefit of international data is a more extensive sample from which to draw benchmarks.

51. The ERA is aware of considerable scale differences between Australian and international below-railway operations.

52. A further question is whether or not benchmarks for all parameters of the WACC calculation (being the gearing ratio, the credit rating and the equity beta) for a railway owner should refer to the same sample of firms. It is not considered contentious that the sample of firms is varied for the purpose of benchmarking parameters for different regulated railway owners, as this reflects the variations in operations and risk profile of each railway owner.

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5 Economic Regulation Authority, June 2008, Final Determination; Weighted Average Cost of Capital for the Freight (WestNet Rail) and Urban (Public Transport Authority) Railway Networks.

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

53. Benchmarks are generally based on an average or median of an observed industry sample. An alternative would be to determine benchmarks from best practice outcomes to provide greater incentives for achievable cost reductions in financing costs.

2.3.3 Issues for consideration

54. The ERA is seeking views and supporting information from interested parties on the following issues:

5. *What elements of the evaluation of the WACC should be informed by benchmarking?*
6. *What considerations are relevant when estimating the associated parameters for the benchmark efficient railway owner?*
7. *Should the same sample of benchmark firms be used to inform each parameter?*
8. *Should benchmark measures be based on an average or median of the sample or from the best practice outcomes?*

2.4 Degree of risk associated with infrastructure projects

55. The degree of risk associated with the railway owner in providing infrastructure is a key element in pricing of capital. The degree of risk is generally taken to be associated with the industry, rather than any particular infrastructure provider, and therefore is closely related to the concept of the benchmark efficient infrastructure provider.

2.4.1 Current practices

56. The ERA assesses equity risks for the three regulated railways in Western Australia by benchmarking against a sample of comparable railways in Australia and overseas.

57. For the cost of equity, this is reflected in the beta associated with the observed sample of railways. For the cost of debt, the risk is assessed from the debt margin of the observed sample.

2.4.2 Discussion of issues

58. A key issue is whether estimates of the degree of risk should be derived from a sample of Australian railways only, or whether an international sample is relevant and acceptable.

59. Railway owners have previously expressed the view that the Capital Asset Pricing Model (**CAPM**) does not adequately compensate infrastructure providers for the non-systematic risk of assets becoming stranded and therefore reduces the incentive for investment in new railway assets, particularly greenfield mining-related assets.

60. Stranding risk is the risk that the economic life of a railway (or a route section) is truncated due to a change in circumstances, such as the closure of a mine.

61. Railway owners have suggested that they should be compensated for the residual risk borne by infrastructure providers after any risk mitigation strategies have been employed. Compensation options that have been suggested include:

- an option valuation approach, which provides the equivalent of an insurance premium to take into account the impact of asymmetric risk;
- an adjusted cost of capital, which involves increasing the maximum allowed cost of capital such that the expected return is equivalent to the conventionally determined cost of capital; and
- estimating the premium to the cost of capital by reference to the debt premium for the debt raised to finance the project, based on the margin above the normal credit rating.

2.4.3 Issues for consideration

62. The ERA is seeking views and supporting information from interested parties on the following issues:

9. How should the degree of risk for a railway owner be measured? What does this imply for the estimation methods, models, data sets and other information required to determine the WACC?

10. Should stranding risk be considered a non-systematic risk?

11. Does the CAPM framework accommodate an assessment of stranding risk? If not, why not?

3 Overall Regulatory Framework

63. In establishing a framework for determining the WACC, the ERA will need to consider:

- the form of the WACC; and
- the components of the WACC.

3.1 Form of the WACC

64. The Code does not specify a method to be applied in estimating the WACC for regulated railway networks. Accordingly, the method to be applied is a matter for determination by the ERA, and is not limited by the Code.

3.1.1 Current practices

65. The ERA currently employs the Officer WACC model to calculate a real pre-tax WACC for railway owners, with an assumption of the effective taxation rate of the rail businesses being equal to the statutory rate of corporate income tax.

3.1.2 Discussion of issues

66. The ERA has applied a range of different treatments to taxation in recent regulatory decisions across the regulated industries of electricity, gas and railway networks.

67. The key question for treatment of taxation is whether an allowance for the costs of taxation to the railway owner should be made by:

- making a high level assumption about the effective tax rate that would apply to the regulated activity and providing compensation for taxation by including an allowance in the WACC (that is, a pre-tax method); or
- explicitly modelling the likely taxation payments for the regulated business and allowing for taxation costs as an explicit cost in the building block calculation of ceiling cost (that is, a post-tax method).

68. For the purposes of regulating gas networks, the ERA is now required to apply a post-tax nominal vanilla approach to determining the WACC in accordance with National Gas Rule 87(4) and 87(A). Although no such restrictions on the form of the WACC apply to railway networks under the Code, there may nevertheless be advantage from a change to a post-tax method if this would result in administrative improvements by ensuring that the ERA's approach is consistent with that applied to other regulated industries in Western Australia (and with that applied to other regulated railway networks in Australia).

69. In advising the ERA on the 2008 Rail WACC Determination, the Allen Consulting Group discussed the relative merits of a pre- and post-tax approach to estimating the WACC. The Allen Consulting Group advised that, as a general principle of regulation, it is of the view that it is appropriate and preferable to use a post-tax WACC in determination of regulated revenues and prices because this results in a determination that is closer to the cost of taxation that would be incurred by an efficient provider of rail services.

70. In this respect, the ERA notes that the adoption of a post-tax WACC would require railway owners to estimate their future tax liability explicitly. Generally, this would require the establishment of a tax asset base for regulatory purposes, and the estimation of future tax liabilities, based on a forecast of future cash flows for the business. These estimates would then be incorporated in the ERA's determination, creating an explicit tax 'building block'. The estimation of future tax liabilities may be inconsistent with the light handed nature of the rail access regime, and the determination of the asset base on a GRV basis.

3.1.3 Issues for consideration

71. The ERA is seeking views and supporting information from interested parties on the following issue:

12. What form of WACC is considered most appropriate to apply to rail networks?

13. What would be the costs and benefits of moving from a pre-tax WACC to a post-tax WACC?

14. In particular, would there be any significant costs associated with estimating tax liabilities under a post-tax approach? Would these costs outweigh any benefits, such as through more accurate recompense for tax liabilities?

3.2 Components of the WACC

72. The pre-tax form of the WACC is derived from a post-tax form of the WACC.

73. In the absence of an imputation tax system, the nominal post-tax form of the WACC is expressed as below:

$$WACC_{\text{nominal post-tax}} = E(R_e) \times \frac{E}{V} \times + E(R_d) \times \frac{D}{V}(1 - T_c)$$

where:

- $E(R_e)$ is the nominal post-tax expected rate of return on equity - the cost of equity;
- $E(R_d)$ is the nominal pre-tax expected rate of return on debt - the cost of debt;
- E/V is the proportion of equity in the total financing (which comprises equity and debt);
- D/V is the proportion of debt in the total financing; and
- T_c is the tax rate.

74. The Australian tax system provides credits to shareholders for tax already paid at the corporate level, to avoid double taxation of the same income stream. In this circumstance, the nominal post-tax WACC formula needs to be modified to reflect the additional element of shareholders' return available through the taxation system. This is an estimate of the post-tax return on assets in the presence of an imputation credit tax system:

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

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

The Nominal Pre-Tax WACC Formula:

75. This is an estimate of the pre-tax return on assets, which can be obtained by dividing the right hand side of the formula for the above nominal post-tax return on assets by the component $(1 - T_c)$, which can be expressed as:

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

The Real Pre-Tax WACC Formula:

76. A real pre-tax WACC is obtained by removing expected inflation π_e from the nominal pre-tax WACC:

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

77. The proportion of debt in total financing is derived from the gearing ratio, which is thus a key consideration in determining the WACC.

3.3 Gearing

78. Gearing refers to the proportions of the total asset value assumed to be financed by debt and equity. Financial gearing generally refers to the ratio of debt to total asset value, which comprises debt and equity. The relative proportions of debt and equity that a firm has outstanding constitute its capital structure. Choices of capital structure differ across industries, as well as for different companies within the same industry.

79. Intuitively, the cost of equity is expected to be higher than the cost of debt due to the relatively higher uncertainty associated with holding equity. This would mean a lower gearing level (that is, less debt in the total asset) would result in a higher cost of capital when applying the WACC formula. In practice however, a highly geared company will often be perceived as riskier, and investors will demand a higher premium on securities issued by the company. Theoretically, an optimal gearing level exists that maximises the value of the firm. It is expected that firms move towards this optimal level of gearing over time.

80. It is regulatory practice to make a benchmark assumption regarding the gearing level of a regulated entity, as opposed to observing the actual gearing level. Observing the actual financial structure of a railway owner may create incentives for the railway owner to deviate from an efficient financial structure.

81. In addition, gearing is also used in converting between the (unlevered) asset beta and the (levered) equity beta. This allows for the equity beta to be determined on a basis that is consistent with the assumed gearing of the benchmark efficient railway owner. The gearing ratio is also considered as a factor to determine the credit rating of a railway owner for the purpose of determining the debt risk premium.

3.3.1 Current practices

82. The ERA has in its most recent WACC determination assumed a gearing of 35 per cent debt to assets for PTA and Brookfield Rail and 30 per cent for TPI.[7]

83. The estimate for PTA and Brookfield Rail was based on the report prepared for the ERA by the Allen Consulting Group.[8] The Allen Consulting Group considered market based observations of capital structures for a set of comparable businesses containing:

- listed railway owners in the USA and Canada;
- listed transport infrastructure and services firms in Australia and New Zealand; and
- listed global toll-road operators.

84. In its most recent Railway Access Undertaking for the interstate rail network, the Australian Competition and Consumer Commission (**ACCC**) adopted a gearing ratio of 50 per cent.[9]

85. The ACCC considered the regulatory precedent of adopting a gearing of 60 per cent for other regulated industries in Australia, for example gas transmission and distribution.

86. The ACCC noted that railway owners are likely to experience more volatile operating cash flows than other regulated firms, and as a consequence, railway owners would be expected to have a lower level of debt. The ACCC considered the leverage of overseas railways and noted the average of gearing was 26.31 per cent. The ACCC noted that, whilst overseas rail operators are not ideal benchmarks, they are most likely the best proxies available.

87. The ACCC also stated that it considers trucking and shipping companies to be less than ideal proxies for the capital structure of regulated rail entities. Based on this analysis, the ACCC decided a 50 per cent gearing level was appropriate.

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7 Economic Regulation Authority, June 2008, Final Determination; Weighted Average Cost of Capital for the Freight (WestNet Rail) and Urban (Public Transport Authority) Railway Networks.

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

9 Australian Competition & Consumer Commission, July 2008; Access Undertaking – Interstate Rail Network.

88. The Queensland Competition Authority adopted a gearing of 55 per cent in its most recent 2010 Draft Access Undertaking for the Queensland Rail Network.[10] This adopted gearing was unchanged from its 2006 undertaking.

3.3.2 Discussion of issues

89. Key considerations relating to the relevant data and information required to determine the benchmark gearing level for railway owners include:

- the companies to be included in the benchmark sample (including whether to include only domestic railways or international samples as well);
- the period in which gearing levels for these companies are observed;
- the methodology that is adopted to determine the appropriate gearing from the sample; and
- the data sources.

90. It has been noted that different firms have inherently different risk profiles and as a consequence have varying debt capacities.[11] The optimal capital structure is determined by the business risk inherent to firms in an industry and the expected loss if default occurs.[12] Given that the expected loss of default for the regulated entity is likely to differ from that of the comparable sample, the optimal capital structure of the entity is likely to differ as well. As such, it may be appropriate to adjust any estimate of gearing levels to reflect differences in the level of risk.

3.3.3 Issues for consideration

91. The ERA is seeking views and supporting information from interested parties on the following issues:

15. *What are the key characteristics or the selection criteria for businesses to be included in the benchmark sample?*
16. *Should international railways be included in the sample of benchmark companies used to determine benchmark gearing levels?*
17. *What are the appropriate time periods and the methodology for determining the benchmark gearing ratio from available market data?*
18. *Is it appropriate to adjust benchmark estimates of gearing levels to reflect differences in the level of risk between benchmark businesses and the regulated railway owners?*

[10] Queensland Competition Authority, September 2010, Final Decision, Queensland Rail Network's 2010 DAU.

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

[12] Brealey, Myers and Allen, *Corporate Finance*, McGraw Hill, New York p. 476.

4 Nominal Risk Free Rate

92. The nominal risk free rate is a key input to the calculation of both the cost of equity and the cost of debt.

93. The risk free rate is the rate of return an investor receives from holding an asset with a guaranteed payment stream (that is, that has no risk of default). Since there is no default risk on the risk-free assets, the return on risk-free assets compensates investors for time value of money. In addition, the risk free rate of return also compensates investors for bearing liquidity risks, because the risk free rate is assumed to be entirely liquid.

4.1 Current practices

94. Commonwealth Government Securities (**CGS**) are widely used by regulators as a proxy for the risk free rate in Australia.

95. Different terms to maturity of the risk free rate have been adopted by regulators. Some regulators use CGS with a ten year term to maturity whereas others use CGS with a five year term to maturity.

96. The Australian Energy Regulator (**AER**), for example, has adopted a ten year term for a nominal risk free rate.[13] The ERA and other regulators, including the Queensland Competition Authority and the Independent Pricing and Regulatory Tribunal, have adopted a five year term for the risk free rate for energy industries.

97. The ERA has adopted a ten year term for regulated railway networks in WACC determinations.

98. Current practices by Australian regulators generally involve an averaging period of 20 trading days (or a period of between 10 and 40 days for the AER) as being the best proxy for a forward-looking risk free rate.[14] The ERA's recent empirical work, using Australian historical data, has confirmed that this observation holds.[15] Further details on this empirical work are discussed in 4.2.3 below.

99. The Alberta Utilities Commission (**AUC**) has traditionally used the Consensus Economics forecast on 10-year Government of Canada bonds in order to estimate the value of the risk free rate.[16]

100. The New Zealand Commerce Commission (**NZCC**) considers that terms for the risk free rate could be 3, 4, or 5 years, depending on the length of the regulatory control

[13] Australian Energy Regulator, May 2009, Final Decision, Electricity transmission and distribution network service providers, Review of the weighted average cost of capital (WACC) parameters, p. 168.

[14] There are three different types of moving averages: (i) Simple Moving Average; (ii) Exponential Moving Average; and (iii) Weighted Moving Average, and they are all calculated slightly differently. However, all have a similar smoothing effect on the data, so that any unexpected changes on rates are removed, and, as a result, the overall direction is shown more clearly. For simplicity, the ERA adopts the simple moving average in its calculations.

[15] Economic Regulation Authority, September 2012, Final Decision on Proposed Revisions to the Access Arrangement for the Western Power Network, pp. 659-666.

[16] Alberta Utilities Commission, December 2011, 2011 Generic Cost of Capital, Decision 2011-474, p. 9.

period. NZCC uses Bloomberg data on New Zealand Government bonds with corresponding terms to maturity.[17]

101. The risk free rate of return is annually updated by the NZCC for some particular regulated businesses. This practice of updating the risk free rate is also applied in the rail access regime in Western Australia.

102. UK regulators including the Office of the Gas and Electricity Markets (**OFGEM**) and the Water Services Regulation Authority have adopted a range with the lower bound matching the 10 year average yields on 10-year Index Linked Gilts and the upper bound with reference to regulatory precedent.

4.2 Discussion of issues

103. The three identified key issues relating to estimation of nominal risk-free rates of return are:

- the choice of the proxy for "risk-free" assets;
- the term to maturity; and
- the averaging period.

Each of the above are discussed below.

4.2.1 The choice of proxy for "risk free" assets

104. Australian regulators have consistently adopted the observed yield to maturity of the CGS bonds as the best proxy for the nominal risk-free rate of return. The bonds issued by the Commonwealth Government of Australia have been considered as the best proxy for the nominal risk free rate in Australia on the following grounds:

- CGS bonds are essentially free from default risk. The Australian Government has consistently received the highest possible credit ratings from both Standard and Poor's (**S&P**) and Moody's. Payments from these bonds are guaranteed by the Australian Government.
- CGS bonds are the most liquid assets in Australia in terms of the volume at issuance; various terms to maturity; and narrow spreads between bid-ask yields.
- The observed yields of these bonds are transparently recorded and reported by the Reserve Bank of Australia (**RBA**) on a daily basis and are publicly available.

4.2.2 The term of the risk free rate

105. The ERA adopted a ten year term for the risk free rate in the 2008 Rail WACC Determination. This decision was based upon a recommendation from the Allen Consulting Group. The Allen Consulting Group referenced the draft decision of the Victorian Essential Services Commission on the access arrangements for the Victorian gas distributions networks. On the basis of this work, the Allen Consulting

[17] Commerce Commission New Zealand, September 2012, Cost of Capital Determination for Electricity Distribution Businesses to Apply to a Customised Price-Quality Path Proposal, 2012 NZCC 25, p. 6.

Group recommended that the ERA derive the nominal risk free rate based on a 20 trading day average of the ten year nominal government bond rate.[18]

106. The ERA has subsequently adopted a term for the risk free rate of five years in the Final Decision on the Dampier to Bunbury Natural Gas Pipeline Access Arrangement in 2011.[19] This decision is based on the following:

- The "NPV = 0" principle from academic studies and consultant reports. An explanation of the principle is set out in Appendix A.
- The debt profiles for Australian rated utilities presented by S&P in their industry report cards.
- The current debt profile of Australian utilities.

107. Consideration must be given as to whether the ERA continues to apply a ten year term to railway networks or adopts a five year term as it has for gas and electricity networks.

108. Using a five year term as the basis for setting the terms of the proxies for the risk free rate and the cost of debt is seen as appropriate for gas and electricity industries on the basis that this term matches the regulatory control period, which is generally five years in Australia. This is discussed in more detail in Appendix B.

109. No regulatory control period applies to regulated railway networks in Western Australia. The ERA is required to determine a WACC for each regulated railway owner annually.

110. The ERA notes that in most circumstances, the yield curve, which represents the relationship between the observed yields and terms to maturity, is assumed to be upward sloping. As such, the risk free rate observed from a security with a 5 year term to maturity is generally lower than the risk free rate obtained from a security with a 10 year term to maturity.

4.2.3 The averaging period

111. Australian economic regulators favour an averaging period of 10-40 trading days prior to the release of the regulatory decisions.

112. The ERA applied a 20 trading day averaging period to railway networks in the 2008 Rail WACC Determination.

113. The ERA has conducted analysis that concludes that a 20 trading day average is the best proxy for the forward looking estimate of the risk free rate for the electricity industry.[20]

[18] The Allen Consulting Group, October 2007, Railways (Access) Code 2000: Weighted Average Cost of Capital 2008 WACC determinations, p. 15.

[19] Economic Regulation Authority, March 2011, *Draft Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline*, p.186.

[20] Economic Regulation Authority, September 2012, Final Decision on Proposed Revisions to the Access Arrangement for the Western Power Network, pp. 659-666.

4.3 Issues for Consideration

114. The ERA is seeking views and supporting information from interested parties on the following issues:

19. Are there any viable alternatives to the Commonwealth Government Securities as an appropriate proxy for the nominal risk free rate of return for railway networks?

20. What is the appropriate period for determining the term of the risk free rate?

21. What is the best proxy for the nominal risk free rate of return for railway networks?

5 The Cost of Equity

115. The tool commonly used for quantifying the return on equity and associated risk has been the Capital Asset Pricing Model (**CAPM**). The CAPM explains the expected return on equity for any financial asset in terms of its specific risk premium, over and above the nominal risk free rate.

116. The CAPM estimates the risk premium associated with a particular asset by quantifying the relationship between the specific asset or firm and the level of systematic (or non-diversifiable) risk.[21] The higher the level of non-diversifiable risk of the asset, the higher is the required or expected rate of return. The CAPM uses the asset beta to describe the non-diversifiable returns of a particular asset.

117. The Code does not specify a method to be applied to estimate the return on equity for railway networks. Accordingly, the method to be applied is a matter for determination by the ERA, and is not limited by the Code.

118. Alternative methods for calculating the cost of equity, as well as approaches for estimating a risk free asset and the market risk premium, are discussed below.

5.1 Models for estimating the cost of equity

119. The standard regulatory implementation of the CAPM is labelled the Sharpe-Lintner CAPM, named for two of the original authors. A range of other asset pricing models have been developed, including:

- the Black model;
- the Fama-French model;
- the Zero-beta Fama-French model; and
- the discounted cash flow model.

120. A summary of these alternative asset pricing models for estimating the cost of equity is set out in Appendix B.

5.1.1 Current practices

121. In its 2008 Final Determination on the Rail WACC, the ERA formed the view that it was appropriate to use the same general method for estimating the WACC as was applied in the 2003 Final Determination. Accordingly, the ERA estimated the cost of equity using the Sharpe-Lintner CAPM.

122. The ERA and other regulators in Australia have used the Sharpe-Lintner CAPM exclusively for estimating the return on equity. This variant of the model is considered by the ERA to be a well accepted financial model.

123. Alternative models to the CAPM have not been adopted in Australia due to concerns about the theoretical background of the models and the robustness of inputs that are used in the models.

[21] The systematic risk or non-diversifiable risk encompasses those risks faced by market as a whole, which cannot be reduced by diversification through a well constructed portfolio of assets. This is the market risk premium.

124. The ERA has considered the merits of alternative models for estimating the cost of equity. These have most recently been discussed in some detail in the ERA's draft decision on the access arrangement for the Dampier to Bunbury Natural Gas Pipeline.[22]

5.1.2 Discussion of issues

125. A potential issue is whether a single model or a combination of methods and models should be used to inform the cost of equity.

126. In this context, reliable and unbiased estimates of the inputs are crucial to the output of the asset pricing models. Estimating the return on equity using the Sharpe-Lintner CAPM requires the estimates of three different parameter inputs:

- the nominal risk-free rate of return;
- the market risk premium; and
- an equity beta.[23]

127. There are many studies of the three inputs used in the Sharpe-Lintner CAPM, including studies undertaken within Australia. As a result, there is a good understanding of the factors driving the outcomes of the model.

128. In contrast, estimates of the input parameters used in the alternative models are much less common, at least in Australia. Estimates for the cost of equity are volatile and depend on the method employed and the research period. Estimates of the inputs have varied substantially, despite being from the same authors within a relatively short period of time.[24]

129. The use of Australian data reflects a choice by regulators for a domestic form of CAPM. However, as noted by the AER:[25]

> ...one of the key areas of debate in the Australian regulatory literature is the extent to which foreign investors should be recognised in the Australian domestic capital market. The choice of whether to adopt a domestic CAPM or an international CAPM is likely to influence the estimation of the...WACC parameters.

130. Having considered this issue, the AER ultimately retained the domestic form of the CAPM in its 2009 WACC decision, arguing that it was appropriate and reasonable given past regulatory practice and the reality of cross-border capital flows.[26]

131. Alternatives to the CAPM for estimating the cost of equity include:

- the discounted cash flow model;
- estimated market returns on comparable businesses;

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[22] Economic Regulation Authority, March 2011, Draft Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline, pp.113-117.

[23] The Sharpe Lintner CAPM uses the asset beta to describe the non-diversifiable returns of a particular asset. The higher the level of non-diversifiable risk, the higher is the required or expected rate of return. The systematic risk or non-diversifiable risk encompasses those risks faced by market as a whole, which cannot be reduced by diversification through a well constructed portfolio of assets.

[24] Economic Regulation Authority, August 2010, *Draft Decision on WA Gas Networks Revisions Proposal for the Access Arrangement for the Mid-West and South-West Gas Distribution Systems*, pp.126-133.

[25] Australian Energy Regulator 2008, *Explanatory Statement: Electricity transmission and distribution network service providers: Review of weighted average cost of capital (WACC) parameters*, www.aer.gov.au, December, p. 51.

[26] Ibid.

- price to book ratios.

These alternatives are detailed in Appendix B.

132. The AUC make reference to a selection of alternative models, as a means of cross-checking the estimates calculated from the Sharpe-Lintner CAPM.

5.1.3 Issues for consideration

133. The ERA is seeking views and supporting information from interested parties on the following issues:

22. Is it reasonable to rely on a single internally consistent model for determining the return on equity, or should a broader range of models and methods be used? If so, how might internal consistency be maintained for the overall method?

23. Is the adoption of a domestic form of the CAPM – with foreign investors recognised only to the extent that they invest within Australia – appropriate from a theoretical and practical point of view? If not, what are the alternatives?

24. Would it be appropriate, feasible and practical to adopt either a fully segmented (domestic) or a fully integrated (international) version of the CAPM?

25. What other evidence on return on equity might be used as a cross-check to the estimates from financial models?

5.2 Market Risk Premium

134. The market risk premium (**MRP**) is the average expected return of the market – above the risk free rate – that investors require in return for their investment in a well diversified portfolio of risky assets. In other words, it is the premium that investors demand for investing in a market portfolio relative to the risk-free rate.

$$MRP = R_m - R_f$$

where:

R_m is the expected market return

R_f is the risk-free rate

5.2.1 Current practices

135. Since the MRP is not directly observable, the preferred approach of Australian regulators has been to estimate the MRP using historical data on equity returns from the Australian stock market.

136. A study by Professor Handley of the University of Melbourne used historical data on equity premiums from the Australian stock market and observed yields on ten year CGS for various periods to estimate the MRP. This study concluded that a MRP of 6 per cent is appropriate. In this study, a ten year term was adopted for the risk free rate.[27]

137. The ERA has conducted analysis using the same approach (that is, using historical data on the equity premium) to derive an estimate of the MRP, using a five year term for the nominal risk free rate. The findings from this study also indicate that a MRP of 6 per cent is appropriate.[28]

138. In New Zealand the NZCC has surveyed MRPs, assuming a ten year investment term.[29] The results from this survey are consistent with surveys of MRPs based on a five year term. Based on its studies, the NZCC has observed that the MRP increased temporarily in 2010 and 2011 due to the effect of the global financial crisis. However, more recent data suggests that the MRP will return to more historic levels after June 2011.[30]

139. The AUC departed from using a long-term average estimate of the MRP on the grounds that the risk free rate was far below its long term historical average. Reference was made to a survey of CAPM forecasts made by experts in order to determine a reasonable range.[31]

140. OFGEM used estimates of the equity risk premium for the UK from 1900 to 2009 based on calculations sourced from Dimson, Marsh and Staunton's 2006 study[32] and the Credit Suisse Global Investment Returns 2010 Sourcebook.[33]

5.2.2 Discussion of issues

141. The three most common approaches to estimating the MRP are:

- The historical equity risk premium approach, which is a well-established method based on the assumption that the realised equity risk premium observed over a long period of time is a good indicator of the expected equity risk premium. This approach requires compiling historical data to find the average rate of return of a country's market portfolio and the average rate of return for the risk-free rate in that country.
- The dividend discount model approach or implied risk premium approach, which is implemented using the Gordon growth model (also known as the constant-

[27] Handley, 2011, "An estimate of the historical equity risk premium for the period for 1883 – 2010", A report for the Australian Energy Regulator, January 2011.

[28] Economic Regulation Authority, September 2012, Final Decision on Proposed Revisions to the Access Arrangement for the Western Power Network, pp. 372 - 381.

[29] Lally Martin, 2008, *The Weighted Average Cost of Capital for Gas Pipeline Businesses*, p. 23.

[30] The market risk premium is expressed as a tax adjusted figure for use in the Brennan-Lally CAPM. The Brennan-Lally CAPM reflects New Zealand's taxation system by taking the presence of imputation credits and absence of taxes on capital gains into account. Source: Commerce Commission New Zealand, December 2012, Reasons Paper: *Input Methodologies (Electricity Distribution and Gas Pipeline Services)*, p.147 and Commerce Commission New Zealand, December 2012, *Reasons Paper: Input Methodologies (Electricity Distribution and Gas Pipeline Services)*, pp.477-507.

[31] Alberta Utilities Commission, December 2011, *2011 Generic Cost of Capital, Decision 2011-474*, p. 11.

[32] Dimson Elroy, Marsh and Staunton, 2006, *The Worldwide Equity Premium: A Smaller Puzzle*.

[33] Europe Economics, March 2011, Final Phase I Report*, The Weighted Average Cost of Capital for Ofgem's Future Price Control*.

growth dividend discount model). For developed markets, corporate earnings often meet the model assumption of a long-run trend growth rate. As a result, the expected return on the market is the sum of the dividend yield and the growth rate in dividends. The MRP is therefore the difference between the expected return on the equity market and the risk-free rate.

- The direct approach or survey approach. A panel of finance experts is asked for their estimates and the mean response is taken.

142. If the approach of using historical data on equity premiums is used to estimate the MRP, consideration will need to be given to the optimal sampling period for historical data. This reflects that there have been significant improvements in the quality of data on equity premiums over the last fifty years.

143. In Australia, new methods have emerged, that are different to the existing historical data method and the survey methods, that aim to estimate the MRP such as Capital Research's DGM estimates,[34] NERA's regime switching model,[35] and VAA's implied volatility glide path approach.[36] These new methods have often originated from consultants working for regulated businesses.

5.2.3 Inter-relationship between the risk-free rate and the MRP

144. Over the last two years, the risk-free rate of return has been at a relatively low level due to a "flight to quality" into the CGS bonds market. As such, the cost of debt and cost of equity have been relatively lower in the regulatory decisions in Australia in comparison with those issued before two years ago because the risk free rate of return is a direct input into both estimates.

145. While the risk free rate of return has been lower over the last two years, the MRP of 6 per cent has remained unchanged in regulatory decisions over the period.

146. Given the observations of a lower risk free rate and an unchanged estimate of the MRP, some regulated businesses have suggested that a long-term average sampling period of five years for the risk free rate is more appropriate than the 20 trading day average. They have argued that there is a negative relationship between the risk free rate of return and the MRP, and that the MRP must be revised upwards to compensate for a decrease in the estimate of the risk free rate.[37]

5.2.4 Issues for consideration

147. The ERA is seeking views and supporting information from interested parties on the following issues:

[34] This method examines the forecasted future dividends of selected businesses and derives the cost of equity that makes these forecasted dividends consistent with the market valuation of the equity of those businesses.

[35] This model is highly complex and involves the following steps: (i) determining the appropriate assumptions of high- and low-volatility states; (ii) estimating the current probability of being in the high-volatility state; (iii) using a Markov chain to roll over this probability; (iv) calculating a short term MRP in relation to the three month bill return; (v) estimating a forward one-year bill rate; and (vi) converting the short term MRP to a five-year MRP.

[36] This method derives the one-year MRP from the Black-Scholes option pricing for 12-month ASX200 index call options.

[37] Economic Regulation Authority, September 2012, Final Decision on Proposed Revisions to the Access Arrangement for the Western Power Network, pp. 382-388.

26. What is the best method for estimating the MRP?

27. If the approach of using historical data on equity premium is used to estimate the MRP, what is the best sampling period of historical data to be used?

28. Should the more recent sampling periods, such as financial deregulation (1980) and the introduction of the imputation credit tax system (1988), be used in estimating the MRP as these periods may be more relevant to the current financial environment in Australia?

29. Are there any theoretical grounds for considering an inter-relationship between the risk-free rate of return and the MRP over the horizon of five years and longer?

30. When the risk-free rate of return is low/high, should the MRP be revised upwards/downwards? If yes, what is an unbiased mechanism for doing so? What is the threshold of the risk-free rate in which the prevailing risk-free rate can be considered low?

5.3 Equity Beta

148. The systematic risk (beta) of a firm is the measure of how the changes in the returns to the firm's stock are related to the changes in returns to the market as a whole. Systematic risks are those risks that cannot be costlessly eliminated through portfolio diversification, such as risks relating to unexpected changes in real aggregate income, inflation and long-term real interest rates.

149. The most common formulation of the CAPM directly estimates the required return on the equity share of an asset as a linear function of the risk free rate plus a component to reflect the risk premium that investors would require over the risk free rate:

$$R_e = R_f + \beta_e\left(R_m - R_f\right)$$

where R_e is the required rate of return on equity, R_f is the risk-free rate, β_e is the equity beta that describes how a particular portfolio i will follow the market and is defined as $\beta_e = \mathrm{cov}\left(r_i, r_M\right)/\mathrm{var}\left(r_M\right)$; and $\left(R_m - R_f\right)$ is the market risk premium.

150. The above equation reveals that the equity beta of a particular asset will scale the MRP up (when its value is greater than one) or down (when its value is lower than one) to reflect the risk premium, which is over and above the risk-free rate, that equity holders would require to hold that particular asset in a well-diversified portfolio.

5.3.1 Current practices

151. The ERA in its 2008 Rail WACC Determination derived the equity betas for three railway owners using a benchmarking approach using a sample of comparable businesses in rail and related industries in Australia and overseas.

152. For the PTA, the ERA's method for deriving its equity beta estimates follows the advice from the Allen Consulting Group. In this estimate, a sample of Australian and

international toll road companies was considered. Raw equity betas estimated by Bloomberg were obtained. These raw equity betas were de-levered using debt to asset ratios also provided by Bloomberg. Macquarie Infrastructure Group was isolated from the sample due to having a particularly high beta. The average asset beta for the remaining businesses was calculated to be 0.25. The average asset beta including Macquarie was higher at 0.30. Accordingly, the range of average asset betas was deemed to be 0.25 to 0.30, which is equivalent to a range of equity beta values of 0.38 to 0.46.

153. In 2003 Network Economics Consulting conducted an analysis based on three United Kingdom based rail providers in which they estimated an asset beta of 0.32. Considering this finding, together with the Allen Consulting Group findings based on market data, the ERA determined that an asset beta of 0.30 (which is equivalent to an equity beta of 0.46) was appropriate.

154. For WestNet Rail (now Brookfield Rail), the ERA adopted the same method as for the estimate of equity beta for the PTA. However, the sample of comparable firms included rail infrastructure businesses in the United States and Canada and listed transport infrastructure services firms in Australia and New Zealand. The equity beta for the WestNet Rail (now Brookfield Rail) network of 1.0 was adopted in the 2008 Rail WACC determination.

155. For the TPI the average asset beta was estimated to be 0.69 based on the sample of eight comparable US and Canadian freight railways. However, Genesee & Wyoming Inc. was likely to be the best comparator for a short line railway operator such as TPI. As such, using data from mid 2006 to mid 2007, an asset beta of 0.95 was obtained for GWI. However, when a longer period of time of five years to the end of November 2008 was used, the asset beta was estimated at 1.07.

156. Based on these observations, an asset beta of 1.00, which is equivalent to an equity beta of 1.43, was adopted for TPI.

5.3.2 Discussion of issues

157. Empirical studies on the estimates of equity beta using historical data have relied on estimates of the returns for each stock in the sample and for the stock market as a whole (for example, in Australia, the ASX 200 is generally considered as a proxy). This approach has been taken by Australian economic regulators for electricity and gas businesses. This methodology has presented a wide range of estimates. It is noted that there does not appear to be any alternative method by which the equity beta for a railway owner can be estimated.

158. Businesses selected as comparators to the railway owners in Western Australia may vary considerably in size and scope. It is considered that there are no comparable rail businesses in Australia for PTA, Brookfield Rail, and TPI. It may therefore be appropriate to select businesses from different industries (such as toll road, truck) and/or rail businesses from overseas.

5.3.3 Issues for consideration

159. The ERA is seeking views and supporting information from interested parties on the following issues:

31. *Results from the econometric evaluation of historic market returns as a means to estimate the equity beta are sensitive to input data. What is the best way to determine the point estimate of the equity beta from the resulting wide range of estimates (e.g.. median, average, any relevant quartiles)?*

32. *Given that there are no comparable rail businesses in Australian for the three regulated railway owners, is it appropriate to select businesses from different industries (such as toll road, truck) and/or rail businesses from overseas.?*

33. *Are there any viable alternative methods to the econometric evaluation of historic market returns, such that the equity beta for regulated businesses might be estimated in a more robust manner?*

6 Cost of debt

160. The generally accepted approach to estimating the cost of debt involves estimating the debt risk premium, which is added to the estimate of the risk free rate. Key components in estimating the cost of debt include:

- the credit rating of the benchmark infrastructure provider;
- the resulting debt risk premium of the benchmark infrastructure provider; and
- debt raising costs.

161. Australian economic regulators have consistently adopted this method for determining the cost of debt. However, an alternative approach – adopted by overseas regulators such as OfGem and NZCC – is to estimate the cost of debt directly from a sample of corporate bonds (without separately identifying the risk free rate or debt risk premium).

162. Approaches to estimating each of these components are considered in what follows.

6.1 Credit Rating

163. Credit ratings provide a broad classification of a business's probability of defaulting on its debt obligations. This probability is one of the most important factors that investors consider when pricing business debt. A business with a higher probability of default, other things held constant, will have a lower credit rating. Accordingly, that business will face a higher cost of debt as investors demand a premium to compensate them for the higher risk of default.

6.1.1 Current practices

164. Benchmarking exercises have been used by the ERA to determine the appropriate credit rating for the three regulated railway owners in Western Australia. The three railway owners have very different operations. The PTA operates passenger railways. Brookfield Rail operates a railway for diversified freight. TPI operates a short line rail with homogenous freight to a single destination. Due to these differences, the samples of comparable businesses for these three rail companies are also different.

165. Using a benchmarking approach, the ERA concluded in the 2008 WACC determination that the appropriate credit ratings were as follows:

- PTA A
- WestNet Rail (Brookfield Rail) BBB+
- TPI BBB-

6.1.2 Discussion of issues

166. The key issue for determining a benchmark credit rating is to determine the benchmark sample of Australian entities and/or their debt instruments, from which their latest credit ratings can be observed. This is an important starting point.

167. There are two distinct types of credit ratings: for the company, and for the debt instrument. The credit rating for the company is oftentimes different to the credit rating for debt instruments issued by this company. It is unclear at this stage which type of credit rating is more relevant to the determination of the credit rating for a regulated business.

168. Credit ratings are not available for all companies in the benchmark sample. Credit ratings may not be available year after year for the same company. In addition, credit ratings for some companies and/or debt instruments may not be relevant as they were issued by international rating agencies such as S&P's or Moody's a long time ago. It is unclear how far back the credit ratings can go while still being considered relevant.

169. As such, it appears that the benchmark sample of the companies operating in the same or similar industry and/or their debt instruments should cover as many entities/instruments as possible to determine the benchmark credit rating. In addition, the most recent credit ratings should be used to better reflect the current ratings of the associated companies in the sample.

170. Observed credit ratings can be used as a benchmark credit rating for regulated businesses. The "median" of the observed credit ratings is preferred by Australian economic regulators.

171. As observed credit ratings may not be stable, some cross-check analysis is required to ensure the robustness of the benchmark credit rating. S&P and Moody's financial indicator matrix is a tool that may be used for this purpose. Alternative approaches, such as using historical financial indicators to rank companies in terms of their financial strengths, may also be relevant.

6.1.3 Issues for consideration

172. The ERA is seeking views and supporting information from interested parties on the following issues:

34. *Are there appropriate alternatives to the Authority's current method for estimating the credit rating?*

35. *What are the key characteristics or the selection criteria for companies to be included in the benchmark sample to determine the credit rating for a regulated business in rail?*

36. *Among the different types of credit rating for the same company, for example, entity credit rating (i.e. the credit rating for the entire entity) versus instruments credit rating (i.e. the credit rating for a particular debt instrument), which type is more appropriate for determining the credit rating for the purpose of determining the WACC as it is to be used under the Code?*

37. *How recent should the credit ratings for the company and debt instruments be in order to be considered valid as an input to determining credit ratings? How many years in the past can a credit rating be assigned and still be used?*

38. *Is the median credit rating of a benchmark sample the best indicator for the credit rating of a railway owner? If not, then which is the best method to determine the credit rating from the benchmark sample?*

39. *What methods are suitable as a cross-check of the robustness of a determination of a credit rating for a railway owner?*

6.2 Debt Risk Premium

173. The focus of this section is on the estimate of the debt risk premium. The debt risk premium (also referred to as the debt margin) is a margin above the risk free rate of return reflecting the risk in provision of debt finance.

6.2.1 Current practices

174. Prior to 2011, the ERA relied on the estimates of 10-year fair yield curves derived by Bloomberg and CBASpectrum for the purpose of calculating debt risk premiums for the regulated railway networks. However, Bloomberg progressively shortened its estimates of fair yields across credit ratings for Australian corporate bonds and, in September 2010, CBASpectrum ceased publishing its estimates of the fair yield curves across all credit ratings for Australian corporate bonds.

175. Bloomberg's estimates of fair yield curves for BBB credit rating for Australian corporate bonds have presented significant deviations from the observed yields for Australian corporate bonds. Since the method used by Bloomberg to derive its fair yield curves is not released to the public, it is not possible to understand and verify these differences.

176. From 2011, the ERA has applied an alternative 'bond yield' approach for calculation of the WACC for all industry sectors. This followed consultation with infrastructure owners, including railway owners.[38]

177. Using the bond yield approach, the debt risk premium is estimated by selecting a sample of Australian corporate bonds within a predetermined S&P's credit band. A 20-trading day average of the yields for each security is observed and adjusted for the risk free rate. As the bonds are of varying yields to maturity, the term to maturity for the risk free rate used in the adjustment is matched with the term to maturity on each Australian corporate bond in the sample.

178. A weighted average of the sample of risk free rate adjusted yields is then calculated. The ERA has calculated these weighted averages using a "scenario based approach" for regulated railway owners and a "joint weighted approach", which has been applied to the gas and electricity industries since June 2012.

179. The scenario based approach weights debt risk premiums by the term to maturity only. A joint weighted approach weights debt risk premiums by the term to maturity and the amount issued.

180. The ERA applied a scenario based approach in the 2012 WACC determination for TPI, Brookfield Rail and PTA Four different averages were estimated based on the following scenarios:

- all bonds in the sample;
- bonds with a term to maturity of 5 years or more;
- bonds with a credit rating higher than BBB-; and
- bonds with a term to maturity of 5 years or more and a credit rating higher than BBB-.

The debt risk premium was then calculated as the simple average of all four of the above averaging methods.

181. In the course of finalising the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline, the ERA agreed to apply a joint weighted approach (weighting by both the term to maturity and the amount issued) as a method that might be more reflective of all the relevant conditions, including risk in the market for debt.[39]

182. The ERA has subsequently adopted a joint weighting system for all WACC determinations since June 2012, whereby bonds with a longer term to maturity and/or a higher amount issued are given more weight. [40,41]

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[38] Dampier to Bunbury Natural Gas Pipeline – Estimating the Debt Risk Premium, public submissions accessed from http://www.erawa.com.au/access/gas-access/dampier-to-bunbury-natural-gas-pipeline/estimating-the-debt-risk-premium/ on 3 January 2012.

[39] Australian Competition Tribunal, 2012, *Application by WA Gas Networks Pty Ltd (No 3) [2012] ACompT 12*, 8 June 2012, paragraph 176, p.42.

[40] The Authority also amended the averaging calculations in access arrangement revisions for the Mid-West and South –West Gas Distribution System. See Economic Regulation Authority, June 2012, *Revised Decision Pursuant to Rule 64 (4) of the National Gas Rules Giving Effect to the Economic Regulation Authority's Proposed Access Arrangement Revisions for the Mid-West and South –West Gas Distribution System*, pp. 7-9.

6.2.2 Discussion of issues

183. In the bond yield approach, a lack of corporate bonds issued by Australian utilities was recognised. As such, a more practical set of selection criteria to determine the benchmark sample of Australian corporate bonds was adopted. Taking into account the Australian Competition Tribunal's (**ACT**) view on the bond-yield approach, the benchmark sample is developed based on the following selection criteria, using Bloomberg's terminal:

- a S&P credit rating that matches the benchmark credit rating determined for the regulated entity;
- time to maturity of 2 years or longer;
- bonds issued in Australia by Australian entities and denominated in Australian dollars;
- inclusion of both fixed bonds[42] and floating bonds;[43] and
- inclusion of both Bullet and Callable/Putable redemptions.[44]

184. From the observed yields of Australian corporate bonds in the benchmark sample, an average debt risk premium is estimated. The current bond-yield approach indicates that bonds with a longer term to maturity and a larger issuance should be assigned a higher weight in the sample. As such, it is appropriate to use the *multiplicative rule* to account for this compounding effect.

185. There is a small difference between the credit ratings by S&P and Moody's, being the two key credit rating agencies in the international credit rating market. A preliminary investigation was conducted using BBB/BBB+ bonds as an example to highlight that more companies will be included in the benchmark sample of the bond yield approach if both S&P and Moody's credit ratings are considered.

186. The drawback of this combination is when there is a significant difference in the credit rating assigned to the same company. For example, if S&P produces the credit rating of BBB and Moody's presents a credit rating of A3, which is equivalent to S&Ps credit rating of A-, it is unclear whether the extra benefit (a larger sample size) will outweigh the extra cost (differences between credit ratings).

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[41] Economic Regulation Authority, September 2012, *Final Decision on Proposed Revisions to the Access Arrangement for the Western Power Network*, p. 368.

[42] This is a long term bond that pays a fixed rate of interest (a coupon rate) over its life.

[43] This is a bond whose interest payment fluctuates in step with the market interest rates, or some other external measure. Price of floating rate bonds remains relatively stable because neither a capital gain nor capital loss occurs as market interest rates go up or down. Technically, the coupons are linked to the bank bill swap rate (BBSW) (it could also be linked to another index, such as LIBOR), but this is highly correlated with the RBA's cash rate. As such, as interest rates rise, the bondholders in floaters will be compensated with a higher coupon rate.

[44] A callable (putable) bond includes a provision in a bond contract that gives the issuer (the bondholder) the right to redeem the bonds under specified terms prior to the normal maturity date. This is in contrast to a standard bond that is not able to be redeemed prior to maturity. A callable (putable) bond therefore has a higher (lower) yield relative to a standard bond, since there is a possibility that the bond will be redeemed by the issuer (bondholder) if market interest rates fall (rise).

6.2.3 Issues for consideration

187. The ERA is seeking views and supporting information from interested parties on the following issues:

40. Are there more appropriate alternatives to the bond yield approach for estimating the debt risk premium?

41. Are there any considerations associated with the bond yield approach that have not been made by the Authority?

42. Should Moody's credit ratings of Australian corporate bonds be included in the selection criteria for the benchmark sample?

43. If the bond yield approach is adopted, should the current scenario based weighting approach continue to be used, or should a joint weighting approach or some other averaging approach be adopted?

6.3 Debt Raising Costs

188. Debt raising costs may include underwriting fees, legal fees, company credit rating fees and any other costs incurred in raising debt finance. In practice, regulators across Australia have typically included an allowance of 12.5 basis points for these costs in the cost of debt, as an increment to the debt margin.

6.3.1 Current practices

189. The current allowance for debt raising costs of 12.5 basis points is based upon a benchmark analysis conducted by the Allen Consulting Group in 2004.[45] The Allen Consulting Group undertook a study for the ACCC in 2004 on appropriate debt and equity raising costs to be included in costs recognised for the purposes of determining regulated revenues and prices. This study determined debt raising costs based on long-term bond issues, consistent with the assumptions applied in determining the costs of debt for a benchmark regulated entity. Debt raising costs were based on costs associated with Australian international bond issues and for Australian medium term notes sold jointly in Australia and overseas. Estimates of these costs were equivalent to 8 to 10.4 basis points per annum when expressed as an increment to the debt margin.[46] However, Australian regulators have adopted a debt raising cost of 12.5 basis points.

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

[46] Allen Consulting Group, December 2004, Debt and Equity raising transaction costs: Final report to ACCC.

6.3.2 Discussion of issues

190. Australian regulators have used the findings from the 2004 Allen Consulting Group study on debt and equity raising costs in their regulatory decisions. It is noted that this study may become outdated for future regulatory decisions in Australia. In addition, it is noted that sources used in that study are no longer available for an update of the study.

191. The use of actual debt raising costs reported by firms is problematic because these estimates constitute an estimate of a single investment bank. It is not likely that such an estimated figure is unbiased or reflects efficient financing decisions by regulated businesses.

6.3.3 Issues for consideration

192. The ERA is seeking views and supporting information from interested parties on the following issues:

44. What data source is best to gather evidence of debt raising costs incurred by businesses when they use debt financing to finance their capital programs?

45. Are there more appropriate alternatives to the Allen Consulting Group method for estimating the debt raising costs?

7 Gamma

193. In this section, consideration is given to the approach to estimating the value of imputation credits.

194. A full imputation tax system for companies was adopted in Australia on 1 July, 1987. While Australia and New Zealand have full imputation tax systems (which are discussed below), many other countries have a partial imputation system, where only partial credit is given for the company tax.

195. Under the tax system of dividend imputation, a franking credit is received by Australian resident shareholders, when determining their personal income taxation liabilities, for corporate taxation paid at the company level. In a dividend imputation tax system, the proportion of company tax that can be fully rebated (credited) against personal tax liabilities is best viewed as personal income tax collected at the company level. With the full imputation tax system in Australia, the company tax (corporate income tax) is effectively eliminated if all the franking values are used as credits against personal income tax liabilities.

196. It is widely accepted that the approach adopted by regulators across Australia to define the value of imputation credits, known as "gamma" (γ), includes two components of gamma: (i) the payout ratio (F); and (ii) theta (θ).

197. As a result, the actual value of franking credits, represented in the WACC by the parameter gamma, depends on the proportion of the franking credits that are created by the firm and that are distributed (the payout ratio, F), and the value that the investor attaches to the credit (theta), which depends on the investor's tax circumstances (that is, their marginal tax rate). As these will differ across investors, the value of franking credits may be between nil and full value (i.e. a gamma value between zero and one). A low value of gamma implies that shareholders do not obtain much relief from corporate taxation through imputation and therefore require a higher pre-tax income in order to justify investment.

7.1.1 Current practices

198. The ERA adopted a value for gamma of 0.5 in the 2008 Rail WACC Determination. At the time the ERA acknowledged that the valuation of taxation imputation credits in determining the WACC was complicated by unresolved theoretical issues. The ERA maintained the view that until the debate on the value of imputation credits was resolved, it was appropriate to apply a value of gamma of 0.5.

199. Subsequently, SFG's 2011 study on the estimates of theta was adopted by the ACT. This study has used a dividend drop off study to estimate the value of theta for Australia.

200. After the ACT's decisions on the application by Energex Limited on the issues of distribution ratio and gamma, the AER and the ERA have adopted the payout ratio of 0.70[47] and a theta of 0.35,[48] which produces a gamma value of 0.25[49], to be consistent with the ACT's decision.

[47] Australian Competition Tribunal, 2010, *Application by Energex Limited (Distribution Ratio (Gamma)) (No. 3) [2010] AcompT 9.*

201. Other Australian regulators in relation to other industries have adopted different values of gamma. For example, the Essential Services Commission in Victoria adopted a gamma of 0.5. This figure is based on the assumption that only 80 per cent of imputation credits on average can be distributed and that the credits have a value of 60 cents per dollar.[50]

7.1.2 Discussion of issues

202. The estimate of gamma, or more specifically, theta, has attracted significant debates among parties involved for an extensive period of time. In an attempt to estimate the value of theta, in relation to the dividend drop-off study, the following studies are available in Australia.

[48] Australian Competition Tribunal, 2011, *Application by Energex Limited (Gamma) (No. 5), [2011] AcompT 9.*

[49] Economic Regulation Authority, September 2012, Final Decision on Proposed Revisions to the Access Arrangement for the Western Power Network, p. 422.

[50] Essential Services Commission Victoria, October 2011, *2013 Water Price Review*, p.66.

Table 2 Studies on the Estimates of Gamma using Dividend Drop-off Methods

Author	Year	Data	Techniques	Gamma
Brown & Clarke[51]	1993	Statex, Melbourne and Australian Stock Exchange publications, 1973 - 1991	OLS Regression	0.72
Walker & Partington[52]	1999	Securities Industry Research Centre of Asia-Pacific, 1995 to 1997	Not Specified	0.88 – 0.96
Hathaway & Officer[53]	1999	Australian Tax Office and ASX/S&P 500, 1986 - 2004	Generalised Least Squares	0.44 – 0.49
Bellamy & Gray[54]	2004	1995 -2002	Unknown	0.00
Beggs & Skeels[55]	2006	CommSec Share Portfolio 1986 - 2004	Generalised Least Squares	0.57
SFG[56]	2007	Securities Industry Research Centre of Asia-Pacific and FinAnalysis, 1998 - 2006	Generalised Least Squares	0.40
Feuerherdt, Gray & Hall[57]	2010	Securities Industry Research Centre of Asia-Pacific, 1995 - 2002	Generalised Least Squares	0.00
SFG[58]	2011	DatAnalysis, 2000 -2010	Generalised Least Squares	0.00 – 0.35

Source: The ERA

203. Estimates of gamma using the dividend drop-off method can vary significantly from study to study. It has been noted that the approach to filtering the dataset has a

[51] P Brown & A Clarke, 'The Ex-Dividend Day Behaviour of Australian Share Prices Before and After Dividend Imputation', *Australian Journal of Management*, 18, 1, 1993.

[52] S Walker & G Partington, 'The Value of dividends: Evidence from cum-dividend trading in the ex-dividend period', *Accounting and Finance*, vol 39, 1999, pp. 275–96.

[53] NJ Hathaway & RR Officer, *The Value of Imputation Tax Credits,* working paper, Melbourne Business School, 1999

[54] D Bellamy & S Gray, *Using stock price changes to estimate the value of dividend franking credits*, 3 March 2004, p. 26.

[55] DJ Beggs & CL Skeels, 'Market Arbitrage of Cash Dividends and Franking Credits', *The Economic Record*, vol 82, no 258, 2006, pp. 239–252.

[56] Strategic Finance Group (SFG), *The impact of franking credits on the cost of capital of Australian companies*, Report prepared for Envestra, Multinet and SP AusNet, October 2007, pp. 35 - 45.

[57] C Feuerherdt, S Gray & J Hall, 'The Value of Imputation Tax Credits on Australian Hybrid Securities', *International Review of Finance*, 10:3 2010, p. 365.

[58] SFG, *Dividend drop-off estimate of theta, Final Report*, 21 March 2011.

significant impact on the value of theta. As such, more research is required using the most recent data set, in an unbiased sample.

7.1.3 Issues for consideration

204. The ERA is seeking views and supporting information from interested parties on the following issues:

46. What are the best methods and/or studies of estimating the value of gamma that should be considered by the Authority?

47. What are the main considerations for estimating gamma via the estimates of the payout ratio and theta? Is it possible to estimate gamma directly from available market data?

48. Are there methods – other than dividend drop off studies – that could be used to better estimate the value of imputation credits?

Appendix A: The "NPV = 0" Principle

1. This appendix refers to background academic material used to explain the adoption of a five year term for the risk free rate for gas and electricity industries. Regulation of the gas and electricity industries in Australia generally requires a regulatory control period of five years, and the setting or capping of prices.

2. The Western Australian rail access regime does not prescribe a regulatory control period and prices are not regulated.

3. In a regulated environment in which output prices are set or capped, the present value of the revenue earned from an asset must be equal to the initial investment to ensure that the total costs incurred are recovered. If no more than or no less than the total costs are recovered, in discounted terms, then the net present value is zero (NPV=0).

4. It is argued that setting the terms of the proxies for the risk free rate and the cost of debt to match the regulatory control period – which is generally five years in Australia and New Zealand – will satisfy the NPV=0 principle. This view is supported by a range of studies, each of which is summarised briefly in what follows.

5. First, under the assumption that future interest rates are the only source of uncertainty and that the company is financed entirely by equity, Marshal et al. (1981) concluded that the period associated with the risk-free rate should match the regulatory period. These authors argued that if this principle is not satisfied, then equity holders are either over or under compensated by the regulator.

6. Schmalensee (1989)[59] and Lally (2012)[60] also assumed that there is no debt and no source of risk other than the uncertainty of the future risk free interest rates. The authors concluded that the term of the risk free rate and the term of the debt margin should be matched with the regulatory control period to ensure that equity holders are not under- or over-compensated.

7. Lally (2004)[61] relaxed the above assumptions by considering cost and demand shocks, and risks arising from depreciation methods in which the aggregate depreciation allowed by the regulator may diverge from the cost of the assets. However, in this study, Lally continued to make the same assumption that the firm is to be totally financed by equity. The author concluded that if the risk-free rate is revised at the end of each regulatory cycle, in accordance with the prevailing rate, then the appropriate rate should be that matching the regulatory period.

8. Lally (2007)[62] continued relaxing the previous assumptions by considering the implications of issuing corporate debt. The purpose of this study was to consider the implications of the regulated firm being at least partly debt financed, as well as the possibility of the firm choosing a duration for this debt finance that diverges from the length of the regulatory cycle. Lally concluded that the NPV=0 principle is only

[59] Schmalensee, Richard, 1989, "An Expository Note on Depreciation and Profitability Under Rate-of-Return Regulation", *Journal of Regulatory Economics*, Volume 1, No.3, pp. 293-298.

[60] Lally, Martin, July 2012, *The Cost of Equity and The Market Risk Premium*, p. 28.

[61] Lally, Martin, 2004, "Regulation and the Choice of the Risk Free Rate", *Accounting Research Journal*, Volume 17, No. 1, 2004, pp. 18-23.

[62] Lally, Martin, 2007, "Regulation and the Term of the Risk Free Rate: Implications of Corporate Debt", *Accounting Research Journal*, Volume 20, No. 2, 2007, pp. 73–80.

satisfied on the following two conditions: (i) the terms of the risk free rate and the debt risk premium must be set equal to the regulatory control period; AND (ii) the regulated businesses choose their borrowing to match the regulatory cycle. Lally also concluded that departure from either of these conditions will lead to violations of the NPV=0 principle.

9. Lally agreed that these findings do not consider any refinancing risk – the risk arising due to the exposure to unusual conditions in the debt markets at the time the debt needs to be refinanced. In response to this potential problem, Lally argued that a company may seek to stagger the roll-over of the debt in such a way that the same proportion – which is relatively small – is to be refinanced each year. Lally argued that the company's actual schedule of debt can be converted into the schedule that aligns with the regulatory control period using swap contracts available in the market (interest rate swaps would be used to deal with the risk free rate of return component and credit default swaps would deal with the debt premium).

10. More recently, Lally (2010)[63] has argued that where the average debt term used by regulated businesses materially exceeds five years (that is, the term of the regulatory cycle), and where these firms use neither interest rate swaps nor credit default swaps to intermediate the longer term (say 10-year) debt into the five year debt, then the NPV=0 principle would be violated. This is because the allowed costs would diverge from those actually incurred by the firms.

[63] Lally, Martin, April 2010, *The Appropriate Term for the Risk Free Rate and the Debt Margin,* p. 14.

Appendix B: Models for estimating the cost of equity

1. There is a range of approaches for estimating the return on equity:
   - Sharpe-Lintner CAPM;
   - Black model;
   - Fama-French model; and
   - Zero-beta Fama French model.
2. In addition, there are a range of alternatives to the CAPM for estimating the cost of equity. These include:
   - the discounted cash flow model;
   - estimated market returns on comparable businesses; and
   - price to book ratios.
3. Each of these models is briefly summarised in what follows.

The Asset Pricing Models

4. The CAPM can be traced back to its first version in 1956, which became known as the Sharpe-Lintner CAPM after its developers.

Sharpe-Lintner CAPM

5. The Sharp-Lintner CAPM explains the expected return, $E(r_t)$, on any financial asset i in terms of the rate of return on a risk-free asset, r_f, and a premium for risk, $(E(r_M)-r_f)\times\beta_i$, where $E(r_M)$ is the expected rate of return on a market portfolio of assets, the term $(E(r_M)-r_f)$ represents the market risk premium (**MRP**) and β_i is the equity beta of asset i and is defined as $\beta_i = \text{cov}(r_i, r_M)/\text{var}(r_M)$:

$$r_e = r_f + (E(r_M)-r_f)\times\beta_i$$

Black Model

6. The Black model was developed from the Sharp-Lintner CAPM, but without assuming the existence of a risk free rate asset and without assuming unrestricted borrowing and lending. In Black's derivation of CAPM, the return on a portfolio, known as zero-beta portfolio $(E(r_z))$, for which the return is uncorrelated with the return on the market portfolio, acts as the equivalent of the risk free return.

$$r_e = E(r_z) + (E(r_M) - E(r_z))\times\beta_i$$

7. The main findings from the Black model are that: (i) when β is low, the expected return predicted by the Sharp-Lintner CAPM is less than the expected return predicted by the Black model; and (ii) when β is high, the expected return predicted by the Sharp-Lintner CAPM is greater than the expected return predicted by the Black model. The Black model is more reflective of actual returns.

Fama-French Model

8. The Fama-French Model (**FFM**) identifies three sources of undiversifiable risk that capture all three below-mentioned anomalies:

   - the excess return to the market portfolio (the market risk premium, MRP);
   - the value or growth risk premium, high minus low (**HML**) – the premium earned by high minus low book value shares. In this asset pricing model, high-value firms have a high ratio between book value of equity and market value of equity whereas the opposite is true for low-value firms (also known as growth shares); and
   - the size risk premium, small minus big (**SMB**) – the premium earned by small minus big shares. Small (big) firms have small (big) total capitalisation (i.e. equity at market value).

$$r_e = r_f + \left(E\left(r_M\right) - r_f\right) \times \beta_m + HML \times h + SMB \times s$$

9. The FFM states that small firms and firms with high book-to-market ratios require additional returns to compensate investors for these additional risks. Accordingly, large firms and firms with a low book-to-market ratio have less risk and therefore investors require a lower rate of returns.

Zero-beta Fama French Model

10. The Zero-beta Fama-French model is a minor extension from the Fama-French model. This extension is a combination of selected elements from both the Black model and the Fama-French model in which a zero-beta portfolio from Black model is used instead of the risk-free rate of return from Fama-French model.

$$r_e = E\left(r_z\right) + \left(E\left(r_M\right) - r_f\right) \times \beta_m + HML \times h + SMB \times s$$

Other models for estimating the rate of return

Discounted Cash Flow Model

11. The discounted cash flow model is used to estimate the required return on equity by predicting expected dividends of a company's shares plus expected future dividend growth rates. The return on equity (**ROE**) is the rate of return that equates the present value of the estimated future stream of dividends with the current share price observed from the market. The fundamental issues with this approach relate to the treatment of expected dividends and expected dividend growth rate for a particular company.

Market returns on comparable investments

12. Another cross check is to consider a return on equity for comparable investments to regulated business. It is, however, noted that the evidence on comparable investments is generally inconclusive regarding the return investors expect and there is no evidence to suggest that these returns are sufficiently comparable to the regulated utilities.

Price-to-Book ratios

13. Evidence is presented linking the equity-to-book ratio (the market to book ratio) to the return to equity. It is generally agreed that a market-to-book ratio that is greater than 1 indicates that the earned ROE is higher than the allowed cost of equity.