Draft Explanatory Statement for the Rate of Return Guidelines (2018)

Meeting the requirements of the National Gas Rules

29 June 2018

Economic Regulation Authority
WESTERN AUSTRALIA

Economic Regulation Authority

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About this review

The Economic Regulation Authority (**ERA**) is currently undertaking a review of the gas rate of return guidelines (**guidelines**).

The ERA originally published the guidelines on 16 December 2013. The guidelines detailed the method the ERA intended to use to estimate the allowed rate of return for gas transmission and distribution service providers.

The ERA is required to complete its first review of these guidelines, producing a final version of this document, by 16 December 2018. To this end, the ERA has published this draft document to allow the public to provide feedback the ERA's proposed approach.

The ERA's approach to estimating the rate of return is different to the approach in the 2013 guidelines. This draft draws on the ERA's approach in recent access arrangement decisions, such as that applied in the Dampier to Bunbury Natural Gas Pipeline (**DBNGP**) access arrangement decision.[1]

The guidelines relate to assessments made under the National Gas Rules and their relevant provisions.

The ERA is currently undertaking a review of Western Power's fourth access arrangement proposal. Where relevant, the ERA has considered information received during the Western Power access arrangement process when coming to its position in these draft guidelines. The ERA will continue to monitor developments and take into account views received from Western Power's stakeholders where these are relevant to the guidelines.

The ERA is now seeking stakeholder feedback on this publication (*Explanatory Statement for the Draft Rate of Return Guidelines (2018))* and on the accompanying *Rate of Return Guidelines (2018)*.

[1] ERA, *Final Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline 2016 – 2020: Appendix 4 Rate of Return*, 30 June 2016.

Making a submission

Interested parties are invited to make submissions on the ERA's draft rate of return guidelines by **4:00 pm (WST) Friday, 28 September 2018** via:

Online: www.erawa.com.au/consultation
Email address: publicsubmissions@erawa.com.au
Postal address: PO Box 8469, PERTH BC WA 6849

CONFIDENTIALITY

In general, all submissions from interested parties will be treated as being in the public domain and placed on the ERA's website. Where an interested party wishes to make a submission in confidence, it should clearly indicate the parts of the submission for which confidentiality is claimed and specify in reasonable detail the basis for the claim. Any claim of confidentiality will be considered in accordance with the provisions of the *Economic Regulation Authority Act 2003.*

The publication of a submission on the ERA's website 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, whether the submission in whole or part contains information of a confidential nature and no duty of confidence will arise for the ERA.

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1 Introduction

1. The Economic Regulation Authority (**ERA**) is responsible for approving third party access arrangements in Western Australia for gas transmission and distribution services. These services include the Dampier to Bunbury Natural Gas Pipelines (**DBNGP**), the Goldfields Gas Pipeline and the Mid-West and South-West Gas Distribution Systems. The ERA's responsibilities are established under the National Gas Law and National Gas Rules as applied in Western Australia.[2]

2. The National Gas Rules require the ERA to produce rate of return guidelines (**guidelines**),[3] and to review these guidelines "at intervals not exceeding five years for the first interval and three years for all subsequent intervals, with the first interval starting from the date the first rate of return guidelines are published under these rules".[4] These reviews provide an opportunity to undertake a comprehensive review of approaches for determining the allowed rate of return on capital.

3. The ERA first published the rate of return guidelines on 16 December 2013 (referred to throughout this document as the '**2013 guidelines**').

4. The companion to this document – the *Draft Rate of Return Guidelines (2018)* – sets out the ERA's current position on determining the allowed rate of return on capital.

5. This document – the Draft Explanatory Statement for the Rate of Return Guidelines (2018) – provides the ERA's reasoning supporting the position set out in the Draft Rate of Return Guidelines (2018).

1.1 The requirement

6. The National Gas Rules require that the rate of return guidelines set out:

   - "the methodologies that the [ERA] proposes to use in estimating the *allowed rate of return*, including how those methodologies are intended to result in the determination of a return on equity and a return on debt in a way that is consistent with the *allowed rate of return* objective";[5] and
   - "the estimation methods, financial models, market data and other evidence that the [ERA] proposes to take into account in estimating the return on equity, the return on debt and the value of imputation credits referred to in rule 87A".[6]

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[2] The *National Gas Access (WA) Act 2009* implements the National Gas Access (Western Australia) Law and National Gas Rules for Western Australia. All references to National Gas Law (NGL) and National Gas Rules (NGR) referred to throughout this document are references to the NGL and NGR which apply in Western Australia.

[3] Australian Energy Market Commission, *National Gas Rules*, Sydney, AMEC, 2017, clause 87(3); or, in short, National Gas Rules 87(13).

[4] National Gas Rules 87(16)(a).

[5] National Gas Rules 87(14)(a).

[6] National Gas Rules 87(14)(b).

7. In what follows, the ERA interprets that:

- a rate of return 'approach' refers to the systems or methods used in the development of the rate of return guidelines, and encompasses the subsidiary methods, estimation methods, financial models, market data and other evidence;
- 'estimation methods' refers to the procedures used for estimating the rate of return, including through financial models;
- 'financial models' refers to those mathematical and statistical representations that are used to inform the rate of return – for example, the Sharpe-Lintner Capital Asset Pricing Model;
- 'market data' refers to any input data that is used to determine the rate of return – for example, financial data or sample data from firms that are comparable to the benchmark efficient entity;
- 'other evidence' may be broad-ranging, but must be relevant to the estimation of the rate of return to be considered; and
- 'estimation material' may be used to refer to any of the relevant information relating to estimating methods, financial models, market data and other evidence.

8. The guidelines will provide guidance for subsequent gas access decisions of the ERA for Western Australian gas pipelines and networks.

1.2 Application of the guidelines

9. At the date of this publication, the rate of return guidelines are not mandatory.[7] The ERA or service providers may depart from the guidelines in reviewing an access arrangement, provided that an adequate explanation for any proposed change, in terms of the National Gas Law and National Gas Rules, is provided.

10. However, the COAG Energy Council is currently developing a framework for binding rate of return guidelines.[8]

11. This will have implications for the application of these rate of return guidelines to future determinations. The ERA expects that the guidelines will be adopted as a mandatory instrument if the legislative changes are made and the Ministerial order adopts the changes for the Western Australian National Gas Law.

1.3 Reviewing the guidelines

12. This review has allowed the ERA to assess its approach to setting the rate of return for covered gas pipeline and network access arrangements.

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[7] National Gas Rules 87(18).

[8] COAG Energy Council, *Binding Rate of Return Guideline*, October 2017, available at: www.coagenergycouncil.gov.au/publications/binding-rate-return-guideline
AER, *Consultation paper: Process for reviewing the rate of return guidelines – July 2017*, Canberra, Commonwealth of Australia, 2017, p. 7.

13. The ERA has maintained a focus on the overall methods, estimation methods, financial models, market data and other evidence for developing the rate of return. It is consistent with the requirements of the National Gas Law and the National Gas Rules.

14. Where relevant, as a means of illustration, the ERA has set out current indicative estimates of the rate of return and associated parameters. However, the specific values arising from the application of the ERA's approach to estimating the rate of return will be determined at each subsequent access arrangement review, by applying the approaches set out in these guidelines.

2 The broad regulatory framework

15. This chapter sets out the relevant requirements of the National Gas Law and National Gas Rules. These requirements establish the regulatory framework for the rate of return decision-making process.

2.1 The National Gas Law

16. The National Gas Law provides for a legislated, uniform national framework governing access to monopoly gas infrastructure, and arrangements for prices oversight. The national gas objective sets out the aim of the National Gas Law.[9]

> The objective of this Law is to promote efficient investment in, and efficient operation and use of, natural gas services for the long term interests of consumers of natural gas with respect to price, quality, safety, reliability and security of supply of natural gas.

17. The National Gas Law and the national gas objective are intended to promote economic efficiency.[10]

> The national gas objective is an economic concept and should be interpreted as such.
>
> The long term interest of consumers of gas requires the economic welfare of consumers, over the long term, to be maximised. If gas markets and access to pipeline services are efficient in an economic sense, the long term economic interests of consumers in respect of price, quality, reliability, safety and security of natural gas services will be maximised. By the promotion of an economic efficiency objective in access to pipeline services, competition will be promoted in upstream and downstream markets.

18. The revenue and pricing principles in the National Gas Law give effect to the national gas objective.[11] The revenue and pricing principles establish that the national gas objective is to be promoted by targeting economically efficient outcomes, through effective incentives.[12]

> A service provider should be provided with effective incentives in order to promote economic efficiency with respect to reference services the service provider provides. The economic efficiency that should be promoted includes—
>
> (a) efficient investment in, or in connection with, a pipeline with which the service provider provides reference services; and
>
> (b) the efficient provision of pipeline services; and
>
> (c) the efficient use of the pipeline.

19. This specification of “effective incentives in order to promote economic efficiency” in the revenue and pricing principles is entirely consistent with an incentive regulation approach.

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9 National Gas Law, s. 23.

10 Holloway, P., Second Reading Speech: National Gas (South Australia) Bill 2008, *Parliamentary Debates (SA)*, Legislative Council, 30 April 2008.

11 Holloway, P., Second Reading Speech: National Gas (South Australia) Bill 2008, *Parliamentary Debates (SA)*, Legislative Council, 30 April 2008.

12 National Gas Law, s. 24(3).

20. The Australian Energy Market Commission has established the allowed rate of return objective in the National Gas Rules.[13]

> The *allowed rate of return objective* is that the rate of return for a service provider is to be commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk as that which applies to the service provider in respect of the provision of reference services.

21. In this context, the Australian Energy Market Commission has stated that the allowed rate of return objective is intended to be consistent with the national electricity objective, the national gas objective and the revenue and pricing principles.[14]

> The Commission has taken the opportunity in this final rule determination to explain how the new rules are to be interpreted. Most importantly, the new rules allow the regulator (and the appeal body) to focus on whether the overall rate of return meets the allowed rate of return objective, which is intended to be consistent with the [national electricity objective], the [national gas objective] and the [revenue and pricing principles].

22. The allowed rate of return objective must be interpreted in a manner consistent with the national gas objective. The National Gas Law takes precedence over the National Gas Rules.

2.2 National Gas Rule 87

23. National Gas Rule 87 (NGR 87) includes a number of sub-rules which refer to matters the regulator is to 'have regard to' when determining the allowed rate of return, including: [15]

> **NGR 87(5):** "In determining the *allowed rate of return*, regard must be had to:
>
> (a) relevant estimation methods, financial models, market data and other evidence;
>
> (b) the desirability of using an approach that leads to the consistent application of any estimates of financial parameters that are relevant to the estimates of, and that are common to, the return on equity and the return on debt; and
>
> (c) any interrelationships between estimates of financial parameters that are relevant to the estimates of the return on equity and the return on debt."
>
> **NGR 87(7):** "In estimating the return on equity under subrule (6), regard must be had to the prevailing conditions in the market for equity funds."
>
> **NGR 87(11):** "In estimating the return on debt under subrule (8), regard must be had to the following factors:
>
> (a) the desirability of minimising any difference between the return on debt and the return on debt of a benchmark efficient entity referred to in the *allowed rate of return objective*;
>
> (b) the interrelationship between the return on equity and the return on debt;
>
> (c) the incentives that the return on debt may provide in relation to capital expenditure over the *access arrangement period*, including as to the timing of any capital expenditure; and

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13 National Gas Rules 87(3).

14 Australian Energy Market Commission, *Rule Determination: Price and Revenue Regulation of Gas Services (GRC0011)*, 29 November 2012.

15 National Gas Rules 87.

(d) any impacts (including in relation to the costs of servicing debt across *access arrangement periods*) on a benchmark efficient entity referred to in the *allowed rate of return objective* that could arise as a result of changing the methodology that is used to estimate the return on debt from one *access arrangement period* to the next."

24. In addition, NGR 87 sets out additional requirements for the allowed rate of return, including that:[16]

- it is to be determined such that it achieves the allowed rate of return objective (NGR 87(2));
- subject to the rate of return objective (NGR 87(2)), the allowed rate of return for a regulatory year is to be:
  - a weighted average of the return on equity for the access arrangement period in which the regulatory year occurs and the return on debt for that regulatory year (new NGR 87(4)(a)); and
  - determined on a nominal vanilla rate of return that is consistent with the estimate of the value of imputation credits (new NGR 87(4)(b));[17]
- it results in a return on debt for a regulatory year that contributes to the achievement of the allowed rate of return objective (NGR 87(8)) which is either the same in each year of the access arrangement period or which varies in each year through the application of an automatic formula (NGR 87(9) and NGR 87(12)); and
- it incorporates a return on debt that would be required by debt investors over a relevant time period (whether shortly before the access arrangement decision, or on average over an historical period, or some combination of the two approaches) (NGR 87(10)).

2.3 Implications for the regulator

25. The anchor for any regulatory decision will be the regulatory approach that best delivers the requirements of the National Gas Law, National Gas Rules, national gas objective, revenue and pricing principles, and allowed rate of return objective. This requirement may be summarised in terms of a primary function and a number of constraints.

a) A key objective is to achieve an allowed rate of return for a service provider "commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk in respect of the provision of reference services".[18] Related objectives include achieving the allowed rate of return:

i) for each of the regulatory years;[19]

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16 The points are paraphrased – see the National Gas Rules for exact language.

17 The specification of a vanilla WACC implies that tax liabilities must be estimated separately to the rate of return. On this basis, the requirement is for a 'post-tax' approach.

18 National Gas Rules 87(3) – the allowed rate of return objective.

19 National Gas Rules 87(4).

ii) incorporating effective incentives to promote efficient investment;[20] and

iii) that it is in the long term interests of consumers.[21]

b) A constraint is that uncertainty about the future, information asymmetries and circularity problems complicate the task of determining the rate of return. On this basis, it is recognised that the regulator needs to estimate a cost of debt and cost of equity that give the efficient service provider 'reasonable opportunity' to recover at least the efficient costs it incurs over the regulatory period.[22]

c) A further constraint is a requirement to minimise transaction costs for the service provider and regulator, all else equal.

26. The current regulatory approach assumes that the efficient firm that meets the above objectives provides the 'benchmark'. The 'benchmark efficient firm' informs the cost building blocks for each regulatory decision.

27. An implication of point a) in paragraph 25 is that the rate of return must remunerate the efficient financing costs of the service provider over the lives of the assets, in terms of net present value.[23]

28. The implication of the efficiency element of point a) is that the benchmark firm is assumed to be on, or near, the efficiency frontier, consistent with the performance and cost structure of an efficient service provider. The efficient firm would be part of the portfolio of efficient assets held by an investor.

- The benchmark firm's efficient cost of finance will reflect the prevailing conditions in capital markets for the cost of debt and equity, taking risk into account. The resulting discipline on its cost structure is entirely consistent with that faced by firms in effectively competitive markets, where prices and returns are set with reference to the prevailing cost of capital.

- An implication of adopting the benchmark efficient firm is that the actual decisions of the service provider may differ (and often will differ) from the benchmark firm. However, under incentive regulation the regulator does not compensate the regulated service provider for its actual decisions, but compensates it as if it were operating efficiently. If the service provider is not actually operating efficiently relative to the benchmark, then that is a matter for management and the shareholders of the service provider.

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[20] National Gas Law, s. 24(3) – a revenue and pricing principle – states that the "a service provider should be provided with effective incentives to promote economic efficiency with respect to reference services". Note that the AEMC has stated that "The Commission has taken the opportunity in this final rule determination to explain how the new rules are to be interpreted. Most importantly, the new rules allow the regulator (and the appeal body) to focus on whether the overall rate of return meets the allowed rate of return objective, which is intended to be consistent with the [national electricity objective], the [national gas objective] and the [revenue and pricing principles." (Australian Energy Market Commission 2012, *Rule Determination: National Electricity Amendment Rule 2012*, www.aemc.gov.au, 29 November, p. 23.)

[21] As per the national gas objective.

[22] National Gas Law, s. 24(2) – a revenue and pricing principle – states that the "service provider should be provided with a reasonable opportunity to recover at least the efficient costs the service provider incurs".

[23] This is consistent with the 'NPV=0', or 'present value' condition. For more detail on the present value principle, refer to Appendix 2 of the Authority's 2013 *Appendices to the Explanatory Statement for the Rate of Return Guidelines.*

- The benchmark cannot be purely hypothetical. The benchmark should be based on the actual costs and risks faced by an efficient service provider.

- The benchmark approach provides incentives for the regulated business. If the regulated business is able to exceed the benchmark performance, it is able to retain any increased profits during the regulatory period. If the regulated firm fails to achieve the benchmark, then it bears the losses.

29. The efficient firm would provide reference services in a way that meets consumers' preferences with regard to price, quality, reliability, safety, and security, thereby meeting the requirement of a)(iii) (long-term interests of consumers).

30. An implication of the subsidiary objective of point a)(i) in paragraph 25 (regulatory years) is that the allowed rate of return objective looks ahead to the actual regulatory years of the access arrangement period.

31. An implication of the subsidiary objective of point a)(ii) (effective incentives) is that best practice regulation will generally set an estimated return *ex ante*, and then allow the firm to capture a portion of any subsequent out-performance or be penalised for under-performance.

32. An implication of point a)(i) (regulatory years) and point b) (uncertainty) is that the regulator sets the rate of return based on the most 'reasonable' predictors of the cost of debt and the cost of equity for the future regulatory years.[24]

33. An implication of point c) (transaction costs) is that regulators are reluctant to revisit the returns to the firm too frequently, particularly where this significantly increases transaction costs for both the regulator and the firm, or where it reduces the power of any incentives associated with an *ex ante* approach. Current practice is to set the regulated return for a five year period.

2.4 Introduction of a binding rate of return

34. At present, the rate of return guidelines are not binding. However, the COAG Energy Council is currently developing a framework for a binding rate of return instrument. These reforms will have implications for the application of the rate of return guidelines to future determinations.

35. It is expected the revised guidelines will become the mandatory instrument in the event that the National Energy Laws Amendments that establish the Binding Rate of Return Instrument are adopted in Western Australia.

2.4.1 Proposed draft legislation

36. The current draft legislation has implications on the application of current gas rules.

37. This includes that when the mandatory instrument is given effect in Western Australia the allowed rate of return objective will fall away.

[24] National Gas Law, s. 24(2) – a revenue and pricing principle – states that "a service provider should be provided with a reasonable opportunity to recover at least the efficient costs the service provider incurs...".

38. After the mandatory instrument is given effect, in making the rate of return instrument, the proposed binding instrument will require that a regulator have regard to—

(a) the National Gas Objective;

(b) the revenue and pricing principles;

(c) the following matters received by the ERA in relation to making the instrument—

(i) advice or recommendations given by a consumer reference group;

(ii) submissions on the making of the draft rate of return instrument;

(iii) advice or recommendations given by experts;

(iv) the report given by the independent panel under section 30L; and

(c) other information the ERA considers appropriate.

2.4.2 Importance of National Gas Objectives

39. Under the current rules, the ERA sets the allowed rate of return to achieve the national gas objective and the allowed rate of return objective. In setting the allowed rate of return, we must also have regard to the revenue and pricing principles.

40. The national gas objective governs our regulatory determinations and has primacy, including over the allowed rate of return objective.

41. The allowed rate of return objective is a rate of return commensurate with efficient financing costs and the risks involved in providing energy network services.

42. The ERA has, as far as possible, drafted these draft guidelines to apply equally to the current framework and the proposed binding rate of return framework, if implemented.

43. The ERA views this is appropriate as:

- the national gas objective is the overarching objective for the natural gas regulatory framework;
- a focus on the national gas objective and the revenue and pricing principles will still engage with key concepts required to promote the allowed rate of return objective; and
- the draft binding rate of return legislation will change the rules framework for estimating the rate of return (including the removal of the allowed rate of return objective), however, the national gas objective will remain unchanged.

2.4.3 New consultation requirements

44. The draft legislation to introduce the binding rate of return instrument introduces new consultation requirements for regulators.

45. In preparing its first rate of return instrument, the ERA will be exempt from the requirement to seek advice from a consumer reference group and is not required to seek advice from experts.

46. However, the ERA in making the instrument will have to commission and have regard to a report given by an Independent Panel.

47. The objective of the Independent Panel is to assist the ERA in making the best possible final guideline by providing an independent perspective on the development of the draft guideline.

48. The ERA will issue a separate document to detail the role of the panel, how it is to be engaged and to seek nominations for panel members.

3 Overall rate of return

49. The National Gas Rules require the ERA to adopt a 'nominal vanilla' Weighted Average Cost of Capital (**WACC**) in developing the rate of return for the benchmark efficient entity.[25]

50. A vanilla WACC does not include any adjustment for tax impacts, such as the effect of imputation credits on the rate of return. The impact of tax on the returns must be accounted for separately, as an explicit deduction from the relevant cash flows. A vanilla WACC is therefore a 'post-tax' framework.

51. The nominal vanilla WACC provides for a simple weighted average of the nominal post-tax return on equity and the nominal return on debt.

52. This chapter sets out the approach the ERA will adopt for future regulatory decisions.

3.1 Approach

3.1.1 A nominal post-tax model

53. The ERA will apply an explicit nominal post-tax modelling approach when making its decisions.

54. The Australian Energy Regulator's Post-Tax Revenue Model, or a similar model, will provide a basis for access arrangement determinations. The Post-Tax Revenue Model will enable the ERA to use a nominal vanilla rate of return.

55. The Post-Tax Revenue Model deals with tax explicitly through operating cash flows, consistent with the use of a nominal vanilla rate of return.

3.1.2 Components of the rate of return

56. The ERA will adopt a WACC for a benchmark efficient entity in its simplest 'vanilla' form, expressed as:

$$WACC_{vanilla} = E(r_e)\frac{E}{V} + E(r_d)\frac{D}{V} \quad \text{(equation 1)}$$

where

$E(r_e)$ is the expected return on equity;

$E(r_d)$ is the expected return on debt;

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

[25] National Gas Rules 87(4).

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

3.1.3 The term of the rate of return

57. The term of the estimates for the rate of return will be, as far as possible, consistent with the term of the regulatory period.

58. Accordingly, as the regulatory period for the ERA's gas pipeline and networks decisions is five years, the term of its estimates for the rate of return will generally be five years.

3.1.4 Requirement to meet the allowed rate of return objective

59. The ERA will evaluate its estimate of the allowed rate of return in terms of the requirements of the allowed rate of return objective and the National Gas Rules more broadly. In particular, the ERA will consider whether its allowed rate of return estimate is reasonable for a benchmark efficient entity with a similar degree of risk as the service provider in respect of the provision of the reference services.[26]

60. As discussed in Chapter 2, the introduction of a binding rate of return instrument, if implemented, may remove the allowed rate of return objective. The ERA views that the national gas objective and the revenue and pricing principles will still engage with key concepts required to promote the allowed rate of return objective.

3.2 Reasoning

61. The National Gas Rules specify the WACC that is to apply in any regulatory year is to be comprised of a weighted average of:[27]

- the return on equity for the access arrangement period in which that regulatory year occurs; and
- the return on debt for that regulatory year.

62. This specification is in turn subject to the requirement that it achieves the allowed rate of return objective.[28] This means that the estimate of the return on equity and the return on debt "is to be commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk as that which applies to the service provider in respect of the provision of reference services".[29]

63. The definition of the 'benchmark entity' and the approach to addressing the requirement for a 'similar degree of risk' are important considerations. These issues are considered in *Chapter 4 – The benchmark efficient entity*.

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[26] When the mandatory instrument is given effect in Western Australia the allowed rate of return objective will fall away. The allowed rate of return objective currently must be interpreted in a manner consistent with the National Gas Objective and the revenue and pricing principles. After the removal of the allowed rate of return objective, the ERA will continue to set the rate of return in a consistent manner with the National Gas Objective and the revenue and pricing principles.

[27] NGR 87(4)(a).

[28] NGR 87(2).

[29] NGR 87(3).

3.2.1 Implementing a nominal post-tax model

64. NGR 87 requires the ERA to use a post-tax financial model for the purpose of calculating the rate of return.

65. In the 2013 guidelines and in recent regulatory decisions, the ERA has used a model similar to the Australian Energy Regulator's Post-Tax Revenue Model (**PTRM**), which provides a nominal post-tax modelling framework for its decisions. The PTRM provides a full nominal building block approach to estimating the revenue requirement for a service provider.

66. The nominal framework means that its building block revenue forecasts include estimates of expected inflation. The revenue allowances are therefore estimated in nominal dollar terms. The regulatory asset base is indexed in each year by expected inflation when calculating the rate of return on capital element in the building block. This is multiplied by a nominal rate of return that includes expected inflation.

67. There is an inflationary gain that arises when a nominal rate is used to compute the return on the nominal capital base. The amount of the inflationary gain is separately calculated and removed from the revenue building block to address the issue with double counting of inflation.

68. The PTRM deals with tax explicitly through operating cash flows, which is consistent with the use of a nominal vanilla WACC.

69. The ERA will continue to use the PTRM for access arrangement determinations, along with a nominal vanilla WACC.

3.2.2 Components of the rate of return

70. The National Gas Rules specify that the rate of return should be a weighted average of the cost of equity and cost of debt (NGR 87(4)(a)). This approach to estimating the overall rate of return is a 'bottom up' approach, which combines separate estimates for the cost of equity and the cost of debt.

71. The resulting WACC for a benchmark efficient entity represents the competitive rate of return that an entity must earn on its existing asset base in order to satisfy its creditors, shareholders and other providers of capital. In its simplest 'vanilla' form, the WACC may be expressed as set out in (equation **1**) above.

3.2.3 The term of the rate of return

72. The National Gas Rules require the ERA to have regard to "the desirability of an approach that leads to the consistent application of any estimates of financial parameters, that are relevant to the estimates of, and are common to, the return on equity and the return on debt".[30]

[30] NGR 87(5)(b).

73. The 'present value principle' is a major consideration in establishing the appropriate term for the return on equity and the return on debt. The present value principle requires that the present value of a service provider's revenue stream should match the present value of their expenditure stream (plus or minus any efficiency rewards or penalties).[31] This will result in the so-called net present value equals zero condition (NPV=0).

74. The present value principle helps ensure that investors are compensated at a level to encourage efficient investment. This condition means that the present value of the future stream of expected cash flows of a firm is equal to the regulatory asset base. This means that the value of the regulatory asset base is maintained.

75. Therefore, to maintain the regulatory asset base the rate of return does not over compensate the business (thereby increasing asset values) nor does the rate of return under compensate the business (thereby reducing asset values).

76. The ERA views that the regulatory return is likely to most closely match the NPV=0 condition when the term of components of the return on equity and the return on debt are based, as far as possible, on the length of the regulatory period. (For a more detailed discussion of the present value principle, refer to 2013 guidelines' *Appendix 2 – The present value principle*.[32])

77. Accordingly, as the term of the regulatory period for the ERA's gas pipeline and networks decisions is five years, the term of its estimates for the rate of return will generally be five years. The exception is the return on debt where the debt risk premium is based on a 10 year term.[33]

3.2.4 Requirement to meet the allowed rate of return objective

78. Under the National Gas Rules, additional considerations must be taken into account when combining the estimates of the expected return on equity and debt through the WACC. Specifically:

- the estimate of the rate of return derived from the ERA's rate of return approach needs to be assessed broadly against the allowed rate of return objective;[34] and
- regard must be given to the 'interrelationship between the return on equity and the return on debt' (NGR 87(11)(b)) and 'any inter-relationships between estimates of financial parameters that are relevant to the estimates of the return on equity and the return on debt' (NGR 87(5)(c).

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31 M. Lally, *The risk free rate and the present value principle*, 2012, p. 8.

32 ERA, *Appendices to the Explanatory Statement for the Rate of Return Guidelines*, 16 December 2013, pp.17-30.

33 See *Chapter 11 – Return on debt* for more detail.

34 As noted above, NGR 87(4) states that the allowed rate of return is 'subject to' NGR 87 (2), which is that the allowed rate of return is to be determined such that it achieves the allowed rate of return objective. The allowed rate of return objective set out at 87(3) states that the 'rate of return is to be commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk as that which applies to the service provider in the provision of reference services'.

79. In reviewing the rate of return guidelines the ERA will evaluate its method of determining the allowed rate of return in terms of the requirements of the allowed rate of return objective and the National Gas Rules more broadly. In particular, the ERA will consider whether its allowed rate of return estimate derived from the application of the method is reasonable for a benchmark efficient entity with a similar degree of risk as the service provider in respect of the provision of the reference services.

80. As previously mentioned the COAG Energy Council is proposing that the guidelines will be replaced with a mandatory rate of return instrument to be applied to all pipelines. In the event that draft legislation is adopted in Western Australia, the revised guidelines will become the mandatory instrument.

81. As discussed in Chapter 2, the introduction of a binding rate of return instrument, if implemented, may remove the allowed rate of return objective. The ERA views that the national gas objective and the revenue and pricing principles will still engage with key concepts required to promote the allowed rate of return objective.

4 The benchmark efficient entity

82. The allowed rate of return objective, as set out at National Gas Rule 87(3), introduces the concept of a 'benchmark efficient entity'.

> The *allowed rate of return objective* is that the rate of return for a service provider is to be commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk as that which applies to the service provider in respect of the provision of reference services (*the allowed rate of return objective*).

83. The wording of the allowed rate of return objective requires the rate of return to be based on:

(i) the efficient financing costs of;

(ii) a benchmark efficient entity, with

(iii) a similar degree of risk as the service provider in respect of the provision of reference services.

84. This chapter outlines how the ERA will approach each of these elements.

4.1 Approach

4.1.1 Efficient financing costs

85. Financial markets provide observations that can be used to estimate the efficient financing costs of the benchmark efficient entity.

86. The ERA prefers observations based on market outcomes to other types of information on the premise that markets deliver efficient outcomes.

87. The ERA considers the guiding principle should be that the risk for the assets observed should stem from the economy in which the benchmark efficient entity is situated.

4.1.2 The benchmark efficient entity

88. The ERA defines the benchmark efficient entity as:

> An efficient 'pure-play' gas network business operating within Australia without parental ownership, with a similar degree of risk as that which applies to the service provider in respect of the provision of reference services.[35] [36]

[35] A 'pure-play' business focuses exclusively on a particular product or service.

[36] This definition has changed from the previous Rate of Return Guidelines which used the term 'An efficient 'pure-play' **regulated** gas network'. This definition still allows the ERA to use either regulated or non-regulated businesses for our benchmark sample, which was specifically endorsed by the Federal Court. See Federal Court of Australia, *Australian Energy Regulator v Australian Competition Tribunal (No 2) [2017] FCAFC 79 and Australian Energy Regulator v Australian Competition Tribunal (No 3) [2017] FCAFC 80*, 24 May 2017, [536] for more details.

4.1.3 Similar risk in the provision of reference services

89. The ERA will base its estimates of efficient financing costs on the results from a sample of comparator firms with efficient financing costs that are judged to be 'similar' to a single benchmark efficient entity for the provision of gas pipeline and network services in Australia. This means that comparator firms need not operate in the transmission and/or distribution of gas, but must have operations that are comparable. At the outset of the Guidelines, the sample is established and used to inform the value of *firm* specific WACC parameters which remain fixed until the next Rate of Return Guideline review.[37]

4.2 Reasoning

90. In what follows, the ERA considers:

(i) the efficient financing costs of;

(ii) a benchmark efficient entity, with

(iii) a similar degree of risk as the service provider in respect of the provision of reference services.

4.2.1 Efficient financing costs

91. National Gas Rule 87 makes explicit reference to efficient financing costs as outlined in the *allowed rate of return objective* set out above. Efficient financing costs are expressed as a WACC for the benchmark firm. This is a weighted mix of the return on equity and debt financing for a regulatory year within the access arrangement period or term of the guidelines.

92. The following sections set out theories of efficient financing, including:

- economic theory on the efficiency of market outcomes;
- financial theory on market efficiency;
- financial theory on portfolio efficiency; and
- the use of domestic versus international markets;

4.2.1.1 The role of markets in efficient financing

93. Efficiency of financial markets is typically thought of across a number of dimensions. This includes efficiency from an economic welfare maximising perspective, the speed and extent to which information is incorporated in market determined prices and compensation for market risk.

[37] The term 'firm' here refers to the benchmark efficient firm. Firm specific parameters are those that are specific to the *benchmark efficient firm*. These include gearing, equity beta, credit rating, debt risk premium and hedging costs. In contrast, market wide parameters are those that are observed across the economy's markets more broadly. These include the nominal risk free rate of return, inflation, interest rate swap rate, gamma and the market risk premium.

4.2.1.2 Economic theory on the efficiency of market outcomes

94. From the perspective of economic theory, competitive or market equilibriums are Pareto efficient.

95. Markets provide a platform where competitive pressure bids up prices. Quantities supplied increase as long as the benefit derived from their use is greater than the cost of provision. The increase in supply and consumption represent Pareto improvements because at least one individual is better off while no other individual is worse off. This is because, assuming market participants are rational and informed, they will not engage in a transaction unless it is beneficial to them. Quantities supplied and consumed increase up until the point no more Pareto improvements can be made. The market clearing price and quantity at this point is the competitive equilibrium which corresponds to a Pareto efficient allocation of resources which maximises the benefit accruing to consumers and producers engaging in market transactions.

96. This provides an economic basis for accepting that outcomes observed in markets should give an indication of efficient financing costs, albeit based on the assumption that market participants are rational and informed.

4.2.1.3 Financial theory on market efficiency

97. The efficient market hypothesis postulates that a capital market is efficient if prices always fully reflect all available information.

98. Tests of this hypothesis examine the speed and degree to which financial market prices incorporate new information. Fama reviewed tests based on three subsets of information, where each subsequent set incorporates the last, to establish the point at which the hypothesis looks doubtful:

- *weak-form tests* - based on historical prices;
- *semi-strong form tests* - based on publically available information such as company and economic announcements; and
- *strong-form tests* - based on privately available information.[38]

99. The empirical evidence he reviewed could not disprove the hypothesis that security prices reflected the first two information sets. Limited evidence, however, was found against the hypothesis tested on the strong-form information set. Semi-strong form tests, in particular, are concerned with the speed at which prices adjust to publically available information. Tests based on company and macroeconomic announcements indicated prices reacted at the time of the announcement and that some evidence suggested prices moved in anticipation of the announcement in an unbiased way.

[38] E. Fama, *Efficient capital markets: A review of theory and empirical work*, *The Journal of Finance*, vol.25, no.2, 1981, pp. 383-417.

100. An inefficient market can create opportunities that can be exploited to make abnormal returns. Fama's later review recognised that the cost of getting prices to reflect information is not always zero and so consequently prices are hypothesised to reflect information up to the point where marginal profits from using that information reflect marginal costs. Additionally, an empirical rejection of the efficient market hypothesis could be a result of a bad pricing model used to test the hypothesis and/or market inefficiency. Fama replaced the weak, semi-strong and strong-form tests above with the following three classifications of research identified in the literature:

- tests for return predictability;
- event studies; and
- tests for private information.

101. Although tests for return predictability found some component of returns was predictable, Fama noted that this component was only a small proportion of the variance and could not warrant a conclusion of substantial market inefficiency. Event studies substantially overcame the joint hypothesis problem. These studies typically found that stock prices appear to adjust within a day of event announcements.[39]

102. Fama's reviews provide an empirical basis for accepting that outcomes observed in financial markets should give an indication of efficient financing costs that quickly price in all publically available information. Shiller is a key proponent of the notion that markets are inefficient. He showed that stock prices are far too volatile to be justified by rationally expected changes in dividends.[40] Shiller suggests that psychological factors explain large deviations from efficient prices.[41] While this is an important theoretical debate, there is little alternative as a regulator than to accept that financial markets do obtain and incorporate information on investment prospects.

103. Dimson and Mussavian summarise the usefulness of the assumption that markets are efficient:

> The last two decades have witnessed an onslaught against the efficient markets hypothesis. Yet as Roll (1994) observes, it is remarkably hard to profit from even the most extreme violations of market efficiency. Stock market anomalies are only too often chance events that do not persist into the future. The importance of the efficient markets hypothesis is demonstrated by the fact that apparently profitable investment opportunities are still referred to as 'anomalies'. The efficient markets model continues to provide a framework that is widely used by financial economists.[42]

[39] E. Fama, *Efficient capital markets: II*, *The Journal of Finance*, vol. 46, no.5, 1991, pp. 1575-1617.

[40] R. Shiller, *Do Stock Prices Move Too Much to be Justified by Subsequent Changes in Dividends?*, *The American Economic Review*, vol.71, 1981, p. 421-436.

[41] R. Shiller, *From efficient markets theory to behavioral finance*, *Journal of Economic Perspectives,* vol.17, no.1, pp. 83-104.

[42] E. Dimson and M. Mussavian, *A brief history of market efficiency*, *European Financial Management*, vol.4, no.1, 1998, pp. 91-103.

4.2.1.4 Financial theory on portfolio efficiency

104. A productive investment will yield revenue that recovers its costs (including debt) and in addition provides a return on equity. The revenue to be derived, and consequently, the rate of return from such investments, is not certain and is therefore risky. The expected rate of return for an investment may be compared with expectations for alternative investments, once it has been adjusted for risk. Riskier investments have higher costs of debt funding and a higher expected return on equity meaning higher equity funding costs.

105. Modern portfolio theory provides a foundation for defining risk. It assumes, among other things, that investors are rational and markets are efficient. In modern portfolio theory, an asset's return is modelled as a random variable with a finite mean and variance. The variance of an asset's return measures the likely divergence from the expected return, and is taken as the measure of *total risk* arising from holding the asset.

106. Systematic risk is the part of total risk that is driven by broader market factors. It cannot be eliminated through holding assets that have less than perfectly correlated returns with each other (diversification) because it tends to be a common driver of risk between assets. Systematic risk is typically measured as the standardised covariation of an asset's or a portfolio of assets' returns with the returns of the market portfolio. This covariance is commonly known as asset beta. Assets with higher systematic risk have returns that co-vary more than one for one with market returns. Assets with lower systematic risk have returns that co-vary less than one for one with market returns.

107. Assets or portfolios of assets which minimise systematic risk for any given return or maximise return for any given level of systematic risk are efficient. These portfolios are characterised in the Capital Asset Pricing Model (**CAPM**) as various combinations of risk free and risky assets.[43] The returns on these portfolios are conventionally used to establish the *minimum* return required by an investor for investing in an asset with a given level of exposure to systematic risk.

108. In summary, markets maximise welfare by facilitating transactions which lead to the Pareto optimal or efficient allocation of resources. Despite documented anomalies, financial markets tend to efficiently (immediately and unbiasedly) incorporate new information. This suggests that observations taken from markets are likely to lead to pricing of debt and equity that adequately compensates investors for returns expected under prevailing market conditions. The measurement of systematic risk using market returns as a benchmark assists in establishing the minimum return on equity required by an investor as efficient compensation for risk that cannot be easily diversified away. Pricing of debt and equity that takes prevailing market conditions and systematic risk into account facilitates the efficient allocation of financial resources in the economy. For these reasons the cost of capital observed in the debt and equity markets provides an important reference point for a regulator seeking to establish the efficient financing costs of a regulated benchmark efficient entity.

[43] Brealey R.A. & Myers S.C. *Principles of Corporate Finance*, McGraw-Hill, pp. 173-180.

4.2.1.5 Domestic or international financial markets

109. When making observations of the efficient financing costs of regulated firms operating in Australia, the degree to which international capital market observations are taken into account must be considered.

110. The ERA considers the guiding principle should be that the risk for the asset in question should stem from the economy in which the benchmark efficient entity is situated. This is because the country of risk affects the operational aspects of the benchmark efficient entity, some of which are provided below.

- *Lifecycle risk* – this is the risk stemming from a country's stage of development. Emerging markets are much more susceptible to global market and economic shocks than mature markets in developed economies.
- *Political risk* – countries exposed to corruption, civil unrest or nationalisation/expropriation by governments represent riskier investments than those with less exposure.
- *Legal system* – the protection of property rights and quick resolution of legal disputes creates a lower risk environment for investors.
- *Economic structure* – countries whose economic prosperity is dependent on specific commodities, products or services are exposed to changes in price or demand for the product/service. The effects of this exposure spread beyond the producing industry into other sectors of the economy.[44]

Markets for equity

111. Market risk and systematic risk are the relevant risk considerations for equity markets.

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

113. In evaluating the cost of equity, Australian regulators have implemented this practice through application of a domestic CAPM framework.

114. In this process, regulators have recognised the influence of foreign investors, where they invest domestically and thus contribute to market outcomes within Australia. For example, imputation credits are often distributed with Australian shares. These allow investors paying tax in Australia to claim back money on their tax return. This effectively constitutes part of the return on equity and so should be taken into consideration. However, these credits are only of use to investors lodging an Australian tax return. For this reason estimates of the assumed utilisation of tax imputation credits distributed on Australian shares have taken account of the estimated participation of foreign investors (who potentially do not lodge an Australian tax return) in Australian equity markets.

[44] K. Baker and G. Filbeck, *Investment Risk Management*, Oxford Scholarship Online, 2015, p. 156.

Markets for debt

115. Credit risk, or the likelihood that a debt issuer will meet its contractual obligation to pay interest and repay principal, is the main relevant risk consideration for debt.

116. Regulated Australian firms raise debt both domestically and overseas. Table 1 shows that 49 per cent of Australian utility debt listed on Bloomberg outstanding at December 2017 was issued on foreign markets.

Table 1 Market of issue for utility bonds with country of risk classified as Australia

Market of issue	number	per cent
DOMESTIC MTN (Australia)	14	29.8%
EURO MTN (Europe)	19	40.4%
PRIVATE PLACEMENT (US)	2	4.3%
AUSTRALIAN	10	21.3%
EURO NON-DOLLAR (Europe)	2	4.3%
Total	**47**	**100.0%**

Source: Bloomberg, ERA Analysis

117. The Brattle Group has suggested in the context of estimating the cost of debt that:[45]

> ...lack of data can be a serious problem in environments such as Australia, where there are limited numbers of rate regulated entities and few, if any, entities with the same risk characteristics as the target. Therefore, looking to other sources overseas, recent debt issuances or investment banks' forecasts of financing costs becomes important.

118. Australian markets for debt are be linked to international markets, reflecting a policy of relatively unrestricted capital mobility. With arbitrage, the cost of debt in Australia should be similar to that in other developed countries, once all risk factors, including country specific factors affecting operations and exchange rate risk are taken into account.

119. The ERA considers that debt instruments trading in foreign markets and denominated in foreign currencies are relevant if the country of risk is classified as Australia. This meets the guiding principle that the risk for the asset in question should stem from the economy in which the benchmark efficient entity is situated.[46]

120. However, the base rates in debt denominated in foreign currency are based on foreign interest rates. Covered interest rate parity asserts that once the differential between spot and forward exchange rates used for hedging are taken into account, no interest rate arbitrage opportunities (to make profit) between two currencies exist. The implication is that borrowing and lending in different currencies costs the same. The Australian Competition and Consumer Commission's Regulatory Economic Unit has considered the relationship of interest parity.

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45 DBNGP (WA) Transmission Pty. Ltd., *Response to Consultation Paper*, Att. 4 (Brattle Group 2013, *Estimating the Cost of Debt*), 2013, p. 2.

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

> To assess what treatment of foreign currency bonds is more appropriate for the AER, we need to first consider whether or not a version of 'swap' covered interest parity holds for the AUD, USD and Euro-denominated bonds issued by Australian companies. This would imply that the difference between the AUD bond credit spreads and the hedged foreign currency credit spreads on comparable bonds is small (i.e., can be essentially attributed to transaction costs). If that is the case, then it would be appropriate to treat the hedged credit spreads on the USD and Euro-denominated bonds similarly to the credit spreads on the AUD-denominated bonds. This treatment would be appropriate regardless of whether the AER's benchmark debt instruments only include AUD-denominated bonds or also comparable USD and Euro-denominated bonds.[47]

121. In its reviews of the debt risk premium the ERA has found that there is no significant difference between the Australian denominated bond yields and hedged foreign currency bond yields. Further details are given in the *Chapter 9 – Debt risk premium*.

122. Inclusion of bonds denominated in foreign currency and swapped into Australian dollar equivalents allows observations to be made on a broader sample of instruments thereby overcoming issues arising from a lack of data that the Brattle Group refers to above.

Practical Issues

123. Limiting the risk exposure to the economy in which the benchmark efficient entity is situated raises practical issues for obtaining observations in equity markets. The measurement of systematic risk and market risk premium necessitates selecting a particular stock exchange to represent the market. Corporate actions such as mergers and acquisitions have reduced the number of listed firms with operations in energy network service provision. The current firms are shown in Table 2.

Table 2 Firms listed on the Australian Stock Exchange with operations in energy network service provision

2013	2017	Corporate actions
Envestra	-	Acquired by Cheung Kong Group. Delisted on 17/10/2014
APA Group	APA Group	-
DUET Group	DUET Group	Acquired by Cheung Kong Infrastructure. Data up to 28/04/2017
Hastings Diversified Utilities Funds	-	Acquired by APA Group. Ceased trading on 21/11/2012
SP Ausnet	Ausnet	Renamed
Spark Infrastructure Group	Spark Infrastructure Group	-

Source: Bloomberg

124. The benchmark sample has reduced from six to four firms. Although DUET Group is no longer listed it still has sufficient data on which to perform meaningful analysis.

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[47] Australian Competition and Consumer Commission, *Return on debt estimation: a review of alternative third party data series*, Regulatory Economic Unit Report for the AER, August 2014, p. 25.

125. The reduced sample of listed firms means that the results of the analysis based on this sample are more subject to idiosyncratic events affecting a given firm. Larger sample sizes tend to *smooth out* such idiosyncrasies.

126. Expanding the scope of the analysis to include comparable international firms is a potential solution. The ERA notes in its Rail WACC methodology that:

> There are a range of costs and benefits to be evaluated when considering whether to adopt a domestic or international form of any particular model of the rate of return or its components. On balance, the Authority considers that the regulatory costs of moving to a full international approach would be significant, with uncertain benefits in terms of potentially more accurate estimates.[48]

127. The use of international benchmarks implies higher uncertainty in the resulting estimate of the benchmark parameters. As Frontier noted in its 2013 report to the AER on risk in regulated energy networks:

- the structure of foreign water utilities may differ from those in Australia;
- foreign regulatory arrangements governing water utilities overseas may differ from those in Australia; and
- water utilities overseas may also be exposed to different macroeconomic factors/risk drivers to those in Australia.[49]

128. These statements were made in relation to water utilities, however, they are also applicable considerations in using foreign energy networks as comparators, particularly given that the systematic risk and market risk exposures on foreign firms will be based on foreign stock exchanges.

129. The ERA considers analysis limited to the sample of four companies which have exposure to the Australian market preferable to using foreign comparators, which can fundamentally differ on factors outlined by Frontier above.

130. Debt markets overcome these issues by not being constrained to trading on a particular exchange. Debt instruments are typically traded *over-the-counter* between two parties instead of being listed and traded on an exchange. This means the instruments' risk exposure can be limited to the relevant economy, but still trade in foreign markets. Overcoming this constraint allows for a larger sample of observations which improves the robustness of cost estimates.

131. These issues are considered in more detail in subsequent chapters, within the context of the evaluation of the cost of equity and the cost of debt.

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[48] ERA, *Review of the method for estimating the Weighted Average Cost of Capital for the Regulated Railway Networks: Final Decision,* 18 September 2015, p. 16.

[49] Frontier Economics, *Assessing risk when determining the appropriate rate of return for regulated energy networks in Australia: A report prepared for the AER*, July 2013, p. 93.

4.2.1.6 Role of non-financial market information and data

132. The ERA may consider non-financial market information and data such as the reports of analysts, experts and companies, agency statements, appraisals and quotes in developing values for parameters that remain fixed for the duration of the Rate of Return Guidelines.[50]

4.2.1.7 Role of efficient markets

133. While there is ongoing academic debate on the efficiency of financial markets, the ERA considers the efficient markets model provides a framework that justifies the use of financial market observations to estimate the cost of capital. Financial market observations will be used to evaluate the efficient financing costs of the benchmark efficient entity.

134. The ERA may consider non-financial market information and data in developing values for parameters that remain fixed for the duration of the Rate of Return Guidelines.

135. The ERA considers that the extent to which foreign markets are considered should be guided by the principle that the risk of the asset being observed should stem from the economy in which the benchmark efficient entity is situated. Observations on equity will be limited to domestic markets on account of the need to quantify systematic risk, while observations on debt will be limited to those instruments where the country of risk is classified as Australia.

4.2.2 Benchmark efficient entity

136. Identification of the benchmark efficient entity is central to the determination of the allowed rate of return objective of rule 87 of the National Gas Rules. The allowed rate of return objective is to be commensurate with the efficient financing costs of the benchmark efficient entity. It is therefore a requirement that the benchmark efficient entity have efficient financing costs. It is expected that the benchmark efficient entity would achieve this by structuring its finances so as to minimise its cost of capital, given the degree of risk of providing the reference services. This requirement reflects the National Gas Rules and the allowed rate of return objective, and seeks to ensure that customers do not bear the costs of inefficient financing decisions by service providers.

137. Australian regulators have, to date, used the concept of the benchmark efficient entity when estimating the gearing ratio, the credit rating and the equity beta.

138. There is no definition of a benchmark efficient entity in the National Gas Rules. Therefore, in practice, there is a need to define the key characteristics of the benchmark efficient entity. This involves establishing a conceptual definition for the benchmark efficient entity and then gathering evidence from actual 'comparator' entities which resemble the conceptual entity, as a means to inform the benchmark parameters for the cost of equity and the cost of debt.

[50] The parameters that remain fixed for the duration of the Rate of Return Guidelines are gearing, hedging and debt raising costs, credit rating, equity beta and the value of imputation credits (gamma).

139. This is the 'pure-play' method where the comparator is ideally in the same industry and single line of business.[51] In practice, this is not always possible and is addressed below.

4.2.2.1 Conceptual issues

140. The efficient benchmark need not reflect the actual financial characteristics of the service provider. Instead, the benchmark efficient entity should reflect attainable and efficient means of financing to deliver the reference services. This provides an incentive for the firm to move towards efficient benchmark financing through reducing costs and/or risk or profit from outperforming the benchmark by realising new cost efficiencies. If regulated allowances tracked the actual costs of the firm this may not be efficient if the firm is financed inefficiently. Even if the firm is efficiently financed, awarding actual costs would leave the firm with no profit incentive to further reduce costs.

141. A commonly applied approach involves averaging performance measures across similar firms to infer an attainable benchmark.[52] The ERA uses this as the basis for establishing benchmark efficient financing costs. The firms are similar in that they deliver services similar to reference services. The benchmark takes account of the degree of risk associated with that delivery. The National Gas Law and the National Gas Rules recognise that risk is a key consideration.

4.2.2.2 Implementation issues

142. In the past, the ERA has based its estimates of efficient financing costs on benchmark results from the average of a sample of comparator firms, for:

- gearing;
- the equity beta; and
- the credit rating – and the associated debt risk premium.

143. The benchmark must, as far as possible, reflect achievable financing practices, which reflect the practices of efficient firms exposed to a similar degree of risk as the regulated firm. By reflecting achievable financing practices, these benchmark efficient parameters will allow the service provider reasonable opportunity to attain costs close to those based on them.[53]

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51 Chartered Financial Analyst Institute, *Corporate Finance and Portfolio Management: Level 1 Volume 4*, Charlottesville, Virginia, Wiley, 2014, p. 53.

52 This is a form of 'Yardstick' regulation. See A. Shleifer, *A theory of yardstick regulation*, *Rand Journal of Economics*, vol. 16, no.3, 1985, pp. 319-327.

53 The requirement that the firm have 'reasonable opportunity to recover at least the efficient costs the service provider incurs in providing reference services' is a requirement of the Revenue and Pricing Principles in the National Gas Law: Part 3, Division 2, section 24(2) WA National Gas Access Law.

Interpretation of the word 'similar'

144. The requirement in the allowed rate of return objective is for the benchmark efficient entity to have a 'similar degree' of risk as that of the service provider providing the reference services. The term similar recognises the practicalities of approximating risk profiles. Provided that there is not a material difference between that of the benchmark efficient entity and that associated with providing the reference services, then this aspect of the allowed rate of return objective will be met.[54]

145. Here the key consideration is the meaning of the term similar. Specifically, how wide is the range of allowed differences in the risks, while still being considered similar? Increasing the range would account for the inherent uncertainties in estimating risks, allow sample sizes to be increased and improve the quality of the estimates. However, allowing greater risk differences implies some increased probability that the risk profile of the service provider may have a material difference to the risk profile of the relevant benchmark entity. There is a trade-off between quality of estimates and relevance.

146. Uncertainty in estimation approaches, particularly when it comes to risk assessments, mean that the regulator should not fall into the trap of 'misplaced precision'. The Australian Energy Market Commission, for example, suggested:

> ...the Commission recognises that if a regulator concluded that the risk characteristics of a benchmark efficient service provider are different between, for instance, electricity and gas service providers, there may be challenges in all cases in identifying sufficiently precise measurements of the quantum of the difference for determining the rate of return. [55]

147. The ERA therefore agrees with the AER, which has noted that larger samples are desirable, unless this would lead to a material bias in the efficient financing costs.

> A preference for large samples over close matches to the benchmark—this principle would suggest that all data should be included in the sample unless there was a very clear reason to expect that it would bias the end estimate. Using larger samples can minimise the shortcomings of individual data sources or data points. However, this needs to be weighed against the risk of using a large sample of data that is not reflective of the benchmark efficient firm. [56]

Public or private ownership

148. The benchmark efficient firm need not take ownership into account, be it public or private. Efficiency requires that risk adjusted cost of capital be the same for all firms in the economy. This means that efficient firms with the same or similar degree of risk must incur the same or similar risk adjusted capital costs. Put differently, the risk adjustment should be the same or of a similar magnitude.

149. To ensure competitive neutrality and reflect risk more appropriately State Governments charge State-owned utilities a debt neutrality or loan guarantee fee over and above the rate that the State can borrow at.

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54 Discussions with Moody's suggested that credit rating agencies evaluate such materiality quantitatively, without reference to a quantified threshold.

55 Australian Energy Market Commission, *Rule Determination National Electricity Amendment (Economic Regulation of Service Providers) Rule 2012,* 2012, p. 67.

56 AER, *Rate of Return Guidelines Issues Paper*, 2012, p. 22.

150. Such adjustments recognise that, without the passing of risk to the government parent, the State-owned regulated firm would face the same cost of debt as a private sector regulated firm. Introducing a distinction between public and private ownership would violate the term 'without parental ownership' in the ERA's definition of a benchmark efficient entity.

A single benchmark or multiple benchmarks

151. The allowed rate of return requires the regulator to account for risks associated with the provision of the reference services.

152. The ERA's preference is to retain a single 'average' benchmark efficient entity for gas pipeline and network service provision in the Australian domestic market. The use of multiple benchmarks degrades incentives to reduce costs by creating an incentive to attain the application of a different benchmark. Regulated network service providers in Australia are considered to have sufficiently similar risk in the provision of the reference services to avoid the need for multiple benchmarks.

153. For consistency between the ERA's estimate of equity beta and the benchmark credit rating, the ERA considers that the starting point is to form a benchmark sample from which the benchmark gearing level can be determined.

154. The ERA is of the view that companies included in the benchmark sample must have three characteristics in order to be useful as comparators for the benchmark efficient entity.

- The company must be a network service provider in the gas and/or electricity industry in Australia.
- The company must be listed so that the market value of its equity can be estimated using available data sources, such as Bloomberg.
- Data on the values of debt and equity must be available.

155. The ERA has considered the length of time over which data should be analysed. Data for the analysis needs to be relatively recent so that it informs a view of current market conditions. For this purpose, a five-year period has been used.

156. The following four companies have satisfied the above three criteria.

- APA Group (APA AU Equity)
- Spark Infrastructure (SKI AU Equity)
- Duet Group (DUE AU Equity)
- SP AusNet Group (AST AU Equity)

4.2.2.3 Role of benchmark efficient entity

157. The ERA defines the benchmark efficient entity as:

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

158. The financing practices of the benchmark efficient entity should be based on actual practices of firms operating in the market to ensure that the benchmark is attainable. The ERA will base its estimates of efficient financing costs on the observations from a sample of comparator firms that are judged to be similar to the single benchmark efficient entity for the provision of gas pipeline and network services in Australia.

4.2.3 Degree of risk associated with provision of reference services

159. The perceived degree of risk associated with the service provider in providing reference services is a key element in the cost of capital. The risks that matter for the investor, and hence for the rate of return, are the systematic risks. Systematic risk is discussed below.

160. The first step is to identify the range of potential risks and the second step is to classify whether those risks are potentially systematic or non-systematic.

161. The next step is to assess whether the identified risks are material, and hence whether the risk needs to be accounted for in the rate of return. The perspective of the investor is important, as the rate of return is the compensation required to induce the investor to supply capital to the firm. This process can only be applied to the determination of parameters which have values fixed at the outset of the Rate of Return Guidelines.

4.2.3.1 Defining risk

162. Under modern portfolio theory, the risk factors influencing the expected returns of a benchmark efficient entity can be separated into systematic risks and non-systematic risks. This is an important risk categorisation that helps to inform which risk should be compensated in the rate of return and those which are not.

163. Systematic risk stems from the market in which a firm operates and is often associated with prevailing economic conditions that will have an impact on all firms, to a greater or lesser degree.[57] Regulators need to be concerned with systematic risk in setting the rate of return, as this risk exposure is not diversifiable and will influence the risk-adjusted returns required by investors seeking to invest in the regulated firm. Systematic risks are key to the determination of the cost of equity.

164. Non-systematic risk, or diversifiable risk, on the other hand, relates to risks that are specific to the firm itself, or to the firm as part of a broader industry segment. Non-systematic risk can be either wholly or partially offset by an investor through an appropriately diversified portfolio.[58]

165. Debt investors may be concerned with systematic as well as non-systematic risk because both of these affect the probability of default on contracted payments of principal and interest.

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[57] Under portfolio theory, the measure of systematic risk for a particular asset is its standardised co-variance with the overall market portfolio. This reflects the portion of variance in the asset's returns that are explained by the variance of the overall market.

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

4.2.3.2 Identifying and classifying risk

166. Major risks may be grouped as:

- revenue risk under the price cap regime applying to gas pipelines and networks;
- input price risks;
- financial risks; and
- political/regulatory risk.

Revenue risk

167. Various risks may contribute to potential variability in revenue, due to variability in pipeline or network throughput. These risks include:

- upstream supply risk – reflecting the potential for the pipeline or network to become stranded;
- operating risk – reflecting the potential for operational or technical problems to reduce throughput for a period of time;
- competitive risk – reflecting the potential for competitive bypass or competing technologies or energy services to reduce demand for the pipeline or network services; and
- downstream demand risk – reflecting the composition of demand and its diversification.

168. Upstream supply risk will be unique to the particular pipeline or network. Some elements of supply risk will be within the control of the entity itself, for example related to decisions on the size of the pipeline or network. In this case, shareholders should bear the risk. Additionally, an investor may diversify across pipelines to reduce the risk of adverse supply shocks. As a consequence, upstream supply risk in general should not be compensated through the rate of return.

169. Operating risks also are within the control of the entity. Operational risk may be reduced or eliminated through appropriate expenditure on capital equipment and maintenance. Operating risks in general should not be compensated through the rate of return.

170. Competitive risks will be unique to the entity, but the risk should be able to be diversified by the investor through holding a portfolio of assets. For example, to the extent that the demand for gas from a transmission pipeline is reduced by an innovative new technology, say solar power, then the investor may invest in the solar power industry. Similarly, to the extent that competitive bypass is possible, then the investor could invest in the bypass itself, or in the industries that would benefit from the bypass. On this basis, competitive risk in general should not be compensated through the rate of return.

171. Downstream demand risk has the potential to be outside the control of the firm, and therefore exogenous and systematic. Indeed, there will be a part of the volatility in revenue which does reflect systematic demand risk faced by all firms in the economy. Such demand risk will be reflected in the variability of returns on equity, which is captured through models such as the capital asset pricing model.

172. However, some proportion of demand risk may be diversifiable. An example might be a gas transmission pipeline, which is heavily exposed to a small set of commodity prices. The risk faced by this pipeline is for a significant demand decline if commodity prices fall and downstream customers fail. However, this risk may be diversifiable to an extent by the investor. To continue the example, a non-systematic downturn in commodity prices, say reflecting a large increase in supply capacity somewhere in the world, may be offset by higher returns in other sectors of the economy, as businesses that use the commodity as an input experience lower cost structures.

173. In general, to the extent that revenue risk is diversifiable, it should not be compensated in the rate of return. Systematic revenue risk will relate to the demand conditions in the economy, which are captured by models of the return on equity.

Input price risk

174. The main input price risks may be grouped as:

- input cost increases – whether due to industry, regional, or international cost increases, including those arising from exchange rate risks;
  - these may affect operating costs and investment costs; and
- inflation risks – which may drive input costs up at a more rapid rate than prices and hence revenue.

175. Industry or regional input cost risks should be diversifiable by investing in other industries or other regions. To the extent that input costs to an industry or region are rising, then investors can diversify into other industries or regions where input costs should fall.

176. With regard to inflation, it is noted that input costs for the regulated firm are part of the building block, which will include inflation. To the extent that there are changes in the composition of inflation, affecting input costs differentially, then these should be diversifiable, as it is likely that the impact on returns of differential rises in input cost rises for the entity could be offset by investing in domestic industries that faced slower input cost rises.

177. These risks in general should not be compensated through the rate of return.

Financial risks

178. The main financial risks may be grouped as:

- refinancing risks;
- interest rate mismatch risks;
- liquidity risks; and

- default risks.

179. Refinancing risk relates to the possibility that the firm will not be able to roll over its debt when its existing facilities end. Firms tend to manage this risk by reducing the amount of debt that needs to be refinanced at any point in time by diversifying the sources of debt, and staggering the timing of debt issuances. This gives a portfolio of debt comprising different instruments with different terms to maturity, which allows the firm to reduce refinancing risks. The investor may further reduce this risk by diversifying across firms. Nevertheless, some level of refinancing risk will remain, related to general economic conditions and this will need to be compensated. Typically, this risk is captured in the debt risk premium applied to the regulated firm.

180. Interest rate mismatch risks, or equivalently, interest rate re-pricing risks, refer to the possibility that the firm when it refinances will face interest rates that diverge from those underpinning its pricing, and hence revenue. All firms face this risk, to a greater or less degree. Firms may manage these mismatch risks by hedging, which will reduce the degree of mismatch.

181. Liquidity risks refer to the ability or otherwise to trade an asset at any particular point in time. The less liquid an asset, the more risky, and the higher rate of return that is likely to be required to hold that asset. This liquidity premium required by the investor in the regulated firm will be influenced by the liquidity in markets more generally. As a result, there is a systematic component in liquidity risk, which will be captured in the debt risk premium.

182. Default risk will be influenced by:

- the capacity to generate cash flows from operations;
- the volatility in those cash flows; and
- debt coverage – given by the ratio of cash flows to interest and principal payments.

183. Default risks arise from the possibility that the firm may run into cash flow difficulties, such that it is unable to meet its financial obligations and becomes insolvent. All firms face this risk to some degree. Default risks are reduced where cash flows are stable and provide good coverage of expenses. Credit ratings agencies assess the potential for individual firm's default risk based on a range of indicators, including the appropriateness of the firm's level of gearing. Other considerations can relate to the operating environment, including sovereign and regulatory risk, as well as the scale and complexity of operations.[59] These credit ratings are a main component informing the debt risk premium required by lenders.

[59] The size of the entity may influence the scale and complexity of operations, as well as liquidity or the ability to engage effectively with financial markets. However, as observed by Frontier Economics in its Discussion Paper for the AER, 'even if the cost of capital is related negatively to business size, there is no compelling extant theory that explains such a relationship. This makes it difficult to judge to what extent the relationship is applicable to specific sectors, such as regulated utilities' (Frontier Economics 2013, *Assessing risk when determining the appropriate rate of return for regulated energy networks in Australia: A discussion paper prepared for the AER*, provided as part of workshop materials, p. 30). Where a smaller operation involves increased costs of engaging with financial markets, then these can be addressed in operating costs, rather than through the rate of return.

184. All firms face these financial risks to a greater or lesser degree. However, some financial risks can be managed through the portfolio, reducing the requirement for compensation through the rate of return. Other financial risks, that cannot be managed or prudently reduced by the firm or investor, will need to be compensated. The resulting financing costs will be efficient.

Political and regulatory risk

185. The main political and regulatory risks may be grouped as:

- policy changes that may affect input costs; and
- regulatory framework changes, which, for example, may affect prices and revenue.

186. All firms in the economy face the risk of policy change. For example, a change in corporate taxation rates would be reflected in input costs, as well as in the after-tax profitability. As such, this is systematic risk. Such systematic risk needs to be compensated. However, it is possible that such risk could be transmitted through interest rate risk and the other financial risk elements, as it is faced by all firms in the economy.

187. The utility regulatory framework can have an effect on the risks perceived by the investor. For example, the effectiveness of governance arrangements and the associated quality of utility regulation.

188. However, such risks will be one of a range of regulatory requirements placed on the firm. The utility will also face a raft of other regulation and policy constraints, for example relating to labour practices or environmental practices, which will be common with those constraints for other firms operating elsewhere in the economy.

189. Other elements of the utility regulatory framework may manifest elsewhere in the risk matrix. For example, the type of regulatory control – whether revenue cap or price cap – may influence the extent of demand risk for the regulated firm.

190. Overall, the possibility of future changes in the regulatory framework poses a risk for the investor. Such risks may be mitigated by good regulatory governance, for example, by ensuring that adequate notice is provided of change. In addition, provision for transitional arrangements where appropriate may also help to increase certainty and reduce the compensation required for these risks.

191. A significant proportion of regulatory risk will be diversifiable by the investor. This is because any change which increases (or decreases) the relative profit of the regulated firm will tend to reflect decreases (or increases) in the prices of the reference services, decreasing (or increasing) costs to other firms, and hence providing offsetting changes in returns. As a result, regulatory risk is likely to be a reasonably small consideration in the investor's requirement for the rate of return, provided that the regulatory regime is reasonably stable. Such risk is likely to be picked up as part of the broader sovereign risk, as it will reflect investor's perceptions of the general standards of policy and government.

4.2.3.3 Role of risk

192. The starting point for the ERA's considerations relating to risk will be the benchmark efficient entity.

193. The ERA will use its judgment to determine whether it needs to adjust the parameters, the return on equity, the return on debt or the overall rate of return, relating to the benchmark efficient entity, in order to account for any material differences in risk.

5 Gearing

194. Gearing refers to the proportions of a regulated business's assets assumed to be financed by debt and equity. Gearing is defined as the ratio of the value of debt to total capital (that is, including debt and equity) and so is generally expressed as follows:

$$Gearing = \frac{Debt}{Debt + Equity} \quad \text{(equation 2)}$$

195. This ratio is used to weight the costs of debt and equity when the regulated WACC is determined. Under the National Gas Rules, the allowed rate of return for a regulatory year should be a weighted average of the return on equity for the access arrangement period in which that regulatory year occurs and the return on debt for that regulatory year.[60]

196. In addition to being used to weight the expected returns on debt and equity to determine the regulated rate of return, the level of gearing of a benchmark efficient business is also used:

(i) to re-lever asset betas for the purposes of analysing the level of systematic risk across businesses in the estimate of equity beta;

(ii) as a factor in determining an appropriate credit rating for deriving the debt risk premium; and

(iii) to determine interest and tax expenses in a post-tax revenue model.

5.1 Approach

197. The target gearing is the relevant gearing level in the cost of capital. The ERA considers that target gearing should be determined from observations of the gearing level of firms in the benchmark sample of Australian utility businesses.

198. The average gearing of the benchmark sample determines the benchmark efficient level of gearing. This approach is consistent with incentive regulation discussed in Chapter 7.

199. The ERA has observed trends in average gearing across various definitions of debt and equity and examined the drivers of the results. The ERA's recent analysis, using the updated data to 2017, indicates that a benchmark gearing level of 55 per cent debt is appropriate. This value is fixed until the next review of the Rate of Return Guidelines.

[60] National Gas Rules 87(4).

5.2 Reasoning

200. Theoretically, market gearing should be used for equity beta derivation and WACC calculation. However, in practice, the market value of debt is not observable, as it is not as frequently traded as market equity. Given the book value of debt is an acceptable poxy for market debt,[61] this led to ERA's preference of a hybrid approach in estimating market gearing by using the book value of debt and market values of equity averaged over five years.

201. The ERA places more reliance on the use of market value gearing estimates as they reflect the market's current information on the efficient financing of the benchmark entity. This can be used to inform the setting of efficient financing costs for the upcoming regulatory period.

202. This is consistent with the 'Henry' approach to estimating equity beta, which uses gearing to de-lever and re-lever beta estimates, and the five year observation period over which equity beta is measured.

203. This measure indicates a pronounced decline in gearing since late 2009. This is mainly driven by firms in the benchmark sample experiencing strong share price growth and share issuance from around 2009.

204. Alternative book value based measures of gearing exhibit a slight decline. This measure suggests that gearing has declined slightly since 2008.

205. Other regulators' decisions are based on analysis that uses a longer 10 year period or analysis that pre-dates December 2013. These decisions are considered out of date or not as relevant to gearing decisions over the coming years.

206. Since the decline in the market value gearing measure is so pronounced, the ERA's preference is to reduce gearing from the long held value of 60 per cent.

207. In the past, the ERA and AER have periodically reviewed gearing.[62] Although the outcome has been to apply a value of 60 per cent, it does not automatically follow that the gearing must be held constant at this value, particularly if evidence suggests otherwise. Appropriately incorporating new information on gearing as it becomes available assists in avoiding a number of well documented analytical biases such as anchoring and adjustment, conservatism, availability, confirmation and status quo.[63] It also assists in avoiding larger changes or 'shocks' if declining trends continue. For example, making small adjustments at each review can avoid shocks resulting from large delayed adjustments that fail to incorporate new information as it becomes available.

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[61] Dr. Martin Lally, Review of the AER's views on gearing and gamma, p. 3.

[62] AER, *Electricity transmission and distribution network service providers: Review of the weighted average cost of capital (WACC) parameters*, May 2009, pp. 111-125.

AER, *Explanatory statement: Rate of return guideline appendices*, December 2013, pp. 126-130.

ERA, *Explanatory statement for the rate of return guidelines*, December 2013,pp. 44-52.

[63] N. Epley and T. Gilovich, *Putting adjustment back in the anchoring and adjustment heuristic: Differential processing of self-generated and experimenter-provided anchors*, *Psychological Science*, vol. 12, no. 5, 2001, pp. 391-396.

M. Hilbert, *Toward a Synthesis of Cognitive Biases: How Noisy Information Processing Can Bias Human Decision Making*, *Psychological Bulletin*, vol. 138, no.2, pp. 211-237.

5.2.1 Theoretical considerations on optimal capital structure

208. A firm's capital structure affects the cost of debt and equity within the WACC independently. The optimal capital structure should minimise the cost of capital thereby maximising the value of the firm. Optimal capital structure choices differ across industries, as well as for different companies within the same industry.

209. Three preeminent theories that attempt to explain optimal capital structure are: the static trade-off theory, the pecking order theory and equity market timing hypothesis.[64]

210. *Static trade-off theory* stems from the propositions of Modigliani and Miller (MM) which are cast in both a *no tax* and *with tax* setting.[65]

211. The starting point is based on an unrealistic *no tax* assumption. MM Proposition I asserts that capital structure is irrelevant.[66] When the tax benefit to the firm from interest deductibility is assumed away, capital structure becomes irrelevant. Investors can apply financial leverage themselves through borrowing funds to purchase equity and so leverage at the firm level is of no value to investors. The total value of a firm is simply equal to the market value of the free cash flows generated by its assets, which is not affected by how they are funded.[67] MM Proposition II under no taxes asserts that the cost of equity increases linearly with increased debt. Debt is typically lower cost than equity because its senior claim over firm assets reduces risk. The benefit from the increased use of relatively cheap debt financing is perfectly offset by the linear increase in the cost of equity. The cost of equity increases as a result of leverage increasing the risk to shareholders.

212. Introducing taxes changes MM Proposition I – capital structure becomes relevant and firm value is maximised using 100 per cent debt financing. The tax benefit (or shield) to the firm from interest deductibility adds value to investors. With taxes MM Proposition II asserts that the cost of capital is minimised at 100 per cent debt as a result of the greater tax shield lowering the WACC.

213. The MM propositions ignore the costs of financial distress. These costs include those directly associated with going into bankruptcy/administration (legal fees etc) and indirect costs such as investment opportunity costs and impairment of goodwill. The static trade-off theory recognises the trade-off between maximising firm value using the benefit of the tax shield on debt and increased costs of financial distress that come with increased leverage. The optimal capital structure balances these considerations to maximise firm value. This is shown diagrammatically in Figure 1.

W. Samuelson and R. Zeckhauser, *Status quo bias in decision making*, *Journal of Risk and Uncertainty*, vol. 1, no. 1, 1988, pp. 7-59.

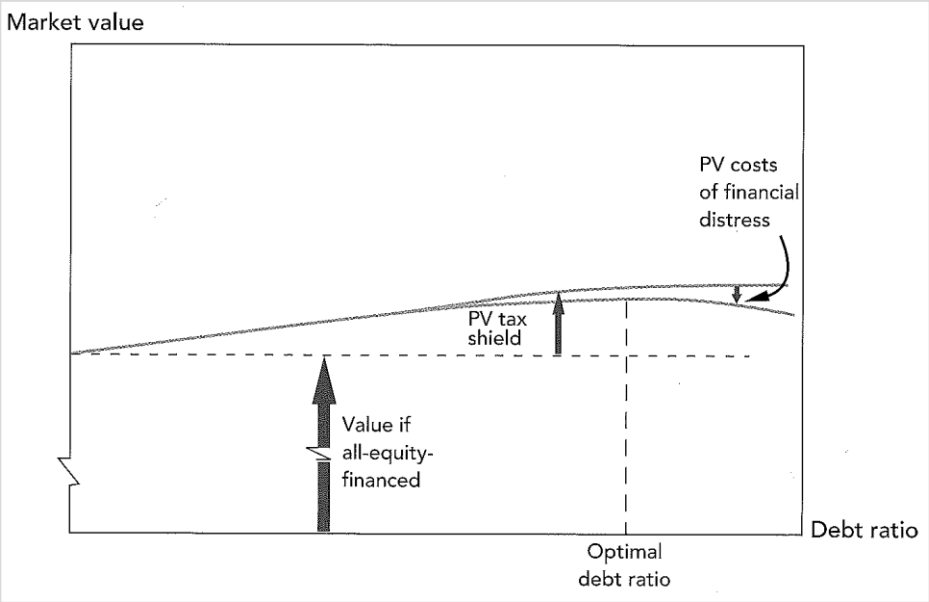
64 Q. Zhou, K. Tan, R. Faff and Y. Zhu, 'Deviation from target capital structure, cost of equity and speed of adjustment', *Journal of Corporate Finance*, vol.39, pp. 99-120.

65 Additional assumption include no transaction or bankruptcy costs, homogeneous investor expectations, riskless borrowing and lending, no agency cost and that operating income is not affected by financing decisions.

66 Berk J., DeMarzo P., & Harford J., *Fundamentals of Corporate Finance*, Pearson International, 2008, p. 489.

67 Modigliani, F. and Miller, M. 'The Cost of Capital, Corporation Finance and the Theory of Investment', *American Economic Review*, 1958.

Figure 1 Static Trade-Off Theory



Source: Brealey, Myers, Allen, Corporate Finance, eighth edition

214. *Pecking order theory* assumes that firm management makes financing choices based on the signalling of management knowledge to investors. Internal financing with retained earnings is least likely to signal investors and is therefore management's most preferred source of financing. Issuing debt signals that management is confident in the firm's ability to meet future interest and principal payments and so is next most preferred. Issuing equity is typically seen as a signal that management views the firm's stock as being overvalued and so is least preferred. This implies that retained earnings are depleted before debt is issued and that issuing equity is a last resort. The firm's capital structure is therefore an artefact of the many financing decisions made according to this *pecking order*.

215. The *equity market timing hypothesis*, in contrast to pecking order theory, proposes that firm's management observe market conditions and subsequently issue equity instead of debt when the market value of equity is high compared to book value and historical values. Conversely firms repurchase equity when the market value is low.[68]

5.2.2 Practical considerations

216. While the firm's management knows the target capital structure, outside observers typically do not. Observed gearing at a given point in time can deviate from a company's target capital structure. This is because market values of outstanding securities used to measure gearing frequently change in value, market conditions change the feasibility of issuing capital or change the feasibility of issuing debt relative to equity, and issuance costs encourage infrequent but large capital raisings. More recent literature examines the dynamics of adjustment toward the target capital structure over time instead of assuming a static framework.[69]

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[68] M. Baker and J. Wurgler, 'Market timing and capital structure', *The Journal of Finance*, vol.57, no.1, 2002, pp. 1-2.

[69] For example, Zhou et al examine whether the sensitivity of the cost of equity to deviation from the target capital structure influences the speed at which gearing adjusts back toward target. See Q. Zhou, K. Tan, R.

217. The method of accounting for investments in associates can reduce the comparability of debt reported in firm's balance sheets. The method used depends on the investing firm's ability to control the investee where percentage of firm ownership in the investee is typically used as a proxy for firm control. This can complicate the estimation of the true target gearing level for each firm in the benchmark sample and thus, the benchmark firm. Adjustments should be made to ensure financial information in firm's balance sheets is comparable.

5.2.3 Other Regulator's estimates of the benchmark gearing

218. Recent decisions by Australian regulators on gearing are presented in Table 3.

Table 3 Benchmark gearing in the Australian regulatory decisions

Regulator	Year	Industry	Gearing
AER[70]	2018	Electricity	60%
ERA[71,72]	2018, 2017	Electricity and water	55%
QCA[73]	2018	Water, sewerage, stormwater drainage and other services	60%
IPART[74]	2018	Water, sewerage, stormwater drainage and other services	60%
ESCOSA[75]	2016	Water, sewerage, stormwater drainage and other services	60%

Source: Compiled by the ERA

219. Australian regulators have consistently used a gearing assumption of 60 per cent for the cost of capital in the provision of various utility network services. This figure has been arrived at through directly observing gearing data for a benchmark sample of energy and water utilities in Australia and overseas, observing the actual gearing of the regulated entity in question and observing other regulators' decisions.

220. Gearing applied in some of the decisions in Table 3 that are not based on actual gearing can be traced back to a few key sources. These include the ERA and AER 2013 Rate of Return Guidelines, Lally's 2011 report on the estimated WACC for the QCA and the ERA 2013 Water Inquiry.[76]

Faff and Y. Zhu, *Deviation from target capital structure, cost of equity and speed of adjustment*, *Journal of Corporate Finance*, vol.39, pp. 99-120.

70 AER, *ElectraNet transmission final determination 2018-23 – Overview,* April 2018, p. 21.

71 ERA, *Draft Decision on Proposed Revisions to the Access Arrangement for the Western Power Network – Appendix 5 – Return on Regulated Capital Base*, May 2018, p. 56.

72 ERA, *The efficient costs and tariffs of the Water Corporation, Aqwest and Busselton Water*, November 2017, pp. 337-343.

73 Queensland Competition Authority, *Seqwater Bulk Water Price Review 2018-21,* March 2018, p. 59.

74 Independent Pricing and Regulatory Tribunal, *WACC Biannual Update*, February 2018, p. 4.

75 Essential Services Commission of South Australia, *SA Water Regulatory Determination 2016 Final determination*, June 2016, p. 125.

76 AER, *Better Regulation, Explanatory Statement Rate of Return Guideline*, December 2013, p. 9.

ERA, *Explanatory Statement for the Rate of Return Guidelines, meeting the requirements of the National Gas Rules*, December 2013, p. 44.

ERA, *Inquiry into the efficient costs and tariffs of the Water Corporation*, Aqwest and the Busselton Water Board: Revised final report, March 2013, pp. 59-60.

221. In addition, other regulators have used a longer term 10 year period to estimate gearing levels.

222. The ERA is aware that the AER is currently undertaking a review of its Rate of Return Guidelines.[77]

223. Other regulator's decisions can be used as a cross-check of the ERA's estimates. However, caution must be applied because following other regulator's decisions without understanding how the estimates are arrived at can result in a number of biases including:

- anchoring and adjustment - relying too heavily on the original estimate and making insufficient subsequent adjustments to arrive at the correct result;
- conservatism – relying too little on new information;
- availability – placing too much weight on readily available information by discounting that which is difficult to access or understand;
- confirmation – selectively valuing information that confirms beliefs and devaluing information that does not; and
- status quo – a predisposition to forego options that may bring about change.[78]

224. While the ERA considers the outcomes of the AER's review relevant to its own review of gearing, the ERA considers the values from the above referenced sources are not directly applicable to the ERA's assessment of gearing.

225. The ERA will therefore use its review of current gearing data to determine a benchmark gearing level.

5.2.4 The ERA's estimates of the benchmark gearing

226. A regulatory gearing estimate contributes to a rate of return that reflects efficient financial costs for the next regulatory period.

227. Gearing requires estimates of the value of a firm's debt and equity, which can be obtained from a firm's financial statements or from market values of traded debt and equity securities.

M. Lally, *The estimated WACC for the SEQ Interim Price Monitoring*, January 2011, pp. 11-16.

[77] AER, *Review of rate of return guideline*, [website], https://www.aer.gov.au/networks-pipelines/guidelines-schemes-models-reviews/review-of-rate-of-return-guideline, (accessed 5 January 2018).

[78] N. Epley and T. Gilovich, 'Putting adjustment back in the anchoring and adjustment heuristic: Differential processing of self-generated and experimenter-provided anchors', *Psychological Science*, vol. 12, no. 5, 2001, pp. 391-396.

M. Hilbert, 'Toward a Synthesis of Cognitive Biases: How Noisy Information Processing Can Bias Human Decision Making', *Psychological Bulletin*, vol. 138, no.2, pp. 211-237.

W. Samuelson and R. Zeckhauser, Status quo bias in decision making, *Journal of Risk and Uncertainty*, vol. 1, no. 1, 1988, pp. 7-59.

228. In principle both the values of debt and equity should be obtained from the same information source. That is, obtained either from book or market data. However, liquidity limitations restrict the ability to source market data for debt securities and a proxy may have to be used.

229. In calculating gearing the ERA has used the following method.

- Use comparator firms in its benchmark sample of firms.
- A market based gearing level is used to reflect efficient financing.
- Gearing is observed over a five-year period. This is consistent with the averaging period used for other parameters. Using inconsistent measures of gearing for de-levering and re-levering can result in under or overestimated equity betas in the Henry approach.
- Gearing estimates are observed on an annual basis from financial statements and market data.
- The market value of equity is equal to a firm's market capitalisation, which is equal to the share price multiplied by volume of shares issued.
- As the availability of market values of debt is limited, the book value of debt is used as a proxy. The book value of debt is calculated from current and non-current borrowings from financial statements.
- Debt is taken at a gross level. That is, no deduction is made for cash or marketable securities. Gross debt is used as it is not possible to determine whether cash equivalents are used to repay debt or pay dividend.[79] In addition, an efficient network business would have some cash as part of its optimal asset mix.
- Debt is adjusted to incorporate a firm's investments in associates and its associated debt, which may not be reported on the firm's balance sheet. Debt from associates is added to parent debt in line with proportional ownership. For example, Spark Infrastructure is adjusted for its investments in SA Power Networks, Victoria Power Networks and TransGrid.
- Debt and equity are adjusted to recognise the nature of hybrid securities. That is, hybrid securities which have equity characteristics are removed from debt. For example, some of Spark Infrastructure's loan notes are denoted as a debt product but have equity characteristics.

230. In its February 2018 discussion paper on gearing, the AER detailed some of these practical considerations of calculating gearing.[80]

231. The ERA has observed trends in average gearing across various definitions of debt and equity and examined the drivers of the results.

232. The ERA's analysis, using the updated dataset to 2017, indicates that the estimated benchmark gearing level has reduced to 55 per cent.

[79] Dr. Martin Lally, Review of the AER's views on gearing and gamma, p.4

[80] AER, *Discussion Paper - Gearing*, February 2018.

233. Table 4 details the gearing for the benchmark entity based on market values.

Table 4 ERA market value gearing estimates

	APA	AST	DUE	SKI	Average
2008	73%	59%	76%	70%	69%
2009	69%	70%	80%	70%	72%
2010	54%	64%	80%	65%	66%
2011	54%	64%	79%	62%	65%
2012	47%	59%	72%	59%	59%
2013	46%	57%	71%	62%	59%
2014	45%	58%	64%	55%	55%
2015	50%	59%	62%	56%	57%
2016	49%	57%	51%	54%	52%
2017	49%	52%	-	52%	51%
5 year average	**48%**	**56%**	**62%**	**56%**	**55%**

Source: Annual reports, Bloomberg, ERA Analysis

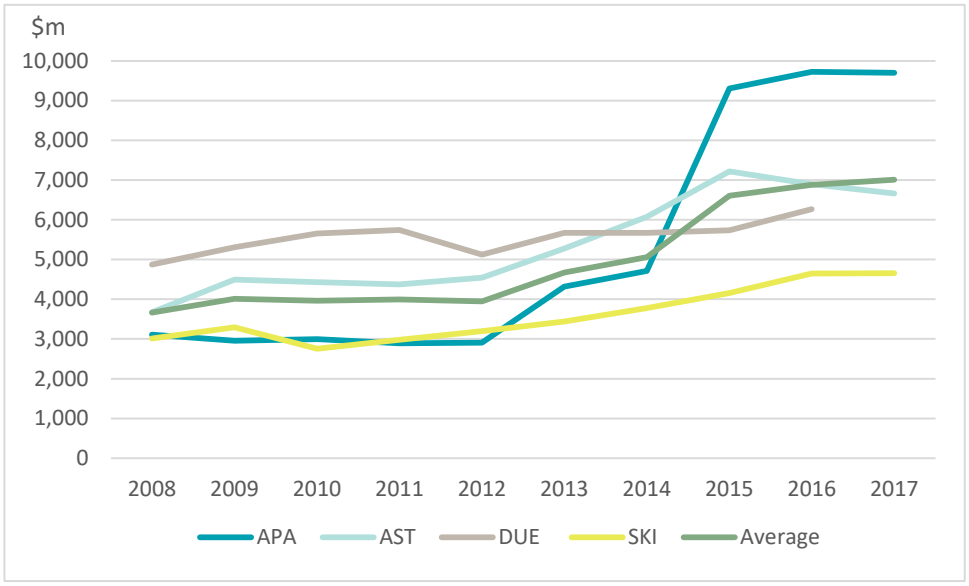
234. The gearing levels of all firms in the benchmark sample have been declining over time. The gearing for three of the four firms in the benchmark sample is less than the benchmark gearing of 60 per cent established in the previous Rate of Return Guidelines.[81]

235. The downward trend can be the result of market capitalisation increasing, the book value of debt decreasing or both of these factors.

236. Figure 2 shows that debt levels have increased across the sample on average over most of the 5 year period from around $4.7 billion in 2013 to $7.0 billion in 2017.

[81] ERA, *Rate of Return Guidelines: Meeting the requirements of the National Gas Rules*, 16 December 2013, p. 13.

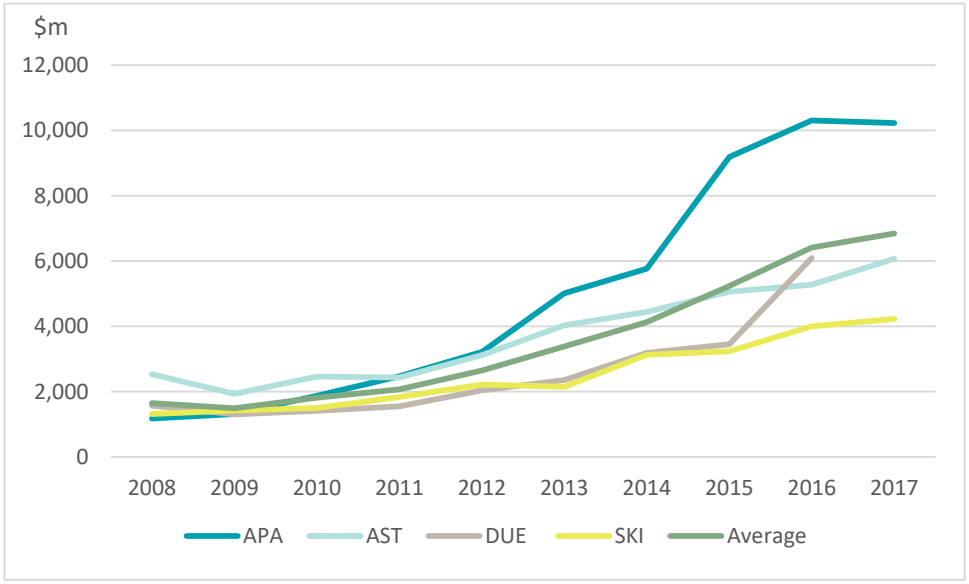
Figure 2 Benchmark firm's book value of debt



Source: Annual reports, ERA Analysis

237. Figure 3 shows that market capitalisation has increased across the sample on average over most of the 5 year period from around $3.4 billion in 2013 to just under $6.8 billion in 2017.

Figure 3 Benchmark firm's market capitalisation



Source: Annual reports, Bloomberg, ERA Analysis

238. The strong increase in market capitalisation appears to be driven by strong growth in share issuance and share price growth

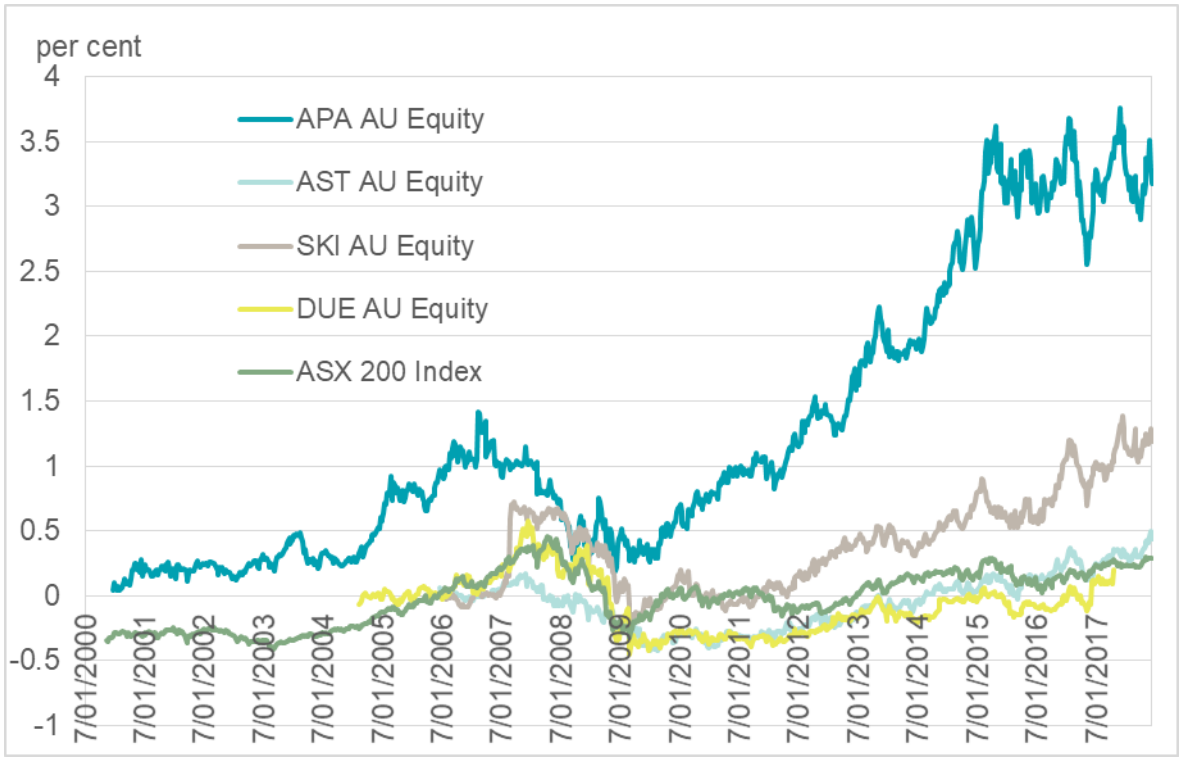
239. All four firms have issued a considerable number of new shares over the past 5 years. Share issuance has outpaced share price growth. This is shown in Figure 4.

Figure 4 Excess growth in number of shares over share price growth

Source: Bloomberg, ERA Analysis

240. The issuance of shares has coincided with particularly strong share price growth during the period, as shown in Figure 5.

Figure 5 Share price growth from inception



Source: Bloomberg, ERA Analysis

241. The strong equity price growth is evident in the steep slopes of the cumulative price growth series for each firm compared with that of the ASX 200 index. The issuance of new equity during this high price growth period is consistent with the equity market timing hypothesis, which suggests that firms issue equity instead of debt when the market value of equity is high compared to book value and historical values. The analysis here is insufficient to ascertain causation. That is, it cannot ascertain whether strong share price growth has caused new equity issuance. However, it is evident from the analysis above that growth in market capitalisation has outpaced growth in debt and that the main driver of growth in market capitalisation is growth in the number of shares while share price growth has also been strong. The high market value of equity for these firms is only a *potential* explanation for the increase in new equity issuance.

242. Data indicates that the decreasing gearing is mainly driven by the increasing market capitalisation from strong share price growth and share issuance from around 2009, without an equivalent rise in debt levels.

243. In addition, the "implementation of sophisticated tax structure and of high-geared investment vehicles may be more difficult to achieve given the more stringent terms on debt funding following the global financial crisis".[82]

244. The ERA has also assessed a gearing measure based on book value of total debt to total assets. Book-value based measures of gearing provide an alternative measure of gearing. On this basis, average gearing has remained the same over the past five years, with a slight decline over 10 years (Table 5). This suggests that growth in debt to finance network investments has kept pace with the book value of equity.

Table 5 ERA book value gearing estimates

	APA	AST	DUE	SKI	Average
2008	71%	58%	76%	89%	74%
2009	70%	67%	79%	85%	75%
2010	68%	62%	79%	66%	69%
2011	63%	60%	77%	69%	68%
2012	64%	61%	77%	68%	68%
2013	63%	61%	79%	68%	68%
2014	65%	64%	76%	67%	68%
2015	68%	69%	74%	66%	69%
2016	71%	66%	65%	68%	67%
2017	71%	64%		69%	68%
5 year average	**68%**	**65%**	**73%**	**68%**	**68%**

Source: Annual reports, Bloomberg, ERA Analysis

[82] Deloitte Corporate Finance, *Regulated assets: Trends and investment opportunities*, July 2011, p. 5.

245. The increase in APA Group's gearing after December 2014 influences the trend in the average book value based gearing in Table 5. The increase in APA Group's gearing coincides with its US $5 billion acquisition of the Queensland Curtis LNG pipeline completed on 3 June 2015, which was funded with US $4.1 billion in debt.[83]

246. The analysis of gearing based on book values suggests that the target level of gearing has not increased and may or may not have declined since the last Rate of Return Guidelines.

247. The AER's recent analysis has also shown that gearing levels, both on the basis of market values and book values, have been declining since 2007.[84]

248. The ERA places more reliance on the use of market value gearing estimates as they reflect the market's current information on the efficient financing of the benchmark entity. This gearing can then be used to inform the setting of efficient financing costs for the upcoming regulatory period. Book values, however, are a historical measure and not representative of forward looking values.

249. It would be expected that new entrants would have a gearing consistent with currently observed market gearings.

250. The use of the market value of equity is consistent with the Henry (2014) approach to estimating equity beta.[85] This is because the Henry approach uses gearing based on the market value of equity to de-lever and re-lever between asset (unlevered) and equity (levered) beta estimates.

251. Lally also supports that use of market value for gearing.[86]

- Beta is mathematically derived from a number of assumptions, and the gearing parameter arises in the course of the derivation and is defined in market terms.
- Though the WACC formula is not derived, it is simply definitional. Its role within a regulatory context is to implement the NPV = 0 condition, that is, the present value of the future cash flows is equal to the initial investment. This condition requires that the allowed rate of return that determines cash flows is equal to an investor's discount rate. Therefore, the allowed rate of return would be a WACC with a market value gearing.

252. The ERA's 2017 analysis of the efficient costs for water providers also updated the gearing estimate for energy.[87] Consistent with the above analysis, the ERA's 2017 analysis found:

- a declining trend in Australian gas and electricity network service provider gearing since 2011;

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[83] See APA group, *ASX Announcements*, [website], 2018, https://www.apa.com.au/news/asx-releases/2014/apa-expands-with-qclng-pipeline-acquisition-and-entitlement-offer/ and https://www.apa.com.au/news/asx-releases/2015/apa-completes-lng-pipeline-acquisition/, (accessed 4 January 2018)

[84] AER, *Discussion Paper - Gearing*, February 2018, pp. 15-16.

[85] See *Chapter 17 – Equity beta* for more details on this approach.

[86] Lally, *Review of the AER's views on gearing and gamma,* May 2018, pp. 7-9.

[87] ERA, *The efficient costs and tariffs of the Water Corporation, Aqwest and Busselton Water*, November 2017, pp. 337-343.

- market capitalisation growth appears to have been outstripping debt issuance in the Australian electricity and gas network utility sector; and
- on average, a decrease in gearing of five percentage points appears reasonable for Australian electricity and gas network utilities from the historic figure of 60 per cent.

253. The ERA's general gearing method involves observing actual gearing over the last five-year period.[88] The ERA does not forecast direction movements of debt relative to equity that may happen. For example, the ERA does not take into account factors such as market capitalisation forecasts and debt issuance constraints.

254. The estimated benchmark gearing of 55 per cent is lower than the 60 per cent that has been consistently used by Australian regulators for over a decade.

255. The ERA considers that available data, presented in Table 4, supports lower gearing of 55 per cent on the basis that:

- there has been a general deleveraging trend, only interrupted by the effect of the global financial crisis on equity values; and
- recent gearing levels of 51 per cent suggest a step change away from gearing levels of 60 per cent.

256. Although 60 per cent gearing has been used for an extended period, it does not automatically follow that the gearing must be held constant at this value, particularly if evidence suggests otherwise. Appropriately incorporating new information on gearing as it becomes available assists in avoiding a number of well-documented analytical biases such as anchoring and adjustment, conservatism, availability, confirmation and status quo.[89] It also assists in avoiding larger changes or 'shocks' if declining trends continue. For example, making small adjustments at each review can avoid shocks resulting from large delayed adjustments that fail to incorporate new information as it becomes available.

257. Considering all the above information, for the draft guidelines the ERA will use a debt to total assets ratio (gearing level) of 55 per cent and the equity to total assets ratio of 45 per cent.

[88] ERA, *Explanatory Statement for the Rate of Return Guidelines,* December 2013, p. 52.

[89] N. Epley and T. Gilovich, '*Putting adjustment back in the anchoring and adjustment heuristic: Differential processing of self-generated and experimenter-provided anchors*', *Psychological Science*, vol. 12, no. 5, 2001, pp. 391-396.

M. Hilbert, 'Toward a Synthesis of Cognitive Biases: H*ow Noisy Information Processing Can Bias Human Decision Making', Psychological Bulletin*, vol. 138, no.2, pp. 211-237.

W. Samuelson and R. Zeckhauser, *Status quo bias in decision making*, *Journal of Risk and Uncertainty*, vol. 1, no. 1, 1988, p. 7-59.

6 Return on debt

258. Under the National Gas Rules, the ERA is required to estimate the return on debt in a way that contributes to the achievement of the allowed rate of return objective. As detailed in the National Gas Rules section 87(3):

> The *allowed rate of return objective* is that the rate of return for a service provider is to be commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk as that which applies to the service provider in respect of the provision of reference services.

259. Subject to that overarching requirement, the method adopted to estimate the return on debt may, without limitation, be designed to result in a return on debt that reflects:[90]

- the return that would be required by debt investors in a benchmark efficient entity if it raised debt at the time, or shortly before the time, that the regulator's decision on the access arrangement for that period is made;
- the average return that would have been required by debt investors in a benchmark efficient entity if it raised debt over an historical period prior to the commencement of a regulatory year in the access arrangement period; or
- some combination of the above returns.

260. This chapter sets out the approach the ERA will adopt to estimate the return on debt and the reason for it.

6.1 Approach

261. The estimate of the return on debt will comprise a risk premium over and above the risk free rate, combined with an additional margin for administrative and hedging costs:

$$\text{Return on Debt} = \text{Risk Free Rate} + \text{Debt Risk Premium} + \text{Debt raising costs} + \text{Hedging costs} \quad \text{(equation 3)}$$

262. The return on debt estimate is based on the hybrid trailing average approach. This method:

- adopts the 5-year bank bill swap rate, set on the day; and
- uses a 10-year trailing average for the debt risk premium, which is updated annually so that each year a new year's debt risk premium is estimated and the oldest estimate in the 10-year series is removed.

263. The on-the-day estimate of the risk free rate will be based on the observed yield of a 5-year term bank bill swap rate, averaged over a 20-day period just prior to the regulatory period (see *Chapter 7 – Risk free rate of return*). The 20-day period will be nominated by the service provider in advance of the ERA's final decision. The 5-year term reflects the present value principle that the term of debt should match the length of the regulatory period, which is 5 years.

[90] National Gas Rules 87(10).

264. The on-the-day debt risk premium will be derived from the yield of an observed sample of bonds, with a term of 10 years, issued by comparator firms with similar credit ratings as the benchmark efficient entity (see *Chapter 8 – Benchmark credit rating* and *Chapter 9 – Debt risk premium*). The ERA calculates the debt risk premium based on a 10-year hybrid trailing average, which will be updated annually.

265. An annual allowance will be provided for debt raising and hedging costs (see *Chapter 13 – Debt and equity raising costs*). The annual allowances for these elements will be set once, at the start of the regulatory period.

6.1.1 Initial revenue path

266. The return on debt estimated for the first year of an access arrangement will contribute to the setting of the initial revenue path for the remaining years of the regulatory period (that is, for years two to five).

6.1.2 Annual update of the return on debt

267. The ERA will revise the return on debt each year to incorporate an annual update of the estimate of the debt risk premium.

268. Each year, the ERA will estimate the latest on-the-day value of the debt risk premium over the specified averaging period. It will then be incorporated in the 10-year trailing average, replacing the estimate made 10 years prior. (see *Appendix 2 – Automatic updating formulas for the return on debt*).

6.1.2.1 Implementing the annual update

269. The ERA will implement the annual update by setting tariffs for regulatory years two to five by including an automatic adjustment to the initial revenue path in each year.

270. The automatic adjustment will account for the change in revenue in each year that arises from the difference between the return on debt under the initial revenue path and that under the annually updated return on debt.

271. The difference in the return on debt will reflect the change in the debt risk premium. The other components of the return on debt – the risk free rate and the allowances for debt raising costs and hedging costs – will apply unchanged for each regulatory year in the regulatory period.

272. First, the cash flow allowance for the return on debt in any regulatory year t may be defined as:

$$RoD_t = (DRP_t + R_f + Drc + Hc).\frac{D}{(D+E)}.RAB_{Op,t} \qquad \text{(equation 4)}$$

where

RoD_t is the return on debt in year t;

DRP_t is the initial debt risk premium;

R_f is nominal risk free rate;

Drc is the debt raising cost;

Hc is the hedging cost;

$\frac{D}{(D+E)}$ is the gearing;

$RAB_{Op,t}$ is the opening regulated asset base at the beginning of year t; and

t ranges from year 1 to 5.

273. The 'initial revenue path' will be calculated in line with the above formula, using the estimated DRP_t for year 1 (that is, DRP_1).

274. Second, the formula for calculating the subsequent annual adjustment to the initial revenue path for a change in the estimate of the debt risk premium will be as follows:

$$\Delta RoD_t = \frac{D}{(D+E)} (DRP_t \times RAB_{Op,t} - DRP_1 \times RAB_{Op,1}) \qquad \text{(equation 5)}$$

where

ΔRoD_t	is the change in the allowance for the return on debt in year t
$\frac{D}{(D+E)}$	is the gearing;
DRP_1	is the initial debt risk premium estimated at the start of the regulated period;
$RAB_{Op,1}$	is the opening Regulated Asset Base at the start of the regulated period;
DRP_t	is the debt risk premium estimated at the start of period t;
$RAB_{Op,t}$	is the opening Regulated Asset Base at the beginning of year t; and
t	is the regulatory year, ranging from year 2 to 5.

275. Under this formula, all return on debt amounts remain unchanged from those provided in the initial revenue path in the final access arrangement decision, except for the annual allowance ΔRoD_t, which reflects the change in the debt risk premium in the regulatory years two to five.

276. Revenue and prices to apply in the relevant regulatory year will be adjusted along with the updated return on debt, as part of the annual tariff update, through the automatic update mechanism.

277. As only the estimate of the debt risk premium is updated annually, the approach constitutes a partial update of the return on debt and the rate of return. This partial update is the approach that best meets the requirements of the National Gas Law, the National Gas Objective, the Revenue and Pricing Principles, the National Gas Rules and the allowed rate of return objective, since it takes both efficiency and the desire of users for stability in gas pipeline tariffs into account.

6.2 Reasoning

278. The approach for determining the expected return on debt involves summing estimates of the risk free rate, the debt risk premium and an allowance for the administrative costs and hedging costs of issuing debt:

$$\text{Return on Debt} = \text{Risk Free Rate} + \text{Debt Risk Premium} + \text{Debt raising costs} + \text{Hedging costs} \quad \text{(equation 2)}$$

279. The approach for estimating each component of the above equation is based on the hybrid trailing average method. Under the hybrid trailing average method, the risk free rate is set once (on-the-day), while the debt risk premium is a trailing average of the on-the-day rate and previous annual observations.

280. The hybrid trailing average compares to:

- the on-the-day approach – whereby both the risk free rate and the debt risk premium are set on the day; and
- the full trailing average approach – whereby both the risk free rate and the debt risk premium are determined as trailing average estimates.

281. These three options for estimating the return on debt may be evaluated in terms of their ability to achieve the National Gas Objective, the Revenue and Pricing Principles, the National Gas Rules and the allowed rate of return objective set out in National Gas Rule 87(3), as well as the other requirements of National Gas Rule 87. In line with these requirements, any approach to estimating the rate of return should, among other things:

- promote efficiency, such that the regulated return on debt will achieve outcomes similar to those observed in markets with effective competition;
- be 'commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk in provision of the reference services',
- deliver 'effective incentives to promote efficient investment in, or in connection with a pipeline, efficient provision of pipeline services and efficient use of the pipeline';[91]
- minimise any differences between the regulated return on debt and that of the benchmark efficient entity, given this is a factor the ERA must consider under the National Gas Rules;[92]
- remunerate efficient financing costs, over the lives of the assets, in net present value terms;[93] and

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91 National Gas Rule 87(3); National Gas Rule 87(11)(c); National Gas Objective, Revenue and Pricing Principles (see relevant parts of the *National Gas Access (WA) Act 2009*). See also Economic Regulation Authority, *Explanatory Statement for the Rate of Return Guidelines*, 16 December 2013, pp. 5–9.

92 National Gas Rule 87(11)(a).

93 Revenue and Pricing Principle 2 (*National Gas Access (WA) Act 2009*, s. 23, clause 24).

- minimise regulatory costs.[94]

6.2.1 The desired method for estimating the return on debt

282. Broad competing approaches for estimating the return on debt include:

- the on-the-day approach for estimating the risk free rate and the debt risk premium;
- the hybrid trailing average approach for estimating the debt risk premium, with annual updating; and
- a full trailing average for both the risk free rate and the debt risk premium, with annual updating.

283. All approaches to estimating the return on debt have strengths and weaknesses. However, the full trailing average:

- has inferior prediction properties for the risk free rate; and
- violates the present value principle for the risk free rate component since it has a 10-year term, thereby resulting in increased costs for customers.

284. Furthermore, the forward-looking risk free rate is observable. For example, 5-year Commonwealth Government Securities provide a proxy for the forward-looking risk free rate expected to apply over a subsequent 5-year regulatory period. These rates are reported regularly. They reflect prevailing market prices for the underlying securities.

285. For these reasons, the ERA does not support the full trailing average.

286. Both the on-the-day and the hybrid trailing average approaches allow for hedging of the risk free rate at the start of the regulatory period. Both approaches similarly allow for debt raising costs, hedging costs or regulatory costs.

287. The key differences between the on-the-day and the hybrid trailing average approach relate to the debt risk premium.

- There is some evidence that the on-the-day approach performs at least as well as the simple trailing average for the debt risk premium for the 5-year regulatory period ahead, and may be superior.
- In signalling efficient use by upstream and downstream users, the limited evidence suggests that the on-the-day approach performs at least as well as, and potentially better than, the hybrid trailing average debt risk premium.

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[94] National Gas Rule 87(3) – least cost regulation is in the long term interests of consumers.

- The trailing average approach to estimating the debt risk premium can be replicated exactly by the firm, whereas the on-the-day approach cannot, due to difficulties in hedging the debt risk premium. With the on-the-day approach, the firm is required to manage the ups and downs of prevailing rates, with its cost of debt sometimes exceeding the regulated return on debt, and sometimes undercutting it. On that basis, the hybrid trailing average approach is superior.

- To the extent that the trailing average may be matched by the regulated firm, it may lower credit risk (and hence cost) as compared to the on-the-day approach. The result is that the return on debt from a staggered debt portfolio can be consistent with an efficient financing strategy. However, over time and on average, there are likely to be limited differences between the various approaches. Nevertheless, this consideration adds further support for the hybrid trailing average approach.

- Trailing average approaches can achieve the present value condition exactly at any point in time, whereas the on-the-day approach only approximates the condition, on average, over the longer term.[95] Again, this provides support for the hybrid trailing average approach.

- Annual updating – which is a requirement of the current hybrid trailing average approach – adds some complexity and resource intensiveness, compared to the on-the-day approach. However, the difference in regulatory cost is not large.

288. The ERA has considered these strengths and weaknesses and has adopted the hybrid trailing average approach.

6.2.2 Key features of the hybrid trailing average approach

289. The estimate of the return on debt is based on a simple hybrid trailing average which will:

- comprise the sum of a debt risk premium and a base risk free rate, combined with a margin for administrative and hedging costs:

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

- estimate the risk free rate once, based on an averaging period at the start of the regulatory period (the 'on-the-day' approach for the risk free rate) (see *Chapter 7 – Risk free rate of return*);

- adopt a 10-year term for the debt risk premium, thereby achieving the present value principle (or NPV=0 condition), to estimate the debt risk premium consistent with the average term at issuance, being 10 years (see *Chapter 9 – Debt risk premium*); and

[95] The present value principle – also known as the financial capital maintenance principle – ensures that the present value of expected capital charges for an asset over its economic life should be equal to the initial value or purchase costs. The capital charge relating to assets comprises both the return on and the return of capital. For a summary of the issues, see Queensland Competition Authority, *Financial Capital Maintenance and Price Smoothing*, February 2014).

- continue to annually update the estimate of the debt risk premium, just prior to the start of each regulatory year, but now based on the updated hybrid trailing average estimate of the debt risk premium.

290. *Chapter 9 – Debt risk premium* explains how to construct the 10-year hybrid trailing average. The annually updated hybrid trailing average will feed through into each annual tariff variation.

7 Risk free rate of return

291. The risk free rate of return is an important input in the ERA's approach to estimating the return on equity and the return on debt.

292. The risk free rate is the rate of return an investor receives from holding an asset with a guaranteed payment stream (that is, where there is no risk of default). Since there is no likelihood of default, the return on risk free assets compensates investors for the time value of money.

293. The risk free rate of return can be estimated as either a nominal or real risk free rate. The nominal risk free rate includes compensation to investors for the reduction in purchasing power caused by inflation. The real risk free rate of return would prevail if the expected inflation rate was zero during an investment period. The National Gas Rules require the ERA to use a nominal vanilla rate of return in regulatory decisions,[96] so in this section, the term 'risk free rate' refers to the *nominal* risk free rate.

294. This chapter outlines the ERA's approach to determining the risk free rate used to calculate the rate of the return.

7.1 Approach

295. A 5-year term to maturity will be used to estimate the risk free rate of return for the return on equity and for the return on debt.

296. The risk free rate of return will be set at the start of a regulatory access arrangement period and will be fixed for the length of that period.

297. Commonwealth Government Security bonds are the best proxy for risk free assets in Australia.

298. Observed yields from these Commonwealth Government Security bonds – as reported daily by the RBA – will be used to estimate the risk free rate of return for the purpose of estimating the return on equity.

299. It is not common to observe a Commonwealth Government Security bond with remaining term to maturity that exactly matches that of the regulatory period.[97] Therefore, for the return on equity, a linear interpolation of the observed yields of Commonwealth Government Security bonds will be used to estimate the risk free rate.

300. For the return on debt, the ERA will use estimates of the prevailing interest rate swaps of appropriate terms for estimating the return on debt. The swap rate is referred to as the 'base rate' in the return on debt calculation. It incorporates a spread to the rate on Commonwealth Government Security bonds and is available at specified terms from data providers such as Bloomberg.

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96 National Gas Rules 87(4).

97 In the linear interpolation approach, two bonds are selected with terms to maturity that fall on either side of the date on which the term of the regulatory period ends The dates on these bonds are referred to as the 'straddle' dates. Linear interpolation estimates the yields on the regulatory period term by assuming a linear increase in yields between the straddle dates on the two bonds observed.

301. An 'averaging period' will be selected to set the rate of return parameters that are calculated using market data (being the risk free rate used to estimate the return on equity, and the base rate to be used in the estimate of the return on debt for the coming 5-year period). The averaging period will meet the following criteria:

- duration of 20 consecutive trading days;
- being as close as possible to commencement of the regulatory period; and
- nominated prior to any of its dates taking place.

7.2 Reasoning

302. Three key issues were considered when developing the risk free rate of return for use in the determination of the regulated rate of return. These were:

(i) the choice of the proxy for "risk free" assets;

(ii) the term to maturity for assessing the risk free rate; and

(iii) the averaging period.

303. This section addresses each of those issues.

7.2.1 The choice of the proxy for the risk free rate

7.2.1.1 The proxy for estimating the return on equity

304. Australian regulators have consistently adopted the observed yields to maturity of Commonwealth Government Security bonds as an appropriate proxy for the nominal risk free rate of return.

305. Commonwealth Government Security bonds are a good proxy for the risk free rate in Australia.

- Commonwealth Government Securities are essentially free from default risk. The Australian Government has consistently received the highest possible credit rating from both Standard and Poor's (**S&P**), and Moody's. Payments from these bonds are guaranteed by the Australian Government.
- These bonds are relatively 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 RBA on a daily basis.

306. The use of the Commonwealth Government Security risk free rate is therefore the approach that best meets the allowed rate of return objective. It is fit-for-purpose, particularly as it is robust, transparent and replicable.

307. To balance the trade-off between reflecting prevailing conditions and smoothing out the influence of idiosyncratic yields, the ERA will use an estimate of the risk free rate averaged over a period just prior to the regulatory period. This is the so-called 'on-the-day' approach.

7.2.1.2 The proxy for estimating the return on debt

308. The ERA will use swap rates to determine the risk free rate when estimating the return on debt.

309. Interest rate swaps are derivative contracts, which typically exchange – or swap – fixed interest rate payments for floating interest rate payments. They provide a strong means to hedge and manage risk. Investment and commercial banks with strong credit ratings are swap market makers.

310. The 5-year interest rate swap spreads capture the credit risk of financial institutions. The interest rate swap rate is the index rate at which financial institutions borrow and lend from each other. This rate is higher than the Commonwealth Government Security yield of an equivalent term with the spread over the Commonwealth Government Security capturing the credit risk of financial institutions.

311. The rationale for using a swap rate is that it is difficult to hedge government bonds. This means that regulated firms can be exposed if the risk free rate does not correlate with the swap rate.

312. For the purposes of determining the cost of debt the use of the interbank swap rate is also more convenient for businesses and regulators. Use of the swap rate simplifies the calculation of the debt risk premium (the alternative approach would be to use the Commonwealth Government Security and incorporate the spread to swap in the debt risk premium). On that basis, use of the swap rate is not inconsistent with the use of the Commonwealth Government Securities as the proxy for the risk free rate.

313. The difference between a Commonwealth Government Security risk free rate and a swap rate of similar term is called the spread of swap. Though interbank lending has a cost above that of Commonwealth Government Securities used to calculate the cost of equity, the use of the interbank rate is equivalent to using a Government Security and separately adjusting the debt risk premium.

314. If debt risk premiums are estimated consistently with the chosen base – whether that base be the Commonwealth Government Security risk free rate or the swap rate – there should be no difference in the resulting build-up of the overall return on debt. The two approaches just represent 'two different ways of splitting up the total interest rate', with:[98]

[98] Chairmont Consulting, *Comparative Hedging Analysis*, 12 June 2013, p. 14.

$$Yield = R_f + SS + DRP_s \quad \text{(equation 6)}$$

where

Yield is the return on debt

R_f is the Commonwealth Government Security risk free rate;

SS is the spread of swaps to the Commonwealth Government Security rate; and

DRP_s is the debt risk premium to the underlying swaps rate base.

315. The spread of swap can vary. Typically it is not large, being in the range of 40 to 60 basis points, although sometimes the spread may be higher.[99] Firms typically base their hedges on swap rates, as the swap markets are deep, and the approach allows hedging of both the underlying risk free rate and the spread of swap.

316. For estimating the return on debt, the ERA will use the 5-year swap mid-rate, as published on Bloomberg (Last Price), over the relevant averaging period for each regulatory year. This will simplify the understanding of the estimate, but remain consistent with the underlying Commonwealth Government Security rate that is used more broadly for the decision. The difference will be the spread between the two.

7.2.2 The term of the risk free rate

317. Some Australian regulators use Commonwealth Government Securities with a 10-year term to maturity whereas others use Commonwealth Government Securities with a 5-year term to maturity or less. The AER, for example, has adopted a 10-year term for a nominal risk free rate of return.[100]

318. Recent Australian regulatory practices for the term of the risk free rate of return are summarised in Table 6.

99 Chairmont Consulting, *Comparative Hedging Analysis*, 12 June 2013, p. 17.

100 Australian Energy Regulator, *Attachment 3 – Rate of return | Final decision: TasNetworks distribution determination 2017–19,* April 2017, p. 3-38.

Table 6 Terms of a risk free rate of return in Australian regulatory decisions

Regulator	Year	Industry	Term of the risk free rate of return (Years)
ERA[101] [102]	2016, 2018	Gas and electricity	5
AER[103] [104]	2017, 2018	Electricity network	10
QCA[105]	2018	Various	3
IPART[106]	2018	Various	10
ESCOSA[107]	2016	Water, sewerage, stormwater drainage and other services	10
ACCC[108]	2015	Fixed Line Services (Telecommunications)	10

Source: Compiled by the ERA

319. An important regulatory principle is the present value condition (NPV = 0), which helps ensure that investors are compensated at a level to encourage efficient investment. This condition means that the present value of the future stream of expected cash flows of a firm is equal to the regulatory asset base. That is, the regulatory asset base maintains its value and the regulated businesses are not over or under compensated.

320. In order to ensure that NPV = 0, the ERA believes that the appropriate term for the risk free rate in the current regulatory setting is five years. The rate of return is reset every five years, consistent with the term of the access arrangement.

321. The present value principle has been detailed in the ERA's consideration of the 2013 gas rate of return guidelines.[109]

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101 Aligns with the length of the regulatory period.
ERA, *Draft Decision on Proposed Revisions to the Access Arrangement for the Western Power Network – Appendix 5 Return on Regulated Capital Base*, May 2018, p. 13.

102 Aligns with the length of the regulatory period.
ERA, *Final Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline 2016 – 2020: Appendix 4 Rate of Return*, 2016, p. 11.

103 AER, *Attachment 3 – Rate of return | Final decision: TasNetworks distribution determination 2017–19,* April 2017, p. 3-38.

104 The AER's terms in its April 2018 final decision on ElectraNet was consistent with that detailed in its draft decision.
AER, *Draft Decision ElectraNet transmission determination 2018 to 2023,* October 2017, p. 3-42.

105 The 3 year term aligns with the length of the regulatory period for Seqwater.
Queensland Competition Authority, *Seqwater Bulk Water Price Review 2018-21,* March 2018, p. 61.

106 Independent Pricing and Regulatory Tribunal, *WACC Biannual Update*, February 2018, p. 2.

107 Essential Services Commission of South Australia, *SA Water Regulatory Determination 2016 Final determination*, June 2016, p. 124.

108 Australian Competition and Consumer Commission, *Public inquiry into final access determinations for fixed line services – Final Decision*, October 2015, p. 66.

109 ERA, *Appendices to the Explanatory Statement for the Rate of Return Guidelines: Appendix 2*, December 2013, pp. 17-30.

7.2.3 The length of the averaging period

322. The risk free rate and the debt risk premium (see *Chapter 9 – Debt risk premium*) are calculated using market data. To set these parameters, it is necessary to choose the period over which market data will be considered. This period is called the 'averaging period'.

323. As there can be unexplained day-to-day volatility, taking an average over a period reduces the risk of over or under compensating regulated businesses. When selecting the averaging period, there is a trade-off between efficiency and short term volatility considerations.

324. The current practice of Australian regulators is to adopt an averaging period in the range of 20 to 40 trading days for smoothing the day-to-day fluctuations of the observed risk free rate.[110]

325. Regulators generally apply a consistent averaging period when calculating the different components of the rate of return – for example, if a regulator uses a 40 trading day period for one decision, it will also use 40 trading days across its other decisions.

326. The length of the averaging period should be informed by both technical considerations and practical ones. The ERA's technical analysis indicates that an averaging period of up to 60 trading days, just prior to the commencement of the regulatory period, provides an acceptable predictor of the forward looking estimate of the risk free rate for the subsequent regulatory period.[111] Prediction performance is important for achieving the efficiency requirements of the National Gas Objective. If the averaging period is greater than 60 trading days, its predictive performance may be impaired. However, it may not be practically feasible for a service provider to nominate an averaging period 60 trading days ahead of time.

327. In its recent decisions, the ERA has accepted a 20 trading day period.[112] Allowing the service provider to nominate a 20 trading day period – agreed with the ERA – that falls close to the commencement of the regulatory period, or close to the submission of a tariff variation, meets both the technical requirements of efficiency and acceptable volatility, and is practical for the ERA and service providers.

7.2.4 Interpolating the term to maturity

328. The yields of Commonwealth Government Securities are reported daily by the RBA, and these reported yields will form the basis for estimating the risk free rate of return. This risk free rate can be observed with reasonable certainty.

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110 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 sharp changes in 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.

111 ERA, *Appendices to the Explanatory Statement for the Rate of Return Guidelines: Appendix 4 – The Diebold Mariano test*, December 2013, pp. 46-55.

112 ERA, *Draft Decision on Proposed Revisions to the Access Arrangement for the Western Power Network – Appendix 5 Return on Regulated Capital Base*, May 2018, p. 14.
ERA, *Final Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline 2016 – 2020: Appendix 4 Rate of Return*, June 2016, p. 49.

329. However, it is not always the case that the remaining term to maturity of an existing Commonwealth Government Security will match the required term of the risk free rate. When this occurs, the ERA will observe the yield of two Commonwealth Government Securities that have maturities closest to, but less than and greater than, that of the required maturity. Linear interpolation between these two bonds will then be used to estimate the risk free rate of the required maturity.

8 Benchmark credit rating

330. The benchmark credit rating is an important input required to estimate the debt risk premium.

331. The credit rating is defined as the forward-looking opinion provided by a ratings agency of an entity's credit risk. Credit ratings provide a broad classification of a firm's probability of defaulting on its debt obligations. As a consequence, credit ratings represent the risk present in holding a debt instrument.

332. As a general rule, the debt risk premium is higher when the credit rating is lower, and vice versa. This is because lenders require increased compensation before they commit funds to a debt issuer with a lower credit rating. A lower credit rating can be associated with a higher risk of default, which leads to a higher debt risk premium.

8.1 Approach

333. Credit ratings provide a broadly uniform measure of default risk. That is, firm's with the same credit rating at a particular point in time should have similar levels of default risk.

334. This characterisation of risk eliminates the need to rely on listed firms, as is the case for equity beta, because it is not measured relative to an index based on a domestic stock exchange. For this reason both listed and unlisted firms can be used where a credit rating is available.

335. The ERA uses the median value approach to determine the credit ratings of the benchmark efficient entity.

336. The median value approach involves taking the median credit rating of a sample of comparator businesses and using this value as the credit rating for the benchmark efficient credit rating. These can be either listed or unlisted or government owned. This approach is relatively robust to the presence of outliers in the comparator business sample. The approach is somewhat superficial because it does not analyse the drivers of credit ratings in much detail and just focuses on the prevalence of the final ratings. This approach suggests a credit rating around BBB+.

337. Other regulators' decisions are referred to as a cross-check. They support a credit rating of BBB+.

338. On the basis of the analysis and cross-checks the ERA determines a benchmark credit rating of BBB+ to be appropriate for application in the cost of debt estimations. This credit rating is fixed until the next review of the rate or return guidelines.

8.2 Reasoning

8.2.1 Median credit rating approach

339. To estimate the benchmark efficient entity's credit rating using a median credit rating approach, a benchmark sample of comparator companies must first be constructed. This does not have to be constrained to listed or privately owned companies, because the analysis takes parent and government ownership into consideration.

340. As set out in the chapter on the benchmark efficient entity and compensation for risk, it is appropriate to select Australian companies with similar risk for the benchmark sample which is used to determine a benchmark credit rating. A company that is included in the sample is required to satisfy two characteristics. First, the company must be a network service provider in the gas and/or electricity industry in Australia. Second, its credit rating must be published by an international rating agency such as S&P or Moody's. Moody's credit ratings are converted into the equivalent S&P credit ratings because the ERA's debt risk premium approach uses S&P ratings.

341. The ERA has used the 2013 rate of return guidelines sample as a starting point for establishing the credit rating. This is shown in Table 7.

Table 7 2013 rate of return guidelines credit rating sample remapped to 2018 and final sample

2013 Sample	2018 Mapping	2018 Sample
Alinta LGA Ltd/Jemena (AGL)/Singapore Power International Assets Australia	Jemena	Jemena
Alinta Network Holding Pty Ltd/WA Network Holdings Pty Ltd/ATCO Gas Australia LP	ATCO	ATCO
The CitiPower Trust	Victorian Power Networks	Victorian Power Networks
DBNGP Finance Co Pty Ltd	DBP	DBP
DBNGP Trust	DBP	
Diversified Utility and Energy Trusts (DUET) Group	Acquired	
ElectraNet Pty Ltd	Electranet	Electranet
Energy Partnership (Gas) Pty Ltd	Energy Partnerships	No data
Envestra Ltd	Australian Gas Networks	Australian Gas Networks
Envestra Victoria Pty Ltd	Australian Gas Networks	
Ergon Energy Corporation Ltd	Ergon Energy	Ergon Energy
Ergon Energy Queensland Pty Ltd	Ergon Energy	
ETSA Utilities Finance Pty Ltd	South Australian Power Networks	South Australian Power Networks
Gas Net Australia (Operations) Pty Ltd/APT Pipelines Ltd	APA Group	APA Group
Powercor Australia, LLC	Victorian Power Networks	
SP AusNet Group	Ausnet	Ausnet
SPI Australia Holdings (Partnership) LP	Ausnet	
SPI Electricity & Gas Australia Holdings Pty Ltd	Ausnet	
SPI Electricity Pty Ltd	Ausnet	
SPI PowerNet Pty Ltd	Ausnet	
United Energy Distribution Holdings Pty Ltd	United Energy Distribution	United Energy Distribution
United Energy Distribution Pty Ltd	United Energy Distribution	
-	-	Transgrid
-	-	Multinet Gas

Source: ERA Analysis

342. An entity's credit rating will generally provide a more appropriate indicator of the risk profile for a business than will the credit rating of instruments issued by the business. This is because credit ratings for instruments can be uplifted due to practices such as credit wrapping. For this reason many of the companies in the sample have been consolidated by sourcing the S&P long term local currency issuer rating that applies to the parent of the duplicates. DUET Group was acquired by Australian Gas Infrastructure Group in April 2017 which now owns DBP, Australian Gas Networks and Multinet Gas. Additional credit ratings for Transgrid and Multinet is available in Spark Infrastructure and DUET Group's annual reports. The ratings are used to augment the 2018 sample. This resulted in a sample of 13 companies with credit ratings.

343. Credit rating companies often take government and parent ownership into account, implicitly or explicitly, when producing ratings. This is because a parent or government with a strong credit rating is seen as a source of credit support for the entity. For this reason the ERA has considered a benchmark credit rating from the following sample and subsamples based on Table 7.

    1. A sample including both Australian gas and electricity companies (*Sample 1*);

    2. A sample excluding gas and electricity businesses with any form of government ownership (*Sample 2*).

    3. A sample including all privately-owned (non-government owned) gas and electricity businesses excluding businesses with support from their parent companies (*Sample 3*).

344. An outline of government and parent ownership for the sample is shown in Table 8.

Table 8 Ownership of firms in benchmark credit rating sample

Firm	Parent (51 per cent plus control)	Government Ownership
ATCO Gas Australia	ATCO Group	No
ElectraNet Pty Ltd	None	State Grid (Chinese Government)
Jemena Ltd	State Grid (Chinese Government)	State Grid (Chinese Government)
United Energy Distribution Holdings Pty Ltd.	Cheung Kong Infrastructure Holdings Limited and Power Assets Holdings	State Grid (Chinese Government)
Australian Gas Networks	Cheung Kong Infrastructure Holdings, Cheung Kong Property and Power Assets Holdings	No
DBP	Cheung Kong Infrastructure Holdings, Cheung Kong Property and Power Assets Holdings	No
Multinet Gas	Cheung Kong Infrastructure Holdings, Cheung Kong Property and Power Assets Holdings	No
APA Group	None	No
Ausnet	None	State Grid (Chinese Government)
Victorian Power Networks (Citipower & Powercor)	Cheung Kong Infrastructure Holdings Limited and Power Assets Holdings	No
SA Power Networks	Cheung Kong Infrastructure Holdings Limited and Power Assets Holdings	No
Transgrid	None	NSW Government (99 year lease)
Ergon Energy	None	QLD Government

Source: ERA Analysis

345. In this analysis, the ERA considers the median credit rating of the above samples for the period of 5 years from 2013 to 2017. The results of the analysis are shown in Table 9.

Table 9 Median credit rating approach results

	2013	2014	2015	2016	2017	Number of firms
Sample 1 - All firms	BBB	BBB+	BBB+	BBB+	BBB+	13
Sample 2 - excluding government ownership	BBB	BBB+	BBB+	BBB+	BBB+	7
Sample 3 - excluding government ownership and parent control	BBB	BBB	BBB	BBB	BBB	1

Source: ERA Analysis

346. Sample 1 and 2 produce the same results. The analysis therefore does not exhibit any difference to credit rating on the basis of government ownership. However, this could be an artefact of the small sample sizes involved. Sample 3 produces results one notch lower from 2014 on. This suggests that parent ownership and control may improve credit rating (from BBB in sample 3 to BBB+ in sample 2), but again, this may be an artefact of the small sample sizes. The analysis shows that credit rating has generally been improving over the period with all samples indicating a BBB rating in 2013 and BBB+ credit rating in 2017.

8.2.2 Other regulators decisions

347. Current Australian regulatory decisions on credit ratings are presented in Table 10 below.

Table 10 Credit rating in the Australian regulatory decisions

Regulator	Year	Industry	Credit Rating
AER[113] [114] [115]	2017, 2018	Electricity network	BBB+
AER[116]	2013	Gas Networks	BBB+
ESCOSA[117]	2016	Water, sewerage, stormwater drainage and other services	BBB
QCA[118]	2014	Various	BBB+
IPART[119]	2014	Various	BBB/BBB+

Source: ERA analysis.

[113] AER, *Attachment 3 – Rate of return | Final decision: TasNetworks distribution determination 2017–19,* April 2017, p. 3-130.

[114] The AER's credit rating in its April 2018 final decision on ElectraNet is consistent with that detailed in its draft decision.

AER, *Draft Decision ElectraNet transmission determination 2018 to 2023,* October 2017, p. 3-115.

[115] This benchmark credit rating is the same rating proposed in its 2013 Rate of Return Guidelines.

[116] Australian Energy Regulator, *Rate of Return Guideline,* December 2013, p. 21.

[117] Essential Services Commission of South Australia, *SA Water Regulatory Determination 2016 Final determination*, June 2016, p. 124.

[118] Queensland Competition Authority, *Cost of debt estimation methodology: Final Decision,* August 2014, p. 10.

[119] Independent Pricing and Regulatory Tribunal, *New Approach to Estimating the Cost of Debt: Use of the RBA's Corporate Credit Spreads*, February 2014, p. 3.

348. While some of the analyses were carried out over four years ago, most regulatory credit ratings support the BBB+ rating.

349. The AER also applied the BBB+ credit rating to decisions that were upheld before the Australian Competition Tribunal.[120] [121] [122] The Tribunal has also observed that the more recent years firmly point towards a BBB+ credit rating for the benchmark efficient entity.[123]

350. On the basis of the analysis and cross-checks the ERA determines a benchmark credit rating of BBB+ to be appropriate for application in the cost of debt estimations.

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120 Australian Competition Tribunal, *Applications by Public Interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1*, 26 February 2016, para 993.

121 AusNet Transmission Group Pty Ltd, *Transmission Revenue Review 2017–2022 regulatory proposal*, 30 October 2015, pp. 191, 196.

122 AusNet Transmission Group Pty Ltd, *Transmission Revenue Review 2017–2022 revised regulatory propos*al, 21 September 2016, pp. 137, 167.

123 Australian Competition Tribunal, *Applications by Public Interest Adocacy Centre Ltd and Ausgrid [2016] ACompT 1,* 26 February 2016, para 993.

9 Debt risk premium

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

352. This chapter outlines the ERA's approach to estimating the debt risk premium.

9.1 Approach

353. Estimating the debt risk premium involves the following steps:

- Step 1: Identifying a sample of relevant corporate bonds that reflect the credit rating of the benchmark efficient entity.
- Step 2: Converting the bond yields from the sample into hedged Australian dollar equivalent yields inclusive of Australian swap rates.
- Step 3: Estimating yield curves on this data by applying the Gaussian Kernel, Nelson-Siegel and Nelson-Siegel-Svensson techniques.
- Step 4: Calculating the simple average of their three yield curves' 10-year cost of debt to arrive at a market estimate of the 10-year cost of debt.
- Step 5: Calculating the debt risk premium by subtracting the 10-year interest rate swap rate from the 10-year cost of debt.

354. These steps determine the debt risk premium at a point in time, being the date of calculation. The ERA refers to this method as the 'revised bond yield approach'.

355. To determine the debt risk premium used to calculate the gas rate of return, the ERA constructs a 10-year trailing average debt risk premium. This will consist of a debt risk premium for the current year and a debt risk premium for each of the nine prior years. The 10-year trailing average debt risk premium must be updated each year.[124]

356. The following sections provide more detail on the ERA's methods for identifying the benchmark sample, converting bond yields into hedged Australian dollar equivalent yields, estimating yield curves and constructing the 10-year trailing average.

9.1.1 Identifying the benchmark sample

357. The ERA's revised bond yield approach uses international and domestic bonds – identified by Bloomberg as having Australia as their country of risk – to estimate the cost of debt each year.

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[124] For a worked example of this method, refer to Appendix 4 of the ERA's *Final Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline 2016-2020.* (Economic Regulation Authority, *Final Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline: Appendix 4 Rate of Return*, 30 June 2016.)

358. The ERA will apply the following characteristics to identify international domestic corporate bonds to be included in the benchmark sample:[125]

- the credit rating of each bond must match that of the benchmark efficient entity, as rated by Standard & Poor's (*Chapter 8 – Benchmark credit rating* discusses the credit rating of the benchmark efficient entity);
- time to maturity must be two years or longer;
- issued bonds must have the country of risk specified as Australia,[126] and must be denominated in either AUD, USD, Euros, and GBP (all compliant bonds are included, except those issued by the financial sector);[127]
- the benchmark sample will include both fixed bonds[128] and floating bonds;[129]
- the benchmark sample will include both bullet and callable/puttable redemptions;[130]
- bonds will have at least 50 per cent of observations for the averaging period (that is, 10 yield observations over the required averaging period of 20 trading days are required); and
- the bonds are not called perpetual, a duplicate, or inflation-linked.

359. The averaging period for the debt data series for any given year will also meet the following criteria:

- be specified before the start of the regulatory period;
- be as close as practical to the start of the relevant regulatory year;
- not overlap with any other regulatory year's debt averaging periods; and
- be confidential.

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125 ERA, *Discussion Paper – Measuring the Debt Risk Premium: A Bond Yield Approach*, December 2010, p. 11.

126 Country of risk is based on Bloomberg's method using four factors listed in order of importance; management location, country of primary listing, country of revenue and reporting currency of issuer. This criteria allows for the largest sample of bonds that reflect an Australian risk premium.

127 As classified by Bloomberg Industry Classification System level 1.

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

129 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 (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.

130 A bullet bond is a bond that is not able to be redeemed prior to maturity and whose entire principal value is paid all at once at maturity. A callable (puttable) bond includes a provision in a bond contract that give 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 (puttable) 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).

9.1.2 Converting bond yields to Australian dollar equivalent yields

360. The ERA will estimate the 'spread to swap' for each bond. The relevant basis swap rate is the interest rate swap – of equivalent tenor to the yield to maturity of each bond in the extended benchmark sample – in the denominated currency of each bond. Subtracting this swap rate from the bond yield isolates the credit spread, giving the 'spread to swap' in the denominated currency.

361. The ERA will then convert this denominated currency credit to Australian dollar terms by accounting for hedging costs.[131]

9.1.3 Estimating yield curves

362. The ERA will apply three curve-fitting techniques to the bond yield data to estimate the cost of debt. These are the Gaussian Kernel method, the Nelson-Siegel method and the Nelson-Siegel-Svensson method. These methods are discussed in section 9.2.3.4 of the explanatory statement for the guidelines.

363. The ERA will then average the results of these three methods to arrive at a market estimate of the 10-year cost of debt.

9.1.4 Constructing the 10-year trailing average

364. The estimate of the debt risk premium for each year will be a simple trailing average, as discussed in *Chapter 6 – Return on debt*.

365. The ERA analysis for the 2013 Guidelines indicated that the term at issuance for a benchmark efficient entity is about 10 years.[132] Consequently, the trailing average is constructed over a 10 year period, to ensure consistency with the average term of debt issued by the benchmark efficient entity and its staggered debt portfolio.

366. The ERA began calculating annual debt risk premiums in April 2015, and will use these as inputs when constructing the 10-year trailing average.

367. For calendar years prior to 2015, the ERA will adopt a third party source for debt risk premiums, being the RBA's historical credit spreads for 10-year non-financial corporate bonds.

368. The trailing average debt risk premium over the most recent 10 years will be a simple average of each year's debt risk premium (that is, the calculation will weight each year's debt risk premium at 10 per cent).

369. The ERA will refer to this approach as a 'hybrid trailing average approach', reflecting its use of both the ERA's on-the-day calculations and historical figures from the RBA.

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131 The ERA accounts for the cross-currency basis swap and the interest rate swap, as per the RBA's method, but not the conversion factor. The cross-currency basis swap is generally the most significant hedging cost. See: RBA, 'New Measures of Australian Corporate Credit Spreads', *Bulletin*, December quarter 2013, p. 25.

132 ERA, *Appendices to the Explanatory Statement for the Rate of Return Guidelines*, December 2013, p. 39.

370. The 10-year trailing average debt risk premium will be updated each year by adding in the most recent estimate of the debt risk premium and dropping the estimate from 10 years ago.

371. Hence, the automatic formula for the simple, equally-weighted 10-year trailing average is:

$$TA\ DRP_0 = \frac{\sum_{t=0}^{-9} DRP_t}{10} \qquad \text{(equation 7)}$$

where

$TA\ DRP_0$ is the equally weighted trailing average of the debt risk premium to apply in the following year as the annual update of the estimate used in the current year; and

DRP_t is the debt risk premium estimated for each of the 10 regulatory years t = 0, -1, -2…. , -9.

372. For detailed information on the automatic formula for annually updating the return on debt (which includes updating the debt risk premium), refer to Appendix 2 of the explanatory statement for the guidelines.

9.2 Reasoning

9.2.1 Theoretical considerations

373. The debt risk premium compensates lenders for the additional risk associated with providing debt capital, over and above the risk free rate. The extent of the compensation, or 'credit spread', is closely related to the risk of the business. When issuing debt in the form of bonds, a credit rating can be assigned which reflects the probability of default of the issuer and hence the risk present in the bond. *Chapter 8 – Benchmark credit rating* discusses the credit rating of the benchmark efficient entity.

374. The debt risk premium for the benchmark efficient firm is estimated by first observing the credit spread on bonds with equivalent credit ratings to that of the benchmark firm. The yield of corporate bonds reflects the discount rate of the cash flows arising from the purchase of a bond and as a consequence reflects the promised return of the bond. Because cash flows are constrained by the promised coupons and face value, the promised yield can be directly observed via the traded price of the bond[133] and is quoted by financial services such as Bloomberg.

[133] By setting the price of the bond equal to the promised cash flows of the bond and solving for the discount rate.

375. As these bonds carry a risk of non-payment, it is possible that these cash flows will not be realised in the event of default. As a consequence, the stated yield to maturity is the maximum possible yield to maturity that can be realised by the purchase of the bond and not the true expected return. In order to produce an unbiased estimate of the expected return for a bond, estimates of the expected losses due to default are required.[134] Therefore, observing the yield of corporate bonds for the purposes of estimating the debt risk premium is conservative. The ERA considers that the observed yields on existing bonds in the market are the best proxy for the cost of debt of the benchmark efficient entity, as they reflect the upper bound of the market's expected return.

376. A benchmark sample of corporate bonds is intended to capture the characteristics of the benchmark firm because the firms in the sample have the same credit rating assigned by an international rating agency such as S&P. Therefore, the corporate bonds in the sample have a similar level of risk to that faced by the benchmark efficient entity and thus have the same level of expected return. The benchmark sample of bonds will reflect the prevailing market conditions for funds of the benchmark efficient entity, consistent with market expectations. As a consequence, any method used to estimate the debt risk premium must first rely on a sample of corporate bonds with a similar degree of risk.

377. Credit rating agencies such as S&P and Moody's explicitly take economy-wide and company specific factors into account when assigning credit ratings to debt securities. For example, S&P determines the credit rating by evaluating the business risk (qualitative assessment) and financial risk (quantitative assessment) faced by holders of debt securities. Table 11 presents the S&P risk profile used to determine the credit rating for a particular business.

Table 11 Standard and Poor's Risk Profile Matrix

Business Risk Profile	Financial Risk Profile					
	Minimal	Modest	Intermediate	Significant	Aggressive	Highly Leveraged
Excellent	AAA	AA	A	A-	BBB	-
Strong	AA	A	A-	BBB	BB	BB-
Satisfactory	A-	BBB+	BBB	BB+	BB-	B+
Fair	-	BBB-	BB+	BB	BB-	B
Weak	-	-	BB	BB-	B+	B-
Vulnerable	-	-	-	B+	B	CCC+

Source: S&P

378. S&P considers a broad list of factors in its assessment of financial risk, including accounting, financial governance and policies/risk tolerance, cash flow adequacy, capital structure/asset protection and liquidity/short-term factors. Its assessment also incorporates business risk factors, including country risk, industry risk, competitive position and profitability/peer group comparisons.[135]

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134 Cooper I.A. & Davydenko S.A, *Using Yield Spreads to Estimate Expected Returns on Debt and Equity*, London Business School, February 2003.

135 S&P Ratings Services, *Methodology: Business Risk/Financial Risk Matrix Expanded*, 18 September 2012, p. 3.

379. Assigning a credit rating to a debt security of a business involves an independent assessment made by an independent rating agency. This process considers both qualitative and quantitative statements that reflect the likely risk of holding a debt security. Therefore, bonds with the same credit rating have a similar probability of default and therefore similar level of risk. As a result, the credit rating is the most appropriate measure for determining the efficient financing costs incurred by a benchmark efficient entity with a similar degree of risk.

9.2.2 Methods adopted by other regulators for estimating the debt risk premium

380. The generally-accepted approach to estimating the return on debt involves estimating a debt risk premium, which is added to the estimate of the risk free rate. The main components used to estimate the return on debt are:

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

381. Australian and overseas economic regulators have frequently adopted this method for determining the cost of debt. For example, the New Zealand Commerce Commission (NZCC) estimates an average debt premium.[136]

382. However, alternative approaches to estimating the cost of debt have also been adopted by regulators.

- The AER estimates the return on debt by reference to independent third party data series from the RBA and Bloomberg. The AER does not directly estimate a debt risk premium.
- Ofgem estimates the cost of debt directly from a sample of corporate bonds (without separately identifying the risk free rate or debt risk premium).

383. Table 12 shows recent Australian regulatory approaches to estimating the debt risk premium.

[136] New Zealand Commerce Commission, *Gas Distribution Services Input Methodologies Determination 2012,* Consolidated 3 April 2018, p. 64.

Table 12 Estimating the Debt Risk Premium and cost of debt in Australian regulatory decisions

Regulator	Year	Industry	Cost of Debt Approach
AER[137] [138] [139]	2017, 2018	Gas and electricity	Average of the BBB-rated Bloomberg and RBA curves
ERA[140] [141]	2016, 2018	Gas and electricity	Revised bond yield approach
ESCOSA[142]	2016	Water, sewerage, stormwater drainage and other services	RBA bond yield curve
ACCC[143]	2015	Fixed Line Services (Telecommunications)	Average of the A-rated BVAL and RBA curves
IPART[144]	2014	Various	RBA bond yield curve
QCA[145]	2014	Various	PwC econometric approach

Source: Compiled by the ERA

384. The AER has used RBA data and Bloomberg Valuation Service (BVAL) data to estimate the cost of debt. It defined the benchmark bond as a 10-year corporate bond with a BBB+ credit rating. It measured the cost of debt by taking a simple average of the RBA broad-BBB rated 10-year curve, extrapolated to an effective term of 10 years and the BVAL broad-BBB rated curve. The BVAL curve depends on the maximum term published at the time – being either the 10-year estimate where it is available, the 7-year estimate extrapolated to a 10-year term or the 5-year estimate extrapolated to a 10-year term.[146]

137 AER, *Rate of Return Guideline,* December 2013*,* p. 21.

138 AER, *Attachment 3 – Rate of return | Final decision: TasNetworks distribution determination 2017–19,* April 2017, p. 3-354.

139 The AER's approach to cost of debt in its April 2018 final decision on ElectraNet is consistent with that detailed in its draft decision.

AER, *Draft Decision ElectraNet transmission determination 2018 to 2023,* October 2017, p. 3-11.

140 ERA, *Final Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline 2016 – 2020: Appendix 4 Rate of Return*, 2016, p. 148.

141 ERA, *Draft Decision on Proposed Revisions to the Access Arrangement for the Western Power Network – Appendix 5 Return on Regulated Capital Base*, May 2018, p. 50.

142 Essential Services Commission of South Australia, *SA Water Regulatory Determination 2016 Final determination*, June 2016, p.

143 Australian Competition and Consumer Commission, *Public inquiry into final access determinations for fixed line services – Final Decision*, October 2015, p. 66.

144 Independent Pricing and Regulatory Tribunal, *WACC - IPART's New Approach to Estimating the Cost of Debt*, April 2014, pp. 1-2.

145 Queensland Competition Authority, *Cost of debt estimation methodology: final decision,* August 2014, pp. 2-10.

146 AER, *Attachment 3 – Rate of return | Final decision: TasNetworks distribution determination 2017–19,* April 2017, p. 3-354.

385. In its final access determination for fixed line services, the ACCC also used a simple average of BVAL and RBA bond yield data to estimate the cost of debt. For this decision, the ACCC used curves for A-rated instruments.[147]

386. The Essential Services Commission of South Australia has used RBA bond yield data for corporate bonds in the range BBB- to BBB+ (that is, the broad-BBB rated curve), noting that this data extends back far enough in time to construct a 10-year trailing average.[148] The IPART also relies wholly on RBA bond yield data to estimate the debt risk premium, having moved to this approach in 2014.[149]

387. The QCA considered the merits of various third-party data providers in its 2014 review of methods to estimate the cost of debt, but decided in favour of using an in-house econometric approach developed by PricewaterhouseCoopers. The QCA uses BVAL and RBA estimates as a crosscheck, when applying its econometric approach.[150]

388. Overseas regulators such as NZCC have also adopted a similar approach to the bond yield approach.[151] In NZCC's method, the debt risk premium is calculated as the spread between corporate bonds and New Zealand government bonds. The bid yields to maturity for New Zealand corporate bonds, issued by an electricity or gas distribution business, denominated in New Zealand dollars, publicly traded, and with a remaining maturity of five years, are used. The bid yields for New Zealand government bonds are interpolated for the remaining term to maturity of 5 years.

389. In the United Kingdom, Ofgem has used the real cost of debt calculated directly from iBoxx data, a fixed income benchmark index, which is deflated using the Bank of England's 10-year breakeven inflation index. The iBoxx indices consist of an average of the non-financial sector's broad A and BBB rated corporate bonds.[152]

9.2.3 The revised bond yield approach (estimate of on-the-day debt risk premium)

390. In 2010, the ERA adopted the bond yield approach to estimate the debt risk premium in its regulatory decisions.[153] The bond yield approach constructs a sample of bonds with the same credit rating as that of the benchmark efficient entity. From this sample, the debt risk premium is estimated for each bond from its observed yields and then weighted.

147 Australian Competition and Consumer Commission, *Public inquiry into final access determinations for fixed line services – Final Decision*, October 2015, p. 66.

148 Essential Services Commission of South Australia, *SA Water Regulatory Rate of Return 2016-2020: Final Report to the Treasurer*, March 2015, p. 34.

149 Independent Pricing and Regulatory Tribunal, *WACC - IPART's New Approach to Estimating the Cost of Debt*, April 2014, pp. 1-2.

150 Queensland Competition Authority, *Cost of debt estimation methodology: final decision,* August 2014, pp. 2-10.

151 New Zealand Commerce Commission, *Gas Distribution Service Input Methodologies Determination 2012* (including all amendments as of 28 February 2017), 28 February 2017, pp. 222-224.

152 Ofgem, *Guide to the RIIO-ED1 electricity distribution price control: guide*, 18 January 2017, p. 60.

153 ERA, *Final Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline*, 31 October 2011, p. 158.

391. In 2015, the ERA reviewed its bond yield approach and augmented it to allow:

- the estimation of a yield curve[154]; and
- the inclusion of Australian bonds denominated in foreign currencies (USD, EUR and GBP).

392. The ERA refers to this approach as 'the revised bond yield approach' in its guidelines and in its decisions. The revised bond yield approach:

- is transparent, because the sample of bonds underlying the bond yield approach estimates is published;
- provides flexibility in sampling bonds within particular credit rating bands;
- directly addresses the issue of the effective tenor of the RBA corporate credit spread estimates being less than 10 years; and
- is more robust to anomalous market yields by virtue of using 20 to 40 days of yield observations instead of using methods based on one day of observations.

9.2.3.1 The benchmark sample

393. A bond price (or its observed yield) is determined by the markets, not by the companies or the regulators.[155] Therefore, relying on market data will provide the best means of estimating the proxy for the cost of debt. This means that observed bond yields play a fundamental role in the method of estimation.

394. Market relevance is also important, as it takes account of the fact that new bond issuers consider the prevailing market conditions prior to the issuance of the bonds. In particular, issuers will consider issuing longer-term bonds in a 'normal' market situation, whereas shorter-term bonds may be more appropriately issued during very unstable market conditions. As a result, the observed yields of bonds currently traded in the market will reflect the nature of the prevailing market conditions prior to the issuance of the bonds.

395. Many Australian corporate bonds are denominated in foreign currencies.[156] Furthermore, overseas markets have assumed greater importance for the longer end of the yield curve.

396. As long as the majority of bond issuances of the various markets and currencies can be captured, then the associated outcomes are 'market relevant' and ideally should be included in the benchmark sample.

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154 ERA, *Final decision on proposed revisions to the access arrangement for the Dampier to Bunbury Natural Gas Pipeline 2016 – 2020: Appendix 4 Rate of Return*, 30 June 2016, p. 144.

155 ERA, *Measuring the debt risk premium: bond-yield approach*, 30 November 2010.

156 RBA, *New Measures of Australian Corporate Credit Spreads, Bulletin*, December quarter 2013, p. 17.

397. The decision to issue bonds in the Australian or overseas financial markets lies with businesses. There may be a cost advantage in issuing bonds overseas taking into account all possible risks associated with the process such as exchange rate risk. Alternatively, it may be more convenient to issue longer-term bonds and/or bonds with larger amounts at issuance in overseas markets given the Australian financial market is generally considered a smaller market in comparison with the US, European and UK markets.

398. Consequently, Australian corporate bonds denominated in selected foreign currencies should be included in the benchmark sample, given the changing nature of debt markets and the clear trend to foreign issuance. Doing so will increase the sample size of the benchmark sample, which leads to a more robust estimate of the debt risk premium. The ERA will include Australian bonds denominated in USD, Euros and GBP in the benchmark sample under its revised bond yield approach.

399. Further, it is standard practice to exclude firms operating in the financial sector, because these firms have a different capital structure.[157]

400. The revised bond yield approach criteria are outlined in Table 13.

Table 13 Bonds in sample with country of risk of Australia

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

Source: Bloomberg and ERA analysis

401. The country of risk criterion ensures that yields and credit spreads estimated on the bonds issued are reflective of risks primarily linked to economic and financial market conditions in Australia.

402. Perpetual, inflation-linked and called instruments are excluded. This is because these instruments appear infrequently in sampling and require additional complexity in calculating yields that are comparable to those of the other instruments. The additional benefit of including such instruments does not justify the additional complexity of including them.

403. Duplicate issues such as those that are reported by Bloomberg as both privately placed and publically issued are excluded to avoid double counting their yields in the sample.

[157] The ERA notes that the RBA estimates exclude financial sector bonds.

9.2.3.2 Converting bond yields to Australian dollar equivalents

404. The ERA's approach for conversion into Australian dollar equivalents does not require estimates of a conversion factor, as it uses Bloomberg Swap Manager facilities directly.[158] This approach is transparent and replicable - anyone with access to a Bloomberg terminal can get the same hedged Australian dollar equivalent yield for any given bond, provided they use the same date, currency, payment frequency and deal type.

9.2.3.3 Data availability and the averaging period

405. It is necessary to agree the averaging period applying to the estimator for the prevailing risk free rate and the annual trailing average debt risk premium estimates just prior to each regulatory year.

406. As discussed in *Chapter 7 – Risk free rate of return*, the ERA has adopted an averaging period of 20 trading days.[159]

407. Given the lack of pricing data on the Australian corporate bond market, the ERA employs a criterion that removes bonds that contain less than 50 per cent of observations over the averaging period.[160] Requiring bonds to have 100 per cent observed yields during the sample period significantly reduces the number of bonds in the benchmark sample. Given the ERA's adoption of a 20-day averaging period, the ERA requires each bond to have at least 10 days of pricing data in this 20 trading day averaging period in order to be included in the benchmark sample. This maximises the number of bonds available in the benchmark sample.

9.2.3.4 Curve-fitting techniques

408. There are different curve fitting techniques that could be used to estimate the cost of debt tenors beyond five years. However, the following three techniques are widely used:

- the Gaussian Kernel method;
- the Nelson-Siegel method; and
- the Nelson-Siegel-Svensson method.

409. A simple average of these three techniques provides a robust approach, improving the validity of the yield estimates. Each of the techniques is described below.

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158 A detailed explanation of the ERA's process for converting foreign currency yields into Australian dollar equivalents can be found in Appendix 5 of the ERA's *Final Decision on the Proposed Revision to the Access Arrangement for the Mid West and South West Gas Distribution System*. (ERA, *Final Decision on Proposed Revisions to the Access Arrangement for the Mid-West and South-West Gas Distribution System: Appendix 5 Converting Foreign Currency Yields into Australian Dollar Equivalents*, 30 June 2015.)

159 ERA, *Final decision on proposed revisions to the access arrangement for the Dampier to Bunbury Natural Gas Pipeline 2016 – 2020: Appendix 4 Rate of Return*, 30 June 2015, p. 216.

160 ERA, *Final decision on proposed revisions to the access arrangement for Western Power*, 2012.

Gaussian Kernel method

410. The ERA implements the Gaussian Kernel method in accordance with the December 2013 RBA Bulletin article, 'New Measures of Australian Corporate Credit spreads'.[161]

411. The Gaussian Kernel method assigns a weight to every observation in the bond sample – informed by the distance of the observation's residual maturity from the target tenor – according to a Gaussian (normal) distribution centred at the target tenor.[162] This method recognises that the observed spreads on bonds with residual maturities close to the target tenor contain more information about the underlying spread at that tenor than spreads on bonds with residual maturities further away.

412. For the ERA's Gaussian Kernel estimates, bond issue amounts expressed in foreign currencies are converted to Australian dollar amounts before being applied as weights in the Gaussian Kernel estimates.[163] Consequently, where a bond is issued in a foreign currency the weighting in the Gaussian Kernel estimates uses the principal amount converted into an Australian dollar amount. The currency conversion uses the closing exchange rate on the date of the bond's issue.

413. Formally, the Gaussian Kernel average credit spread estimator $S(T)$ at target tenor T (say, 5 years) for a given broad rating (say, BBB-rated bonds) and date is given by (equation 8):

(equation 8)

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

where

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

S_i is the observed spread on the i^{th} bond in the sub-sample of N bonds with the given broad rating; and

σ *(sigma),* which is measured in years, controls the weight assigned to the spread of each observation based on the distance between that bond's residual maturity and the target tenor. Sigma is the standard deviation of the normal distribution used to assign the weights. It determines the effective width of the window of residual maturities used in the estimator, with a larger effective window producing smoother estimates.

161 RBA, *New Measures of Australian Corporate Credit Spreads*, *Bulletin*, December quarter 2013.

162 RBA, *New Measures of Australian Corporate Credit Spreads*, *Bulletin*, December quarter 2013, p. 20.

163 ATCO Gas Australia, *Response to the Authority's Draft Decision on required amendments to the Access Arrangement for the Mid-West and South-West Gas Distribution System*, 27 November 2014, Appendix 9.2, p. 72.

414. The weighting function is as follows in (equation 9).

(equation 9)

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

where

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

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

415. The Gaussian Kernel may then be defined as below in (equation 10).

(equation 10)

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

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

Nelson-Siegel method

417. The Nelson-Siegel method assumes that the term structure of the yield curve has the parametric form shown in (equation 11):

(equation 11)

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

where

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

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

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

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

Nelson-Siegel-Svensson method

420. The parametric form of the Nelson-Siegel-Svensson curve used by the ERA is that specified in Svensson's 1994 paper.[164] The notation for this parametric form is shown in (equation 12).

$$\hat{y}_t(\tau) = \beta_{0t} + \beta_{1t}\frac{1-e^{-\tau/\lambda_1}}{\tau/\lambda_1} + \beta_{2t}\left[\frac{1-e^{-\tau/\lambda_1}}{\tau/\lambda_1} - e^{-\tau/\lambda_1}\right] + \beta_{3t}\left[\frac{1-e^{-\tau/\lambda_2}}{\tau/\lambda_2} - e^{-\tau/\lambda_2}\right] \quad \text{(equation 12)}$$

where

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

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

421. The Nelson-Siegel-Svensson method is estimated in the same way as the Nelson-Siegel method, except it uses a different parametric form.

9.2.4 Estimates of the annual debt risk premia prior to the current on-the-day estimate

9.2.4.1 Source for prior-year estimates of the debt risk premia

422. The trailing average approach requires annual estimates of the debt risk premium for nine past years to combine with the current ERA forward-looking annual debt risk premium estimate.

423. As annually updated trailing averages of the debt risk premium are now in place for the Gas Distribution System, the Goldfields Gas Pipeline and the Dampier Bunbury Natural Gas Pipeline, the past year estimates have already be determined.

424. These past year estimates are from two sources:

- past ERA revised bond yield estimates (for years from 2015 when data was available to allow required calculation); and
- RBA estimate (for years prior to 2015).

425. A third-party source for debt risk premia estimates for the past years has been incorporated into the initial trailing average used to determine the rate of return.

426. Various sources have been considered for debt risk premium estimates for the past years, including the RBA's credit spread estimates, Bloomberg's FVC estimates and Bloomberg Valuation Service (BVAL) estimates.[165]

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

165 ERA, *Final Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline: Appendix 4 Rate of Return*, 30 June 2016, p. 164.

427. The BVAL series is unsuitable because it does not go back past 2010.

428. The Bloomberg FVC does not include foreign bonds, which is inconsistent with the ERA's preferred approach.

429. The RBA data is available over a sufficient period and includes foreign bonds. A further advantage of the RBA data is the smaller extrapolation that is generally required (commonly between one and two years), as opposed to the three or more for the Bloomberg FVC (which only goes to tenors of seven years in more recent periods).

430. Hence, the RBA series is fit-for-purpose for estimating past debt risk premium returns. Over time, the historic RBA estimates will be progressively replaced in the trailing average by the ERA's own forward-looking estimates.

431. Past estimates of debt risk premium, be it past ERA revised bond yield estimates or RBA estimates, will not be recalculated. For example, changes to the benchmark credit rating will only effect the estimate of the ERA's current on-the-day debt risk premium estimate and the past nine annual debt risk premium estimates will not be recalculated.

9.2.4.2 Estimating the RBA debt risk premium

432. The Gaussian Kernel method used by the RBA for estimating the return on debt results in the effective tenor of the debt risk premium estimates varying between years, depending on the sample of bonds and their relative weighting in the estimate. In recent times, the actual effective tenor of the estimates has been less than the specified tenor of 10 years.

433. The ERA has overcome this problem in its own estimates by extrapolating the Gaussian Kernel estimates out to a 10-year term.

434. To be as consistent as possible, the ERA has adjusted the RBA estimates from their effective tenors to be the targeted 10-year tenor.

435. The method follows the simple extension technique laid out by Lally.[166] It uses the slope of the yield curve between the two observed tenors (say the effective 7 and 10-year tenor spread to swap estimates or '7e' and '10e' tenors respectively) to linearly extrapolate the spread to swap at an exact 10-year tenor.

436. The formula used by the ERA is analogous to that set out by Lally as follows:[167]

[166] M. Lally, *Implementation Issues for the Cost of Debt*, 20 November 2014, p. 38. The Authority notes that DBP proposed a comparable method (DBP, Proposed Revisions DBNGP Access Arrangement 2016 – 2020 Regulatory Period Rate of Return Supporting Submission: 12, p. 23).

[167] M. Lally, *Implementation Issues for the Cost of Debt*, 20 November 2014, p. 39.

$$RBA(10) = RBA(10e) + Base(10) - Base(10e) + \left[\frac{DRP(10e) - DRP(7e)}{10e - 7e}\right] \times (10 - 10e)$$

(equation 13)

where

$RBA(10) = Base(10) + DRP(10)$;

$DRP(10) = RBA(10e) - Base(10e) + \left[\frac{DRP(10e) - DRP(7e)}{10e - 7e}\right] \times (10 - 10e)$; and

$DRP(10) = DRP(10e) + \left[\frac{DRP(10e) - DRP(7e)}{10e - 7e}\right] \times (10 - 10e)$.

437. The ERA also interpolates the monthly RBA estimates to daily estimates. The formula for achieving this step is shown in (equation 13):

$$y_t = yield_{start} + \left(\frac{yield_{end} - yield_{start}}{Date_{end} - Date_{start}}\right) x\ (t - Date_{start})$$

(equation 13)

where

y_t is the interpolated yield for any given date t;

$yield_{start}$ is the first available yield in any given month;

$yield_{end}$ is the last available yield in any given month;

$Date_{start}$ is the date when first yield was available;

$Date_{end}$ is the date when the last available yield is available; and

t is the date for which the yield is being interpolated.

438. The ERA also annualises the RBA resulting annual data, as the RBA estimates may be generally interpreted as semi-annual rates. To do this, RBA basis point estimates are converted to percentage point numbers and then annualised:

Effective annual rate = 100 (1 + yield in basis points/100/2)^2 – 100* (equation 14)

9.2.4.3 Estimating the 10-year trailing average debt risk premium

439. The trailing average estimate of the debt risk premium would weight the past 10 years of estimates of the annual debt risk premium, consistent with the average term of debt issued by the benchmark efficient entity and its staggered debt portfolio.[168]

440. The resulting 10-year trailing average should be updated annually, adding in the most recent estimate of the debt risk premium, according to its weight, and dropping the estimate from 10 years ago. This replicates the cost of debt for the benchmark efficient entity under a strategy whereby it rolls over 10 per cent of its debt each year.

441. The weights for a simple hybrid trailing average debt risk premium estimate should be 10 per cent for each year's estimate of the debt risk premium over the most recent relevant 10 years.

442. The benchmark efficient entity can then replicate a simple 10-year trailing average by issuing one tenth of its debt each year. While a simplification of likely practice, this would closely replicate the cost of debt under the observed financing strategies of benchmark efficient entities.

[168] Analysis in the Rate of Return Guidelines supported a term at issuance for the benchmark efficient entity of around 10 years. (ERA, *Appendices to the Explanatory Statement for the Rate of Return Guidelines: Meeting the Requirements of the National Gas Rules*, December 2013, p. 39).

10 Return on equity

443. The return on equity is equal to the return that investors require from a firm to compensate them for the risk they take by investing their capital.

444. National Gas Rule 87(7) states that regulators must have regard to the prevailing conditions in the market for equity funds when estimating the return on equity.

445. At the same time, under National Gas Rule 87(5), regulators must have regard for relevant estimation methods, financial models, market data, and other evidence.

446. Overarching these requirements, National Gas Rule 87(3) requires regulators to achieve the allowed rate of return objective.

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

448. Instead, regulators use models to estimate the forward-looking return on equity – one that is sufficient to provide regulated firms with reasonable opportunity to recoup their prevailing equity financing costs. Generally, these models seek to explain the required return on equity through a relationship with some 'portfolio' of risk factors, or else in terms of the present value of the expected stream of future cash flows.

449. In this chapter the ERA sets out its approach to estimating the return on equity.

10.1 Approach

10.1.1 Models of the return on equity

450. To date, Australian regulators have used the Sharpe-Lintner Capital Asset Pricing Model (**CAPM**) to quantify the return on equity and associated risk.

451. The previous National Gas Rules specifically referred to this variant of the CAPM as being an example of a 'well accepted' financial model.[169]

452. Other asset pricing models in the CAPM family build on the standard Sharpe-Lintner CAPM, and include:

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

[169] Other regulators, such as Ofgem in the United Kingdom and the New Zealand Commerce Commission have adopted the Sharpe-Lintner CAPM as the prime means to estimate the return on equity. Ofgem, for example, elected in 2010 to continue the use of the Sharpe Lintner CAPM under its 'RIIO' regime as the main model for determining the return on equity (Ofgem 2010, Regulating energy networks for the future: RPI-X@20 Recommendations: Implementing Sustainable Network Regulation, www.ofgem.gov.uk, p.130).

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

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

454. In addition, there are approaches that are not based on modelling *per se*, but rather on available data from a range of comparators or analysts' reports. These include:

- estimated market returns on comparable businesses; and
- brokers' reports and the Dividend Yield approach.

455. The ERA has reviewed these asset pricing approaches, in terms of their ability to contribute to the achievement of the allowed rate of return objective, and considers that only the Sharpe-Lintner CAPM model is relevant for informing the estimation of the prevailing return on equity for the regulated firm.

456. The Sharpe-Lintner CAPM remains the dominant asset pricing model used to estimate the return on equity.

10.1.2 Estimating the return on equity

457. The ERA will determine a single point estimate for the return on equity using Sharpe-Lintner CAPM.

$$R_i = R_f + \beta_i \left(R_m - R_f \right) \qquad \text{(equation 15)}$$

where

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

R_f is the risk free rate;

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

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

458. Where there are multiple relevant estimation methods, financial models, market data and other evidence informing the return on equity, then the ERA will first combine these to form a range and will determine a point estimate.

459. To estimate the return on equity the ERA will separately estimate:

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

460. The on-the-day estimate of the risk free rate will be based on the observed yield of a 5-year term Commonwealth Government Security, averaged over a 20-day period just prior to the regulatory period (see *Chapter 7 – Risk free rate of return*). The 20-day period will be nominated by the service provider in advance of the ERA's final decision. As it is set once, this rate will apply in each year of the regulatory period. The 5-year term reflects the present value principle that the term of debt should match the length of the regulatory period, which is 5 years.

461. The equity beta will be derived through the methods set out in Henry's advice to the Australian Competition and Consumer Commission in 2009 to define the equity beta estimation approach.[170] Henry's study was updated in 2014, but remained essentially unchanged (see *Chapter 12 – Equity beta)*.[171] The equity beta will remain fixed for the period of the guidelines.

462. The ERA is considering different approaches to determine the market risk premium for the current regulatory framework and under a binding rate of return framework, in the event it is introduced (see *Chapter 11 – Market risk premium*).

463. National Gas Rule 87(5)(a) directs the ERA to have regard to relevant estimation methods, financial models, market data and other evidence. Any methods, models, market data, or other evidence used by the ERA must meet this requirement, while also meeting the broader requirements of the National Gas Law and National Gas Rules.

10.1.3 Theoretical considerations

464. The estimate of the rate of return on equity is forward-looking, since investors make investments based on their expectations of the stream of net cash flows that those investments will generate over the future period.

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

[171] O. Henry, *Estimating beta: An update*, April 2014.

465. The equity investor is principally concerned with the risks relating to the expected future stream of net cash flows. If an investor could expect to achieve the same return elsewhere at lower risk, then it would be irrational to invest in the regulated asset, as the expected present value would be lower than for the alternative investment. The efficient rate of return should just compensate the investor for the additional risk of holding the asset, over and above the risk free asset. This is the key insight of the Markowitz portfolio theory, as well as of the CAPM.[172]

10.1.3.1 Ex ante expected returns versus ex post outcomes

466. The fundamental purpose of using asset pricing models for regulatory decisions is to ensure that the allowed rate of return objective and the other requirements of National Gas Rule 87 are met.

467. The return on equity needs to be commensurate with the efficient financing costs of the benchmark efficient entity, allowing for the degree of risk involved.[173]

468. The regulator must consider the prevailing conditions in the market for equity funds,[174] which implies that the return on equity must reflect the return investors require to invest in the asset over the regulatory period.

469. Realised returns (actual returns) may differ from expected returns (required returns). When equity prices are in equilibrium in the market, the required return is equal to the expected return. However, there is no guarantee that expectations will be realised, or that prices are always in equilibrium.[175] If there were a guarantee that expectations would be realised, then the asset would have no risk.[176] This view is expressed well by Davis:[177]

> The required returns are also referred to as expected returns by financial economists by relying on an assumption that asset prices equilibrate in efficient markets through supply and demand influences. If, given the current price of an asset, investors' expectations about future cash flows or future market value of that asset imply an expected return different to their required return, they will buy or sell that asset causing its price to adjust until it equates expected and required returns. Thus, the theories are simultaneously theories of equilibrium asset prices and *required* and *expected* returns. The theories do not purport to fully explain actual returns, since these can differ from expected returns due to a variety of factors including news about future cash flows which cause investors to reassess the appropriate price of an asset. If actual returns are a poor proxy for expected returns, the ability of a theory of *expected* returns to explain *actual* returns may be limited.

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172 R. Brealey and S. Myers, *Principles of Corporate Finance*, McGraw Hill, 1996, p. 173.

173 NGR 87(3).

174 NGR 87(7).

175 G. Partington and S. Satchell, *Report to the ERA: The Cost of Equity and Asset Pricing Models*, May 2016, p. 6.

176 G. Partington and S. Satchell, *Report to the ERA: The Cost of Equity and Asset Pricing Models*, May 2016, p. 7.

177 K. Davis, *Cost of equity issues: a report for the AER*, January 2011, p. 3.

10.1.3.2 Systematic and non-systematic risks

470. Not all risks will be compensated in the return on equity.

471. Only those risks that are systematic are 'priced'. Specifically, the exposure of the asset to systematic risks will drive the covariance of the return of the specific asset to the variance of the returns on the overall market for securities.

472. Non-systematic or idiosyncratic risks for the return on equity may be diversified away by the investor. Where idiosyncratic risks influence the variance of the expected returns to the asset, then this may be exactly offset through holding other assets in the efficient market portfolio with corresponding offsetting risk and variance.

473. In addition, models of the return on equity tend to assume that systematic risks are symmetric, providing equal chance of out-performance as under-performance. As a consequence, risks that are not symmetric may be unpriced.

474. Where asymmetric systematic risks can be established, there may be a case to provide explicit recompense for these identified risks in the cash flows (see *Chapter 4 – The benchmark efficient entity*).

10.1.3.3 Risk and the benchmark efficient entity

475. Estimates of the return on equity need to be based on the expected returns of securities with similar risks, as the actual risks of the underlying assets of any firm are rarely observable.[178]

476. Provided that the risks of the underlying asset and the observed securities are similar, then the observed returns on equity from those securities should reflect the opportunity costs of investing in the underlying assets.

477. In this context, the National Gas Rules 87(3) allowed rate of return objective refers explicitly to the need for the benchmark efficient entity to have 'a similar degree of risk as that which applies to the service provider in respect of the provision of the reference services'. As noted in *Chapter 4 – The benchmark efficient entity*, the ERA interprets a 'similar' degree of risk as allowing for reasonable differences in the degree of risk among firms informing the benchmark, which recognises the significant uncertainties in the risks and the associated confidence intervals.

10.1.3.4 Prevailing conditions

478. The National Gas Rules require the regulator to consider prevailing conditions for the return on equity.[179]

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178 M. McKenzie and G. Partington, *Risk, Asset Pricing and the WACC*, Report to the AER, 2013, p. 6.

179 NGR 87(7).

479. McKenzie and Partington succinctly capture the rationale for the need to consider prevailing conditions:[180]

> In principle then, what we first need to do is to measure the risk of the investment. We then discount the expected future cash flows from the investment at the current equilibrium expected return in the capital market, for securities with the investment's level of risk. The word 'current' is important here. In any required return calculation we should be using current values because if capital markets are efficient current values [they] contain the best information available on future values. In particular historic values for the rate of return on equity, or interest rates, are not relevant except to the extent that they help us estimate the current rates. Since current interest rates are readily observable, historic interest rates typically have no place in determining the required rate of return. If the current interest rates differ from historic rates then there will have been windfall gains or losses that are already reflected in the current value of equity.

480. The ERA will estimate the prevailing return on equity that compensates investors for holding securities with similar risk of return as the regulated asset. In what follows the ERA considers the tools that may be used to establish estimates for the prevailing rate of return on equity.

10.1.4 Models of the return on equity

481. Australian regulators use the Sharpe-Lintner Capital Asset Pricing Model (**CAPM**) to quantify the return on equity.

482. The previous National Gas Rules specifically referred to this variant of the CAPM as being an example of a well accepted financial model.[181]

483. Other asset pricing models in the CAPM family build on the standard Sharpe-Lintner CAPM, including:

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

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

- the Arbitrage Pricing Theory family of models;
- the Fama-French Three-Factor Model and its extensions;
- the Dividend Growth Model family (both single-stage and multi-stage);
- the Residual Income Model;

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180 M. McKenzie and G. Partington, *Risk, Asset Pricing and the WACC*, Report to the AER, 2013, p. 6.

181 Other regulators, such as Ofgem in the United Kingdom and the New Zealand Commerce Commission have adopted the Sharpe-Lintner CAPM as the prime means to estimate the return on equity. Ofgem, for example, elected in 2010 to continue the use of the Sharpe-Lintner CAPM under its 'RIIO' regime as the main model for determining the return on equity (Ofgem 2010, *Regulating energy networks for the future: RPI-X@20 Recommendations: Implementing Sustainable Network Regulation*, p. 130).

- Market Premium approaches; and
- the Build-up Method.

485. In addition, there are approaches that are not based on modelling per se, but rather on available data from a range of comparators or analysts' reports. These include:

- estimated market returns on comparable businesses; and
- brokers' reports and the Dividend Yield approach.

486. The ERA reviewed each of these approaches when developing the Guidelines in 2013[182] and concluded only the Sharpe-Lintner CAPM model was relevant for informing the ERA's estimation of the prevailing return on equity for the regulated firm.

487. The ERA views that the Sharpe-Lintner CAPM model continues to remain relevant to for the estimation of return on equity.

488. As noted by the AER, the Sharpe-Lintner CAPM remains the dominant asset pricing model used to estimate firms' cost of capital.[183]

489. In 2016, the Australian Competition Tribunal found that the AER had not erred in applying the Sharpe-Lintner CAPM.[184]

490. In making its case for the use of the Sharpe-Lintner CAPM, the AER has pointed out that it:[185]

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

491. Other models and approaches are not relevant within the Australian context at the current time, in the absence of new developments in terms of the theoretical foundations or empirical evidence.

492. The ERA will give full weight to the Sharpe-Lintner CAPM when estimating the return on equity.

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182 ERA, *Appendices to the Explanatory Statement for the Rate of Return Guidelines* - Appendix 8 – Evaluation of models for the return on equity, 16 December 2013.

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

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

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

493. It is unlikely that there will be significant new developments over the course of the life of these Guidelines; consequently, the ERA expects to be able to rely on these Guidelines in making its decisions until the Guidelines are again reviewed. However, the ERA recognises that there may be further development of models or empirical support in the future. In such an event, the ERA will review its position when it next reviews the Guidelines.

10.1.5 Estimation of individual Sharpe-Lintner CAPM parameters

494. The ERA's 2013 Guidelines has previously detailed a five step approach to estimating a single point estimate for the return on equity.[186]

495. This previous approach was developed as a framework to:

- deal with multiple relevant estimation methods, financial models, market data and other evidence informing the return on equity;
- allowed estimates to be derived as ranges and for the determination of a single point estimate for input to relevant estimation methods and models; and
- allow the ERA to give weight to each piece of information according to its merits.

496. For the purposes of the 2018 guidelines, and in place of the five step approach, the ERA will separately detail the approach to estimating each of the CAPM parameters.

497. A high level summary of the ERA's approach is provided below with more detail provided in respective chapters.

498. The on-the-day estimate of the risk free rate will be based on the observed yield of a 5-year term Commonwealth Government Security, averaged over a 20-day period just prior to the regulatory period (see *Chapter 7 – Risk free rate of return*). The 20-day period will be nominated by the service provider in advance of the ERA's final decision. As it is set once, this rate will apply in each year of the regulatory period. The 5-year term reflects the present value principle that the term of debt should match the length of the regulatory period, which is 5 years.

499. The equity beta will be derived through the methods set out in Henry's advice to the Australian Competition and Consumer Commission in 2009 to define the equity beta estimation approach.[187] Henry's study was updated in 2014, but remained essentially unchanged (see *Chapter 12 – Equity beta)*.[188] The equity beta will remain fixed for the period of the guidelines.

500. The ERA is considering different approaches to determine the market risk premium for the current regulatory framework and under a binding rate of return framework, in the event it is introduced (see *Chapter 11 – Market risk premium*).

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186 ERA, *Explanatory Statement for the Rate of Return*, 16 December 2013, p. 127

187 O, Henry, *Estimation Beta: Advice Submitted to the Australian Competition and Consumer Commission*, 2009.

188 O. Henry, *Estimating beta: An update*, April 2014.

11 Market risk premium

502. The ERA uses the Sharpe-Lintner CAPM to estimate the return on equity (as explained in *Chapter 10 – Return on equity*). The market risk premium is a major component of the estimate of the required rate of return on equity.

503. The market risk premium reflects the difference between two components: the nominal risk free rate and the market return on equity. The market risk premium can be defined as the realised return on the market portfolio above the prevailing risk free rate.

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

505. The market risk premium cannot be directly observed. In order to set the return on equity, the market risk premium needs to be estimated for a future time period. The ERA's forward looking market risk premium is estimated over a five-year period, consistent with the term of the regulatory period.

506. This chapter discusses how the market risk premium is to be estimated.

11.1 Approach

507. The ERA's estimation of the market risk premium has in the past involved a level of regulatory discretion.

508. For the purposes of setting the guidelines and future binding instrument, the ERA is considering how best to set a market risk premium under the current regulatory framework and, if implemented, under the proposed binding rate of return framework.

509. The level of discretion applied under the current framework will be informed by matters considered for the adoption of a binding framework.

11.1.1 Under current regulatory framework

510. Under the current regulatory framework the ERA will determine an estimate of the market risk premium through the use of the historic market premium, the dividend growth model and other conditional variables. This will involve a level of regulatory discretion.

511. The ERA will estimate the market risk premium at each determination.

512. Under this approach:

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

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

- The ERA is to determine a final point estimate of the market risk premium by using its regulatory judgement considering the relative merits of all relevant material, including conditioning variables:

  – the default spreads;

  – the five-year interest rate swap spread;

  – dividend yields;

  – a stock market volatility index; and

  – the debt risk premium.

513. The level of discretion applied under the current framework will be informed by matters considered for the adoption of a binding framework.

11.1.2 Under binding regulatory framework

514. In the event that a binding rate of return framework is introduced the ERA is considering, and seeking stakeholder comment, on three options to determine the market risk premium for the binding instrument. These options remove regulatory discretion over the period that the binding instrument is in place.

515. These options include:

- initial regulatory discretion and then fixed for the period;

- a mechanical approach; and

- a historic approach.

11.1.2.1 Initial regulatory discretion and then fixed for the period

516. This method would be based on the same approach as proposed under the current regulatory framework, detailed above. This method allows regulatory discretion in the determination of a market risk premium.

517. However, the market risk premium would be calculated once and remain fixed over the period of the binding instrument.

11.1.2.2 Mechanical approach

518. This method would use a mechanical approach that applies a fixed weight to the historic market premium and the dividend growth model.

519. The market risk premium would be calculated at each determination.

11.1.2.3 Historic approach

520. This method would solely use the historic market premium to estimate the market risk premium.

521. The market risk premium would be calculated once and remain fixed over the period of the binding instrument.

11.1.3 Historic market premium

522. The ERA places more reliance on the historic market premium to estimate the market risk premium, relative to the dividend growth model.

523. The historic market premium is the average realised return that stocks have earned in excess of the five-year government bond rate. This historic market premium can be directly measured.

524. While not forward looking, the historic approach has been used to estimate the forward looking market risk premium as past outcomes contribute to investors' forward expectations.

525. The main historic market premium approach is that established by Ibbotson. This approach has been widely accepted.

526. The ERA's method to calculate the historic market premium is summarised below.

- Arithmetic and geometric averages of the historic market premium observations are calculated using the Brailsford, Handley and Maheswaran (**BHM**) and NERA Economic Consulting (**NERA**) datasets.
- Six overlapping time periods (1883-2017, 1937-2017, 1958-2017, 1980-2017, 1988-2017 and 2000-2017) are used for averaging periods, to reflect different economic conditions.
- A simple average of the lowest arithmetic and highest geometric means of the produced historic market premium matrix is then used to estimate the lower bound of the historic market premium.

11.1.4 Dividend growth model

527. The ERA places less reliance on the dividend growth model to estimate the market risk premium, relative to the historic market premium.

528. The dividend growth model method examines the forecast future dividends of businesses and estimates the return on equity that makes these dividends consistent with the market valuation of those businesses.

529. The ERA will use the two-stage dividend growth model to estimate the market risk premium.

11.2 Reasoning

11.2.1 Overview of the market risk premium

530. The market risk premium consists of two components: the nominal risk free rate and the market return on equity.

531. The market risk premium is generally calculated as follows:

$$MRP = E(R_M) - R_f \quad \text{(equation 16)}$$

where:

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

R_f is the risk free rate of return.

532. The market risk premium is commonly defined, in both finance and academic literature, as the realised return the market portfolio makes above the prevailing risk free rate.

533. Table 14 summarises the recent history of estimates of the value of market risk premiums by Australian regulators.

Table 14 Estimating the Market Risk Premium in Australian regulatory decisions

Regulator	Year	Industry	MRP (%)
AER[189]	2018	Electricity network	6.5%
ERA[190]	2018	Electricity	6.2%
QCA[191]	2018	Various	5.36%
IPART[192]	2018	Various	6.0%
AER[193]	2017	Gas distribution network	6.5%
ERA[194] [195]	2016	Gas transmission	7.4%
ESCOSA[196]	2016	Water, sewerage, stormwater drainage and other services	6.0%
ACCC[197]	2015	Fixed Line Services (Telecommunications)	6.0%
QCA[198]	2014	Various	6.5%

Source: Compiled by the ERA

11.2.2 Theoretical considerations

534. The market risk premium cannot be directly observed, unlike other market-based parameters such as the risk free rate and debt risk premium. Rather, the market risk premium is a forward-looking concept that is subject to high levels of uncertainty in the short term.

535. The ERA is required to estimate the market risk premium for a time period. As the return on equity will be set over a regulatory period and represents the forward looking return required by equity investors for that period, the forward looking market risk premium is estimated over a period of 5 years. This period is consistent with the term for the risk free rate.

189 The AER's terms in its April 2018 final decision on ElectraNet was consistent with that detailed in its draft decision. AER, *Draft Decision ElectraNet transmission determination 2018 to 2023,* October 2017, p. 3-42.

190 ERA, *Draft Decision on Proposed Revisions to the Access Arrangement for the Western Power Network – Appendix 5 Return on Regulated Capital Base*, May 2018, p. 45.

191 The 3 year term aligns with the length of the regulatory period for Seqwater.

Queensland Competition Authority, *Seqwater Bulk Water Price Review 2018-21,* March 2018, p. 62.

192 Using the IPART's 10 year estimate.

Independent Pricing and Regulatory Tribunal, *WACC Biannual Update*, February 2018, p. 2.

193 AER, *Attachment 3 – Rate of return | Final decision: TasNetworks distribution determination 2017–19,* April 2017, p. 3-47.

194 ERA, *Final Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline 2016 – 2020: Appendix 4 Rate of Return*, 2016, p. 189.

195 ERA, *Final Decision on Proposed Revisions to the Access Arrangement for the Goldfields Gas Pipeline*, 2016, p. 298.

196 Essential Services Commission of South Australia, *SA Water Regulatory Determination 2016 Final determination*, June 2016, p. 124.

197 Australian Competition and Consumer Commission, *Public inquiry into final access determinations for fixed line services – Final Decision*, October 2015, p. 66.

198 Queensland Competition Authority, *Final decision – Cost of capital: market parameters*, August 2014, p. iv.

536. Market risk premium estimation methods can be classified as either historic based or forward looking. Historic based methods use actual returns as a proxy for future returns. Forwarding looking methods use forecasts, current market variables and predictions to estimate future returns.

537. The two main methods commonly used to estimate the market risk premium are the historic market premium and the dividend growth model.

538. Stakeholders, at varying times, have also recommended the Wright approach. The Wright approach is discussed in more detail below.

539. Any method used to estimate the market risk premium will make an implicit assumption regarding the relationship that exists between the market risk premium and risk free rate. There are three theoretical conditions that may exist: (i) a negative relationship; (ii) no relationship; and (iii) a positive relationship. Underlying this is the question of whether the return on equity is implied to be stable and how this affects the market risk premium under the Sharpe-Lintner CAPM.

540. In developing the 2013 Guidelines, the ERA undertook a review of theoretical considerations that underpin the market risk premium, and the empirical and academic evidence for a relationship between the market risk premium and the risk free rate.[199]

11.2.2.1 Historic market premium

541. The historic market premium approach is a historic based method. It uses realised returns from market data in order to calculate a historic average of returns above a determined risk free rate.

542. Much previous regulatory practice has implicitly assumed that no relationship exists between the risk free rate and market risk premium, and therefore a long-term average market premium is the most appropriate method for a forward-looking estimate of the market risk premium. The historical risk premium approach assumes a constant expected risk premium; any change in the risk free rate results in a one-for-one change in the return on equity.

543. The historic risk premium approach is based on the assumption that – given a sufficient amount of time – the market return on equity will revert to a long-run historical average. This implies that the long-run historical average is a good forecast of the market return on equity, despite the short-term fluctuations around the average.[200]

544. In contrast, forward-looking approaches like the dividend growth model approach implicitly assume a negative relationship between the market risk premium and the risk free rate. In other words, at any one point in time, it assumes that the market cost of equity never changes over time, which implies that any change in the risk free rate is perfectly offset by an opposite change in the market risk premium.

[199] ERA, *Appendices to the Explanatory Statement for the Rate of Return Guidelines: Meeting the requirements of the National Gas Rules*, 16 December 2013, p. 137-147; and appendices referred to therein.

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

11.2.2.2 Wright approach

545. The Wright approach is an alternative specification of the Sharpe-Lintner CAPM. Stakeholders in the past have suggested the Wright approach is a forward looking method.

546. In the Wright approach the market risk premium is not an individual parameter, rather it is defined as the difference between the return on equity estimate and the prevailing risk free rate.

547. The relevance of the Wright approach is dependent on whether there is an inverse relationship between the market risk premium and the risk free rate.

548. To inform the 2013 Guidelines, the ERA conducted statistical analysis of the long run average market return on equity, the yield on bonds and the market risk premium to confirm the appropriateness of the Wright approach.[201]

549. The ERA analysis used the Dickey Fuller statistical test to test for a random walk and therefore draw conclusions on the stationarity of the long-term data. The results:

- found the market return on equity is stationary (not a random walk);
- found that yields on bills and bonds are non-stationary (a random walk);
- found mixed evidence on a stationary market risk premium, with it probably being non-stationary (a random walk); and
- provided empirical support for the Wright approach in establishing an upper bound of a market risk premium range.

550. This analysis informed the ERA's position on the Wright approach for subsequent market risk premium decisions made by the ERA.

551. The ERA has considered a Partington and Satchell review of the ERA's statistical analysis.[202] Partington and Satchell's analysis found the following.

- There is concern with solely testing for a random walk to establish non-stationarity. Following a random walk is not the only notion of non-stationarity. For example, a process of market evolution will not meet the criteria of a random walk but will be non-stationary.
- There is concern with the finding that yields on bills and bonds are non-stationary. The non-stationary result may have been the result of very high inflation from 1973 to 1986. Had the analysis used real yields, the results may have been stationary.
- The analysis may have been better done on levels of prices rather than on returns. Partington and Satchell note that, except in very unusual circumstances, returns are stationary. Prices better behave like random walks. Therefore it is better to test the linear combinations of random walk variables and whether they are co-integrated (that is, the resulting error term being stationary).
- The ERA analysis did not support the Wright approach.

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

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

552. Partington and Satchell advised the AER they are unconvinced by the Wright approach for estimating the market risk premium and recommended it be given little weight. The Wright CAPM has no "well accepted theoretical support", "does not seem to be much used, if at all, in practice", and "runs contrary to the well accepted view that asset prices are inversely related to interest rates". [203]

553. Most recently, Partington and Satchell have expressed concern regarding the use of the Wright model in the estimation of the market risk premium.

> We feel that the Wright approach has no support based on any clear evidence in the Australian context.[204]

554. Furthermore, the AER has stated that it does "not agree with the underlying premise of the Wright CAPM that there is a clear inverse relationship between movements in the risk free rate and market risk premium. Consequently, we place limited reliance on the Wright approach."[205]

555. Based on the above information, the ERA considers that there exists theoretical and empirical concerns with the Wright approach.

556. The ERA will not consider the Wright approach when estimating the market risk premium.

11.2.2.3 Dividend growth model

557. The dividend growth model is considered a forward looking method to estimate the market risk premium. The dividend growth model method examines the forecast future dividends of businesses and estimates the return on equity that makes these dividends consistent with the market valuation of those businesses.

558. The dividend growth model uses forecast dividend growth, forecast future growth rates, current share prices and historical returns on equity in order to estimate the market risk premium.

559. The dividend growth model method has the benefit of being forward looking and takes the current economic outlook into account through dividend growth expectations, but it is unreliable on its own.[206]

560. McKenzie and Partington note the sensitivity of the model to assumptions and input values:[207]

> Clearly valuation model estimates are sensitive to the assumed growth rate and a major challenge with valuation models is determining the long run expected growth rate. There is no consensus on this rate and all sorts of assumptions are used: the growth rate in GDP; the inflation rate; the interest rate; and so on. A potential error in forming long run growth estimates is to forget that this growth in part comes about because of injections

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

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

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

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

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

> of new equity capital by shareholders. Without allowing for this injection of capital, growth rates will be overstated and in the Gordon model this leads to an overestimate of the MRP.

561. In its evaluation of the dividend growth model the ERA has considered all available information, which includes new information not available at the time of its Dampier to Bunbury Natural Gas Pipeline decision. This new information includes the April 2017 Partington and Satchell report on estimation of the return on equity which reviewed the role of the dividend growth model in estimating the market risk premium.[208]

562. The Partington and Satchell report considered the appropriateness of:

- the dividend growth model in estimating the market risk premium; and
- applying an equal weighting to the dividend growth model and historical excess returns.

563. The Partington and Satchell report raises a range of concerns with the dividend growth model, including:

- the sensitivity of the dividend growth model to its assumptions;
- that forecasts of future earnings and dividends are fairly inaccurate over more than two years;
- that the dividend growth model is subject to upward bias from the smoothed or sticky nature of dividends;[209] and
- that biases in analysts' forecasts can lead to a biased dividend growth model forecast of the market risk premium.

564. Partington and Satchell report that despite the dividend growth model consistently giving numbers above 7 per cent for a predicted market risk premium since the 2013 guidelines, the market risk premium is more likely to be below the long run average than above it.[210]

565. In summary, Partington and Satchell found that:

> Due to the foregoing considerations and other weaknesses of the DGM, on which we have previously commented extensively, see for example Partington and Satchell (2016 pages 25 to 29), we think it very unlikely that the DGM will produce a forward looking MRP commensurate with the prevailing conditions in the market for funds.[211]

566. Given the concerns with the dividend growth model it was unclear to Partington and Satchell that it is appropriate to apply equal weights to the historic market risk and the dividend growth model.[212]

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[208] Partington and Satchell, *Report to the AER: Discussion of Estimates of the Return on Equity*, April 2017.

[209] The sticky nature of dividends can create a disconnect between assumptions where slowly changing dividends may not appropriately correspond with rapidly changing share prices. In addition, dividends are particularly sticky downwards as opposed to upwards, which creates an asymmetry in effects

[210] Partington and Satchell, *Report to the AER: Discussion of Estimates of the Return on Equity*, April 2017, pp. 16-19.

[211] Partington and Satchell, *Report to the AER: Discussion of Estimates of the Return on Equity*, April 2017, p. 25.

[212] Partington and Satchell, *Report to the AER: Discussion of Estimates of the Return on Equity*, April 2017, p. 27.

567. The ERA considers that the dividend growth model also has the following weaknesses.

- There is no clear agreement among experts as to the best form for the dividend growth model, or its input assumptions.
- Forecasts of earnings and dividends are inaccurate and are likely to be upwardly biased.
- The dividend growth model is likely to be upwardly biased due to current low interest rates. Experts have advised that with low interest rates, as currently experienced, the dividend growth model can produce upwardly biased results due to the sensitivity of the model. [213]
- The dividend growth model estimates provide a single discount rate, which equates the present value of the future infinite dividend stream with the observed share price. The estimate therefore looks out beyond the five year period for which the ERA is seeking to estimate the market risk premium. If a lower nominal Gross Domestic Product estimate is expected than used in the model – say for the two years beyond the three actual dividend growth rate forecasts incorporated in the model – then the estimates of the dividend growth model should be lower than that reported here. The implications would be that the 5-year forward looking market risk premium would also be lower.

568. There are concerns with the reliability of the dividend growth model, its suitability for the regulatory task and the manner that a regulator takes it into account when exercising discretionary judgement.[214]

569. In the past, the ERA took the mid-point between the historic estimate and the dividend growth model as a starting point for its evaluation of the market risk premium.

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

571. On the basis of available information, the ERA will place less reliance on the dividend growth model, relative to the historic market premium.

11.2.3 Estimating the market risk premium

572. The following sections discuss the calculation of the market risk premium under the two different approaches.

[213] Lally, *Review of the AER's proposed dividend growth model*, December 2013, pp. 11–12.

[214] AER, *Final decision: TasNetworks distribution determination 2017-19, Attachment 3 – Rate of return*, April 2017, p. 3-80.

11.2.3.1 Historic market risk premium estimate

573. The ERA will determine the historic market premium estimate using the Ibbotson approach.

574. The Ibbotson approach is a well-accepted method for calculating the market premium using historical data. It calculates the averages of a series of annual market premium observations. The market premium is calculated for each calendar year spanning back over the longest period of time for which data is available. There are annual Australian market premium observations dating back to 1883. These observations are derived by deducting the risk free rate in each calendar year from the realised market return on equity in that year. The arithmetic average of these observations is typically employed, but the geometric average is also often quoted.

The robustness of historical risk premium approaches

575. In their 2012 study, Dimson, Marsh and Staunton concluded that the historical average approach on equity risk premium remains the most relevant approach for estimating the market risk premium as there are no better forecasting methods available.[215] The authors argued that there are good reasons to expect that the equity premium varies over time. Market volatility clearly fluctuates and investors' risk aversion also varies over time. However, these effects are likely to be brief. Sharply lower (or higher) stock prices may have an effect on immediate returns, but the effect on long-term performance will be diluted. Moreover, volatility does not usually stay at abnormally high levels for long and investor sentiment is also mean reverting. For practical purposes, the authors conclude that for forecasting the long-run equity premium, it is hard to improve on extrapolation from the longest history that is available at the time the forecast is being made.

576. However, there is also evidence indicating that estimates of the market risk premium using historical data on equity risk premia are biased. For example, McKenzie and Partington[216] and Damodoran[217] are of the view that an estimate of the market risk premium using an historical average of the equity risk premium is likely to overestimate the true expectation due to the presence of survivorship bias. In this method of deriving an estimate for the market risk premium, a national stock exchange index is used as a proxy for the equity market return. For example, in Australia, a proxy for the equity market return is the Australian All Ordinaries Index. Stocks with consistently negative returns that are no longer in the market have been excluded from the Australian All Ordinaries Index.

577. Siegel (1999) considers that historical equity returns are likely to overstate returns actually realised because of early market limitations including historically high transaction costs and the historical lack of low cost opportunities for diversification.[218] The implication is that the long-term forward-looking market risk premium is expected to be lower over time relative to the historical estimate.

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215 Dimson, Marsh and Staunton, *Credit Suisse Global Investment Returns Sourcebook 2012*, February 2012, p. 37.

216 McKenzie, M. and Partington, G., *Equity market risk premium*, 21 December 2011, pp. 6–7.

217 Damodoran, A. *Equity risk premiums: determinants, estimation and implications—the 2012 edition,* March 2012, p. 24.

218 Lally, M., *Cost of equity and the MRP*, July 2012, p. 8.

578. Brailsford, Handley and Maheswaran (**BHM**) note that for the purposes of asset valuation in Australia, historical estimates of the market risk premium have been used. Using a more comprehensive data set than previous studies, they found estimates that were substantially lower. They attributed this to lower estimated stock returns prior to 1958 and to a lower extent higher debt returns prior to 1960.[219]

579. The ERA is also aware that well-regarded financial services providers such as Credit Suisse and Duff and Phelps provide risk premium reports based on historical averages of equity risk premium data.[220] This information indicates that investors are likely to place some weight on historical information on equity risk premiums to form their expected market risk premium. Therefore, historical estimates of the mean of the market premium provide relevant evidence for any forward-looking market risk premium in the Australian context.

Data sources for historical risk premium approaches

580. The Ibbotson approach uses historical market premium data to calculate the market risk premium.

581. BHM have produced the furthest backdated source of historical equity risk premium data for Australia. BHM's data series is, in part, based on a series constructed by Lamberton and the Sydney Stock Exchange (SSE, now the ASX).[221] BHM investigated the Lamberton/SSE data and confirmed with the SSE/ASX had previously adjusted the data set by a factor of 0.75[222] to account for a probable upward bias since it consisted of unweighted yields and excluded non-dividend paying shares.[223] BHM considered this adjustment was appropriate.[224]

582. It is important to note that the adjustment originated with the SSE/ASX and was not one that BHM took upon itself to make. Nevertheless, the adjustment has been the subject of some controversy.

583. In 2013 NERA Consulting (**NERA**) raised concerns about the possibility of a downward bias in some of the older data observations in this dataset and produced an adjusted version of the BHM data.[225]

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219 Brailsford, Handley and Maheswaran, *Re-examination of the Historical Equity Risk Premium in Australia*, *Accounting and Finance*, 2008, vol.48, p. 95.

220 See Duff and Phelps, *Risk Premium Report,* 2013*,* available at: www.duffandphelps.com/expertise/publications/pages/ResearchReportsDetail.aspx?itemid=89
and *Credit Suisse Global Investment Returns Year Book*, 2012, available at:
www.credit-suisse.com/investment_banking/doc/cs_global_investment_returns_yearbook.pdf

221 Brailsford, Handley, Maheswaran, 'Re-examination of the historical equity risk premium in Australia', *Accounting and Finance*, Vol. 48, 2008, pp. 78-79.

222 Brailsford, Handley, Maheswaran, 'Re-examination of the historical equity risk premium in Australia', *Accounting and Finance*, Vol. 48, 2008, p. 80.

223 Brailsford, Handley, Maheswaran, 'Re-examination of the historical equity risk premium in Australia', *Accounting and Finance*, Vol. 48, 2008, p. 79.

224 Brailsford, Handley, Maheswaran, 'Re-examination of the historical equity risk premium in Australia', *Accounting and Finance*, Vol. 48, 2008, p. 81.

225 NERA, *The market size and value premiums*, June 2013.

584. Professor Handley has since responded to concerns about the BHM data by highlighting shortcomings in NERA's adjusted series,[226] which NERA disputes.[227] NERA has also expressed concern about the credibility of the SSE/ASX's adjustment used in BHM's original study.[228]

585. HoustonKemp has recently argued that the ERA should solely use the NERA adjustments and refrain from using the BHM adjustments (and so refrain from using the BHM data prior to 1958).[229] HoustonKemp refers to a NERA June 2015 report. [230]

586. The AER has reviewed the underlying datasets and the June 2015 NERA report. The SA Power Networks final decision describes how there are more concerns with pre-1958 data than those that NERA attempts to address with its adjustment and this creates a problem for any dataset.

> Fourth, and arguably most important, the above discussion crystallises the central issue on the consideration of earlier data. That is, there are significant problems with the earlier data, regardless of which adjustment is used. This finding, in part, informs our position to consider different sampling periods.[231]

587. The AER has chosen to continue the sole use of the BHM dataset.

> We do not consider NERA's adjustment, which is based on less than ten data points out of 300, represents a material improvement in reliability. NERA has also not reconciled the data it uses for its adjustment to the data of the original series.[232]

588. The relative merits of the NERA and BHM datasets prior to 1958 are subject to some controversy. There is a significant difference between the NERA and BHM estimates for the period of between 1883 and 1936. After 1936 NERA and BHM produce similar estimates.

589. Given this uncertainty, it is reasonable to use both the BHM and NERA datasets to minimise any error by favouring one source over the other. Placing more weight on one dataset risks introducing bias. Pink Lake Analytics also considered the two data sources and confirmed this approach.

> If the data prior to 1958 are retained then an 'equanimeous' position of weighting the BHM and NERA estimates equally should also be retained, given the data prior to 1958 are uncertain in nature.[233]

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226 Handley, J. C., *Report prepared for the Australian Energy Regulator: Further advice on the return on equity*, April 2015, p. 8.

227 NERA Economic Consulting, *Historical Estimates of the Market Risk Premium*, February 2015, pp. v-vii; NERA, *Further assessment of the historical MRP: Response to the AER's final decisions for the NSW and ACT electricity distributors*, June 2015 – pp. i-iii.

228 NERA Economic Consulting, *Historical Estimates of the Market Risk Premium*, February 2015, p. v.

229 HoustonKemp Economists, A Constructive Review of the ERA's Approach to the MRP, June 2017.

230 NERA, *Further Assessment of the Historical MRP: Response to the AER's Final Decisions for the NSW and ACT Electricity Distributors,* June 2015

231 AER, *Final decision: SA Power Networks determination 2015-16 to 2019-20, Attachment 3 – Rate of Return,* October 2015, p. 3-380.

232 AER, *Final decision: TasNetworks distribution determination 2017-19, Attachment 3 – Rate of return*, April 2017, p. 3-88.

233 Pink Lake Analytics, *Estimation of the Market Risk Premium – A review of weighting of arithmetic and geometric means*, December 2017, p. iv.

590. The ERA will use the average of the NERA and BHM data, thereby minimising any potential error by incorrectly favouring one source over the error.

Tax imputation credit yields

591. Since the introduction of tax imputation credits in 1988, tax imputation credits have affected investor returns.

592. For the purposes of calculating historic market returns, which are required to estimate the market risk premium, it is necessary to adjust market returns to account for the added value of tax imputation credits.

593. For the purposes of calculating the market premium, ERA will assume that:

- dividends are 83 per cent franked with utilisation rate (theta) being 60 per cent between 1988 and 1998; and
- dividend imputation consistent with the ATO data on credit yields from 1998 onward. [234]

Sampling periods

594. The ERA is to use six sampling periods to calculate the market premium. The dates of four of the selected sampling periods (1883, 1937, 1958 and 1980) reflects changes to the quality of the underlying data, while two of the periods reflect changes to the tax system (the introduction of the imputation tax system in 1988 and the GST in 2000).

595. Partington and Satchel have reviewed the sampling period for calculating the market premium and favour using as much information as possible. They considered that there are valid reasons for using multiple sampling periods, including structural breaks in the data and issues of data quality. Partington and Satchel recognised that the more recent sample periods are likely to provide changing information regarding changes to the taxation and current regimes.[235]

596. There are strengths and weaknesses in taking multiple sampling periods, including that:

- longer time series contain more observations and produce a lower statistical error;
- data quality markedly improved in 1937, 1958 and 1980;
- more recent sampling periods reflect the current financial environment; and
- shorter periods are more affected by the current environment or one-off events.

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234 ATO data on credit yields is available from 1998.
ATO, https://www.ato.gov.au/Rates/Company-tax---imputation--average-franking-credit---rebate-yields/

235 Partington and Satchell, *Report to the AER: Analysis of criticism of 2015 determinations*, October 2015, pp. 45–46.
AER, *Final Decision AusNet distribution determination - Attachment 3 - rate of return*, May 2016, p. 62.

597. Based on the above strengths and weakness, and given that no one data period has been assessed as superior, the ERA will use of six overlapping time periods (1883-2017, 1937-2017, 1958-2017, 1980-2017, 1988-2017 and 2000-2017).

> Until one data scenario may be clearly proven superior to another then it is advisable that the Authority retains its compromise strategy of averaging across the five data scenarios.[236]

598. For the guidelines the ERA will use the six sampling periods when estimating the market risk premium.

Averaging method

599. When applying the market premium one must select an appropriate averaging method to apply to historical returns. The ERA has used both the arithmetic and geometric means to calculate the market premium.[237]

600. There are mixed views as to the best averaging technique to apply in estimating the market premium.

601. An arithmetic average will tend to overstate returns, whereas a geometric average will tend to understate them.[238] These biases are empirically significant. As Blume shows, when compounding the arithmetic average over time, it is the sampling error in the measurement of the arithmetic average return that causes the upward bias in the expected return.[239] The geometric average normally gives a downward biased measurement of expected returns.[240] The geometric mean can understate returns as it is based on an ideal consistent compounding, which does not account for the actual variability of returns over time.

602. Academic literature has found that the geometric average is useful in estimating a forward looking market risk premium.[241]

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[236] Pink Lake Analytics, *Estimation of the Market Risk Premium – A review of weighting of arithmetic and geometric means*, December 2017, p. iv.

[237] The arithmetic mean is also called simple average, which is the sum of all numbers in the series divided by the count of all numbers. The arithmetic mean formula is:

$$Arithmetic\ Mean = \frac{\sum_{i=1}^{n} x}{n} = \frac{x_1 + x_2 + \cdots + x_n}{n}$$

The geometric mean is the average of a set of products. The geometric mean formula is:

$$Geometric\ Mean\ = \left(\prod_{i=1}^{n} x\right)^{\frac{1}{n}} = \sqrt[n]{x_1 \cdot x_2 \cdots x_n}$$

When geometric mean works with percentage returns, the formula is altered to reflect the compounding effect, as below:

$$Geometric\ Mean\ for\ \%\ return = \sqrt[n]{(1 + x_1\%) \cdot (1 + x_2\%) \cdots (1 + x_n\%)} - 1$$

[238] Partington and McKenzie, *Return of equity and comment on submissions in relation to JGN*, May 2015, p. 17.

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

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

[241] Damodoran, *Equity Risk Premiums (ERP): Determinants, Estimation and Implications – The 2016 edition*, March 2016, p. 33

JP Morgan, *The Quest for the Market Risk Premium*, May 2008, p.4

603. An unbiased estimate of the market risk premium is likely to be somewhere between the geometric average and the arithmetic average of annual market premium.[242]

604. The ERA has sought to minimise any error with over reliance on one of the two types of average by using the simple average of the lowest arithmetic mean and highest geometric mean.

605. The respective advantages of the two types of averaging methods has also been considered at length in previous AER decisions.[243] Based on this information the AER has reaffirmed that using both averages is the best use of all information available.

606. In its April 2017 TasNetwork decision the AER continues to use both the arithmetic and geometric means, tempered by an understanding of the potential biases in both.[244] [245]

607. The ERA will continue the use of both arithmetic and geometric means.

Estimate of historic market premium

608. The ERA has recognised the biases of both averaging methods. To account for this when estimating the market risk premium the ERA will average:

- the highest of the geometric averages; and
- the lowest of the arithmetic averages.

609. The following table details the ERA's estimates of the market premium.

Table 15 Estimates of the market premium

	Arithmetic			Geometric		
	BHM	NERA	Average	BHM	NERA	Average
1883-2017	6.82%	6.47%	6.65%	5.47%	5.12%	**5.29%**
1937-2017	6.24%	6.29%	6.27%	4.40%	4.45%	4.42%
1958-2017	6.75%	6.75%	6.75%	4.42%	4.42%	4.42%
1980-2017	6.53%	6.53%	6.53%	4.26%	4.26%	4.26%
1988-2017	6.11%	6.11%	**6.11%**	4.50%	4.50%	4.50%
2000-2017	6.13%	6.13%	6.13%	4.32%	4.32%	4.32%

Source: ERA Analysis

610. The ERA takes the average of the lowest arithmetic mean (6.11%) and the highest geometric mean (5.29%) to develop an estimate of the market premium of 5.7%.

[242] McKenzie and Partington, *Supplementary report on the equity MRP*, February 2012, p. 5.

[243] Partington and McKenzie, *Return of equity and comment on submissions in relation to JGN*, May 2015, p. 1.

[244] AER, *Final decision: TasNetworks distribution determination 2017-19, Attachment 3 – Rate of return*, April 2017, p. 3-88.

[245] McKenzie and Partington, *Report to the AER: Supplementary report on the equity MRP*, 22 February 2012 Partington and Satchell, *Report to the AER: Analysis of criticism of 2015 determinations*, October 2015, pp. 44-45.

11.2.3.2 Dividend growth model

611. The ERA's preferred construction of the dividend growth model is the two-stage dividend growth model set out in the DBNGP decision.[246] The two-stage model assumes that dividends grow at the long-term growth rate following the dividend forecast period.

612. The ERA's two-stage dividend growth model uses a point estimate of 4.6 per cent for the long-term growth rate of nominal dividends per share (**DPS**). This rate is informed by the analysis of Lally.[247]

613. The AER also uses the Lally rate of 4.6 per cent in its model and applies an upper (5.1 per cent) and lower (3.86 per cent) sensitivity. The AER has considered the 4.6 per cent a reasonable estimate:

> We consider our estimated long term growth rate of the nominal DPS of 4.6 per cent to be reasonable, if not 'somewhat on the generous side'.[248]

614. The ERA considers the use of a point estimate of 4.6 per cent is a reasonable assumption. There is evidence that the 4.6 per cent growth rate is on the high side.[249]

615. The two-stage dividend growth model provides for a simple and reasonable approach.

- The ERA considers that the three-stage model is an added complication that does not add much value. In addition, as detailed by Partington, there is significant uncertainty around the optimal construction of the three-stage model and its transition pattern for dividends.[250]
- With a growth rate of 4.6 per cent, the two-stage dividend growth model produces slightly higher results than the three-stage model.[251]
- The ERA's lower weight applied to the dividend growth model further decreases the small difference between the two-stage and three-stage models.

616. Most academic literature tends towards the belief that a single well-constructed DGM should provide sufficient information when considered correctly.[252]

617. The ERA estimates the dividend growth model market risk premium at 7.6 per cent.

11.2.3.3 Conditioning variables

618. The ERA's previous approach determined a range for the market risk premium, with a lower and an upper bound.

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[246] ERA, *Final decision on the proposed revisions to the access arrangement for the Dampier to Bunbury Natural Gas Pipeline 2016-2020 – Appendix 4 Rate of Return,* 30 June 2016, p. 115.

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

[248] AER, *AusNet Services determination 2016-20, Attachment 3 – Rate of return,* October 2015, p. 3-328.

[249] Partington, *Report to the AER: Return on equity (Updated)*, April 2015, pp. 26, 53.

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

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

[252] Partington and Satchell, *Report to the AER: Discussion of Estimates of the Return on Equity*, April 2017, pp. 25-26.

619. Conditioning variables are readily available market data which allow the ERA to take into account current market conditions. Conditioning variables should be considered symmetrically through time to avoid bias.

620. The interpretation of conditioning variables is subject to regulatory judgement. Under a binding rate of return framework the use of regulatory judgement is not allowed once the binding instrument is set. Therefore, the use of conditioning variables would only be appropriate to initially set a fixed market risk premium for the period of the guidelines.

621. To determine a point estimate for the market risk premium the ERA used four conditioning variables/forward looking indicators and regulatory discretion.

Default spread

622. The default spread, which is the difference between the five-year yield from the AA Australian Corporate Bloomberg Fair Value Curve and the yield on a five-year Commonwealth Government bond.

623. The default spread will tend to be high during poor economic times. Fama argues that:

> persistent poor times may signal low wealth and higher risks in security returns, both of which can increase expected returns.[253]

624. Therefore, it can be argued that there is a positive relationship between default spreads and the market risk premium.

Interest rate swap spread

625. The five-year interest rate swap spread, which is the difference between the five-year interest rate swap rate and the yield on a five-year Commonwealth Government bond.

626. Similar to the default spread, it is argued that there is a positive relationship between the swap spread and the market risk premium.

Dividend yields

627. The dividend yields on the ASX All Ordinaries Analyst Consensus Dividend Yield. The dividend yield is the ratio of the dividends paid to the stock or portfolio's price.

628. From a dividend growth model, or Gordon growth model, perspective the dividend yield has a positive relationship with the market risk premium.

Implied volatility

629. The implied volatility is the ASX 200 volatility index (VIX).

630. CAPM suggests that a positive relationship exists between the market risk premium and volatility of returns to the market portfolio.

[253] Fama, Efficient Capital Markets: II, Journal of Finance, Vol 46, 1991, p. 1585.

Debt risk premium

631. The ERA is also considering the relevance of the debt risk premium as a conditioning variable.

632. Debt and equity funding are substitutes to a degree. Therefore, it theoretically makes sense that there will be a positive relation between these two sources of funding.

633. The AER has previously used cross-checks that included the comparison of the debt risk premium and the market risk premium.

634. A Tribunal decision suggested that such a comparison between the market risk premium and the debt risk premium was an appropriate and an obvious cross-check, which could provide reasonable evidence for the overall return on equity decision. Such consideration did not tend to suggest that the overall return on equity estimate was too low.[254]

635. Therefore, it can be argued that there is a positive relationship between the debt risk premium and the market risk premium.

11.2.4 Options to determine market risk premium point estimate

636. The ERA's estimation of the market risk premium has in the past involved a level of regulatory discretion.

637. For the purposes of setting the guidelines and future binding instrument, the ERA is considering how best to set a market risk premium under the current regulatory framework and, if implemented, under the proposed binding rate of return framework.

638. The level of discretion applied under the current framework will be informed by matters considered for the adoption of a binding framework.

639. On this basis, the ERA seeks comments on the following options to determine the market risk premium.

11.2.4.1 Under current regulatory framework

640. Under the current regulatory framework the ERA will determine an estimate of the market risk premium through the use of the historic market premium, the dividend growth model and other conditional variables. This will involve a level of regulatory discretion.

641. The ERA will estimate the market risk premium at each determination.

[254] Australian Competition Tribunal, *Applications by PIAC Ltd and AusGrid AComT1*, February 2016, p. 222.

643. Under this approach:

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

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

- The ERA is to determine a final point estimate of the market risk premium by using its regulatory judgement considering the relative merits of all relevant material, including conditioning variables:

  – the default spreads;

  – the five-year interest rate swap spread;

  – dividend yields;

  – a stock market volatility index; and

  – the debt risk premium.

644. The level of discretion applied under the current framework will be informed by matters considered for the adoption of a binding framework.

11.2.4.2 Under binding regulatory framework

645. In the event that a binding rate of return framework is introduced the ERA is considering, and seeking stakeholder comment, on three options to determine the market risk premium for the binding instrument. These options remove regulatory discretion over the period that the binding instrument is in place.

646. These options include:

- initial regulatory discretion and then fixed for the period;

- a mechanical approach; and

- a historic approach.

Initial regulatory discretion and then fixed for the period

647. This option would be based on the same approach as proposed under the current regulatory framework, detailed above. This method allows regulatory discretion in the determination of a market risk premium.

648. However, the market risk premium would be calculated once and remain fixed over the period of the binding instrument.

649. The ERA considers that the market risk premium is fairly stable over time, given the way it is calculated. Therefore the market risk premium would be fairly constant for the four year period that the instrument would be in place.

650. In addition, to avoid the use of regulatory discretion over the period of the binding instrument it would not be possible to use regulatory judgement to interpret conditioning variables and then also use judgement to determine the required adjustment to the estimate of the market risk premium. This further supports fixing the market risk premium over the period of the binding instrument.

651. The ERA considers that fixing the market risk premium is not going to systematically over or under estimate the market risk premium over the four year period of the guidelines.

652. Fixing the market risk premium provides investor certainty. The ERA considers fixing the market risk premium during the binding instrument will promote stability, predictability and consistency of the allowed rate of return consistent with the National Gas Rules.

653. The ERA recognises that there may be some distortions through time. However, distortions to the market are generally short-term events, which do not detract from the fact that a fixed market risk premium provides a reasonable estimate for the market risk premium over the period.

654. An example of a distortion is the global financial crisis. The ERA views that sourcing equity during this period may not necessarily reflect an efficient financing strategy given the potentially high market risk premium. This would tend to be confirmed by network businesses only sourcing limited amounts of equity finance at the peak of the global financial crisis.

655. Should changes to market conditions be ongoing the market risk premium will be updated as part of the review of the next guidelines.

Mechanical approach

656. Under this option the ERA would determine an estimate of the market risk premium through the use of the historic market premium and the dividend growth model.

657. An estimate of the market risk premium would calculated at each determination.

658. Such an approach may be appropriate if the market risk premium varies to a large degree within a four year period.

659. Given the binding rate of return legislation requires the removal of regulatory discretion, a fixed weight would be applied to the historic market premium and dividend growth model.

661. For the reasons detailed above, this weighting would place more reliance on the historic market premium and less reliance on the dividend growth model.

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

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

662. If a mechanical approach to estimate the market risk premium at each determination is to be used, the ERA seeks stakeholder views on what an appropriate weight may be.

Historic approach

663. Under this option the ERA will determine an estimate of the market risk premium through the sole use of the historic market premium.

664. The market risk premium would remain fixed over the period that the binding instrument is in place.

665. Given significant concerns with the dividend growth model it may be appropriate to fully discount the dividend growth model and therefore solely use the historic market premium.

666. As discussed in detail above, the ERA considers that the dividend growth model suffers from various weaknesses that may mean it is not appropriate in this regulatory context.

- There is no clear agreement among experts as to the best form for the dividend growth model, or its sensitivity to input assumptions.
- Forecasts of earnings and dividends are inaccurate and are likely to be upwardly biased.
- The dividend growth model is likely to be upwardly biased due to current low interest rates. Experts have advised that with low interest rates, as currently experienced, the dividend growth model can produce upwardly biased results due to the sensitivity of the model. [255]
- The dividend growth model estimates provide a single discount rate, which equates the present value of the future infinite dividend stream with the observed share price. The estimate therefore looks out beyond the five year period for which the ERA is seeking to estimate the market risk premium.

667. The ERA considers that the market risk premium is fairly stable over time, given the way it is calculated. Therefore the market risk premium would be fairly constant for the four year period that the guidelines would be in place.

[255] Lally, *Review of the AER's proposed dividend growth model*, December 2013, pp. 11–12.

668. Fixing the market risk premium provides investor certainty. The ERA considers fixing the market risk premium during the binding instrument will promote stability, predictability and consistency of the allowed rate of return consistent with the National Gas Rules.

12 Equity beta

669. Equity beta is the 'slope' parameter β_i in the Sharpe-Lintner capital asset pricing model (**CAPM**) model. The slope parameter β_i correlates the return on the specific asset, in excess of the risk free rate of return, to the rise and fall of the return on the market portfolio.

$$R_i = R_f + \beta_i \left(R_m - R_f \right) \qquad \text{(equation 17)}$$

where

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

R_f is the risk free rate;

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

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

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

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

672. Two risk factors are generally considered to impact the value of equity beta for a particular firm: (i) the type of business, and associated capital assets, that the firm operates measured by asset or 'un-levered' beta; and (ii) the amount of financial leverage (gearing) employed by the firm which levers or 'amplifies' asset beta to arrive at equity beta.

12.1 Approach

673. The ERA's 2013 Guidelines relied on the methods set out in Henry's advice to the Australian Competition and Consumer Commission in 2009 to define the equity beta estimation approach.[256] Henry's study was updated in 2014, but remained essentially unchanged.[257]

674. Henry's analysis uses various time periods over which the data for equity beta estimation is observed. This includes the longest available, the post-tech boom excluding the GFC and the last five years.[258]

675. There is a trade-off between relevance of the data and statistical robustness. Longer time periods can include behaviour in the data that is no longer relevant due to changing economic and market conditions. Shorter time periods may produce estimates that are less statistically robust and fail to capture mean-reverting behaviour where values of beta tend to revert to a long run average level.

676. For example, structural breaks can occur where a 'new normal' persists. In these instances a data observation period as short as one year may be preferable because they are reflective of future conditions. However, it is difficult to know this, before the fact. It is possible that deviations from the past may be short term and in the future the data may exhibit reversion to a long term average. In these instances the longest observed time period may be more suitable.

677. The ERA considers that a 5-year period balances these trade-offs whilst being consistent with the regulatory reset period.

678. The ERA's recent analysis, using the updated dataset to 2017, indicates that an equity beta value of 0.7 is appropriate.

679. This equity beta value will be fixed over the period of the guidelines.

12.2 Reasoning

12.2.1 Theoretical considerations

680. Conceptually, the systematic risk of a regulated energy network would be less than the systematic risk of the market average entity, and hence, less than one.

681. There are two main types of systematic risk relevant for conceptual analysis: business risk and financial risk.

- Business risk is affected by the type of business, and associated capital assets, that the firm operates measured by asset or 'un-levered' beta.
- Financial risk is affected by the amount of financial leverage (gearing) employed by the firm which levers or 'amplifies' asset beta.

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

[257] O. Henry, *Estimating beta: An update*, April 2014.

[258] O. Henry, *Estimating beta: An update*, April 2014, p. 4.

682. It is generally agreed that the business activities of regulated businesses have less systematic risk than the average firm (which has an equity beta of one by definition).

683. However, regulated businesses have higher financial leverage than the average firm (given average gearing of 55 per cent for regulated businesses versus gearing of 30 per cent for the average firm). Therefore, some have argued that regulated businesses have higher financial risk.

684. The two effects of business risk and financial risk operate in different directions. Prior to analysis, there is no compelling reason to suggest which of these effects should dominate the other.

685. In the past some regulated businesses and consultants have proposed that the appropriate expectation is that the equity beta for these regulated businesses is no different from that of the average firm, which is one.

686. However, there is some evidence to suggest that higher leverage provides a signal for investors as to the stability of cash flows and the overall viability of the network businesses.[259]

687. The AER's recent assessment of these risks concluded that:

- business risk of the benchmark efficient entity is low, driven for example by monopoly characteristics and the regulatory regime; and
- though leverage may be relatively high for the benchmark efficient entity, this does not necessarily correspond to high financial risk, given the stability of earnings and its ability to service debt.[260]

688. McKenzie and Partington's conceptual analysis also supports the view that the theoretical beta of the benchmark firm is low.[261]

689. Overall, the ERA considers that the lower cash flow risk of regulated businesses results in a lower equity beta compared with the market, even with the observed higher gearing levels.

12.2.2 Estimating equity beta

690. To estimate equity beta the ERA relies on the methods set out in Henry's advice to the Australian Competition and Consumer Commission in 2009 to define the equity beta estimation approach.[262] Henry's study was updated in 2014, but remained essentially unchanged.[263]

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[259] Klein L.S., O'Brien T.J., & Peters S.R., 2002, Debt vs. Equity and Asymmetric Information: A review, *The Financial Review* 37, pp. 317-350.

[260] AER, *Discussion Paper – Equity Beta*, March 2018, pp. 20-23.

[261] MchKenzie and Partington, *Estimation of equity beta*, April 2012, p. 15.

McKenzie Partington, *Report to the AER, Part A: Return on equity*, October 2014, pp. 11-12.

McKenzie Partington, *Report to the AER: Return on equity (Updated)*, April 2015, pp. 31-32.

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

[263] O. Henry, *Estimating beta: An update*, April 2014.

691. The ERA has used data for firms meeting the criteria for a benchmark efficient firm outlined in Chapter 4 on the benchmark efficient entity.

692. Comparable benchmark entities, which are publicly traded and have available data, are chosen. The four available sample companies are APA Group, DUET Group, SP Ausnet and Spark Infrastructure. These are presented in Table 16.

Table 16 Sample of companies and data period from the ERA's 2017 analysis

Name	Bloomberg's ticker	From	To
APA Group	APA	14/12/2001	Going concern
DUET Group	DUE	20/08/2004	5/04/2017
SP Ausnet	AST	23/12/2005	Going concern
Spark Infrastructure Group	SKI	16/12/2005	Going concern
All Ordinaries Index	**AS30**	**4/01/2002**	**Ongoing**

Source: Bloomberg

693. Price data for all stocks is acquired through the Bloomberg Terminal based on the last daily price provided by the Australian Securities Exchange. Dividend data used in the study were gross dividends including cash distributions, but omitting unusual items such as stock distributions and rights offerings.

694. The dividend was then added to the closing price on the Friday after the ex-dividend dates as this is the first day the price would reflect the payout of the dividend in the data. For the All Ordinaries index, which approximates a return for the entire Australian stock market, the gross last dividend per share was used, which includes the net dividend and any tax credit where applicable. No adjustments were made to historical volume in Bloomberg.

695. For the length of the data period, there is a trade-off between relevance of the data and statistical robustness. Longer time periods can include behaviour in the data that is no longer relevant due to changing economic and market conditions. However, shorter time periods may produce estimates that are less statistically robust. The ERA considers that a period of five years balances these trade-offs.

696. Returns in the ERA CAPM regressions are based on continuously compounded returns which is presented in (equation 18) below.

$$r_{i,t} = \ln\left[(p_{i,t-1} + d_{i,t}) / p_{i,t-1}\right] \qquad \text{(equation 18)}$$

where

$r_{i,t}$ is the continuously compounded return for asset i in day t;

p_{it} is the price of asset i in day t; and

d_{it} is the dividend payout to asset i on day t.

697. Henry outlined in his advice to the AER that beta is estimated by applying or 'fitting' the following equation in regression analysis:[264]

$$r_{i,t} = \hat{\alpha}_i + \hat{\beta}_i r_{m,t} + \varepsilon_{i,t} \qquad \text{(equation 19)}$$

where

$\hat{\beta}_i$ is the equity beta for asset i;

r_{it} is the observed raw returns to asset i in year t;

r_{mt} is the observed market returns in year t;

$\hat{\alpha}_i$ is a constant specific to asset i; and

ε_{it} are the residuals.

698. Based on this advice, the ERA has adopted (equation 19) as the basis for empirically estimating equity beta.

699. Henry suggested using the Least Absolute Deviations (**LAD**) estimator, to reduce the influence of outliers on the resulting Ordinary Least Squares (**OLS**) beta estimate.

700. In addition to these methods the ERA has employed: (i) the maximum likelihood robust method (**MM**) and (ii) the Theil-Sen (**T-S**) method. They have been introduced as alternative ways of addressing the influence of outliers on the OLS estimate. This should reduce any bias associated with the exclusive reliance on LAD to overcome the influence of outliers.[265]

701. The MM regression is a form of robust regression that has a high breakdown point (50 per cent) and high statistical efficiency (95 per cent).[266] For this reason, it is adopted by the ERA.

702. Fabozzi suggests the use of the Theil-Sen estimator for estimating the appropriate value for the equity beta in response to the OLS estimator being acutely sensitive to outliers.[267] Fabozzi proposes that outliers in financial data are far more common than is usually assumed and that it is surprising that the Theil-Sen estimator is not more widely used and appreciated. This was one of the main reasons behind the ERA's adoption of the method in its 2013 study.

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264 O. Henry, *Estimation Beta: advice submitted to the Australian Competition and Consumer Commission*, www.accc.gov.au, 2009, p. 2.

265 Detail on the econometric techniques for estimating equity beta can be found in ERA, *Explanatory Statement for the Final Rate of Return Guidelines, Appendix 17*, 16 December 2013.

266 The breakdown point of a regression is the smallest percentage of incorrect observations a regression estimator can tolerate before becoming incorrect. Statistical efficiency refers to minimum variance in an unbiased estimator.

267 Fabozzi, F.J., *Encyclopaedia of Financial Models*, Wiley Publications, 2013, p. 442.

703. The application of the above four methods to calculate beta is consistent with the ERA's 2013 Guidelines. Further details on these methods are in Appendix 17 of the ERA's 2013 Rate of Return Guidelines.[268]

704. All equity betas are de-levered using the sample firm's average gearing ratio over the latest five-year period. These asset betas are then re-levered by the benchmark gearing.

705. De-leveraging involves multiplying the equity beta estimated using (equation 19) by one minus this 5-year average gearing level to arrive at asset or 'de-levered' beta. One minus gearing gives the weight applied to equity. The asset beta is the firm's systematic risk as if it carried no debt.

706. The use of debt (gearing) increases or 'levers up' asset beta. Dividing asset beta by one minus gearing 're-levers' to equity beta.

707. The logic is outlined in the (equation 20) which assumes debt beta is equal to zero.

$$\beta_{asset} = G \; x \; \beta_{debt} + (1-G) \; x \; \beta_{equity}$$

$$\text{Assuming } \beta_{debt} = 0$$

$$\Rightarrow \beta_{asset} = (1-G) \; x \; \beta_{equity} \qquad \text{(equation 20)}$$

$$\Rightarrow \beta_{equity} = \frac{\beta_{asset}}{(1-G)}$$

where

β_{asset}	is asset or 'unlevered' beta;
G	is gearing defined as net debt divided by the sum of net debt plus the market value of equity;
β_{debt}	is debt beta, assumed to be zero; and
β_{equity}	is equity or 'levered' beta.

708. The de-levering and re-levering process is a major factor in determining equity beta. This is because gearing is typically greater than zero and so dividing asset beta by one minus gearing, as shown in the equation above, results in a sizeable multiplication factor. The magnitudes of this multiplication factor are shown in Table 17.

[268] Detail on the econometric techniques for estimating equity beta can be found in ERA, *Explanatory Statement for the Final Rate of Return Guidelines, Appendix 17*, 16 December 2013. All regression results from applying these methods, associated standard errors and test statistics, are computed using R 3.0.2 open source software.

Table 17 Gearing and multiplication factors

Gearing (G)	Multiplication factor [1/(1-G)]
10%	1.11
20%	1.25
30%	1.43
40%	1.67
50%	2.00
60%	2.50
70%	3.33
80%	5.00
90%	10.00
100%	Undefined as dividing by 0

Source: ERA Analysis

709. De-levering out low levels of gearing and re-levering in higher levels of gearing results in higher equity beta estimates. De-levering out high levels of gearing and re-levering in relatively low levels results in lower equity beta estimates. This means any disparity between the benchmark gearing and the average actual gearing observed across firms from which asset beta is estimated can also have a considerable effect on the final equity beta estimate.

710. Asset betas are re-levered using the 55 per cent benchmark gearing level arrived at in Chapter 5 on gearing. This figure is consistent with the overall averages of actual gearing observed across the firms in the benchmark sample and results in a multiplication or re-levering factor of 2.22.

711. The beta estimates are then averaged, using both equal and market-weighted averages, to determine a point estimate. Equally-weighted portfolios simply assign a weight of ¼ to each of the four firms in the benchmark sample. To calculate a value-weighted portfolio the average market capitalisation was calculated for each firm.[269]

712. Thin trading, which introduces a bias in the estimation of β, was found not to be in evidence during the 2013 analysis through a series of Dimson's tests.[270] For this reason thin trading is not addressed here.

713. Table 18 reports estimates of each firm's beta across the different regression methods, with a data set from April 2013 to March 2018. Equally-weighted and value-weighted portfolios are also reported.

[269] For each firm in the portfolio, its weight is determined by the ratio between the average of a single firm and the sum of the averages of all firms in each portfolio in terms of market capitalisation.

[270] ERA, *Explanatory Statement for the Final Rate of Return Guidelines*, 16 December 2013, pp. 176-177. Dimson, E. And P. Marsh (1983) "The stability of UK risk measures and the problem in thin trading", *Journal of Finance*, 38 (3) pp. 753 – 784.

Table 18 Estimates of equity beta for individual firms and the two weighted portfolios in 2018 for different estimation methods

	APA	AST	DUE	SKI	Mean of firms	Equally weighted mean[271]	Value weighted mean	Mean of portfolios	Mean of firms & portfolios
Gearing	0.489	0.564	0.608	0.557	**0.554**	0.554	0.544	**0.549**	**0.553**
OLS	0.883	0.786	0.449	0.662	**0.695**	0.618	0.759	**0.689**	**0.693**
LAD	0.947	0.813	0.423	0.698	**0.720**	0.699	0.804	**0.752**	**0.731**
MM	0.939	0.791	0.458	0.738	**0.732**	0.669	0.807	**0.738**	**0.734**
T-S	0.916	0.775	0.445	0.718	**0.714**	0.650	0.779	**0.714**	**0.714**
Mean of techniques (OLS, LAD, MM, T-S)	**0.921**	**0.791**	**0.444**	**0.704**	**0.715**	**0.659**	**0.787**	**0.723**	**0.718**

714. The OLS beta estimates are lower than that of any of the other robust estimates. The mean OLS beta across all portfolios and stocks produces a beta of 0.693, which compares to the mean of all robust estimates across all portfolios and stocks of 0.718.

715. Bootstrapping is used to assign measures of accuracy to sample estimates. This method relies on random sampling and replacement as outlined in Appendix 23 of 2013 Guidelines.[272]

[271] The equally weighted mean will be different than the mean of firms. The equally weighted mean approach calculates an equally weighted portfolio at each time period, which is then regressed against market returns. While the mean of firms uses the separate firm betas and takes the mean of these four points.

[272] ERA, *Appendices to the Explanatory Statement for the Rate of Return Guidelines: Meeting the requirements of the National Gas Rules*, December 2013, Appendix 23.

Table 19 Summary bootstrap simulated statistics of OLS estimators (B=10,000, n=261)

Model	Estimator	APA	AST	DUE	SKI	Mean of firms	Equally weighted wean	Value weighted mean	Mean of portfolios	Mean of firms & portfolios
OLS	$\hat{\beta}$	0.883	0.786	0.449	0.662	**0.695**	0.618	0.759	**0.689**	**0.693**
	Standard error $\hat{\beta}$	0.098	0.082	0.114	0.107	**0.100**	0.061	0.084	**0.072**	**0.091**
	Bootstrap $\hat{\beta}$	0.884	0.785	0.449	0.662	**0.695**	0.618	0.759	**0.689**	**0.693**
	Bootstrap S.E. $\hat{\beta}$	0.104	0.086	0.109	0.112	**0.102**	0.068	0.090	**0.079**	**0.095**
	Bootstrap bias	0.001	-0.001	0.000	0.000	**0.000**	0.000	0.000	**0.000**	**0.000**
	Bootstrap LB 2.5%	0.674	0.611	0.241	0.434	**0.490**	0.479	0.574	**0.527**	**0.502**
	Bootstrap median	0.885	0.787	0.446	0.666	**0.696**	0.620	0.762	**0.691**	**0.694**
	Bootstrap UB 97.5%	1.081	0.952	0.666	0.872	**0.893**	0.743	0.930	**0.837**	**0.874**

716. All OLS estimates of β were statistically significant at the 5 per cent significance level, as evidenced by the bootstrapped 95 per cent confidence band excluding the value of zero (Table 19). The bootstrapped upper 97.5 per cent confidence bound was 0.893 when averaged across all four assets, and 0.837 for the mean of the portfolios (Table 19).

717. Standard errors were inconsistently estimated for the LAD estimator and cannot be derived by analytical means for the T-S estimator. For the LAD and T-S estimators the bootstrapped standard error is therefore used in drawing inference about β. Bootstrapped standard errors of β for the robust estimators (LAD, MM, T-S) were consistently lower than that of the OLS estimator, to within 0.01 of the OLS estimator, when considering the mean β across both the assets and portfolios.

718. The 97.5 per cent upper bound for the robust estimators was greater than for the OLS estimates (Table 20); the upper bound for the bootstrapped OLS β estimate was 0.874 when averaged across all models, compared to 0.939 for the LAD estimate. MM and T-S estimates for this upper bound lay between the OLS and LAD upper bounds.

719. The robust estimates of β were higher than that of the OLS β estimate when averaged across both the assets and the portfolios. This difference between estimators was more pronounced for the portfolio estimates than for the assets themselves. The key reason for this difference appears to be the weight placed on the APA Group asset: it has both the estimate with the lowest gearing and the highest market capital value (with a weight of 38.4 per cent in the variance weighted portfolio).

Table 20 Summary of bootstrap simulated statistics of robust estimators (B=10,000, n=261)

Model	Estimator	APA	AST	DUE	SKI	Mean of firms	Equally weighted mean	Value weighted mean	Mean of portfolios	Mean of firms & portfolios
LAD	$\hat{\beta}$	0.947	0.813	0.423	0.698	**0.720**	0.699	0.804	**0.752**	**0.731**
	Standard error $\hat{\beta}$ [1]	-	-	-	-	**-**	-	-	**-**	**-**
	Bootstrap $\hat{\beta}$	0.936	0.825	0.474	0.725	**0.740**	0.685	0.802	**0.744**	**0.741**
	Bootstrap S.E. $\hat{\beta}$	0.096	0.093	0.112	0.106	**0.102**	0.076	0.081	**0.079**	**0.094**
	Bootstrap bias	-0.011	0.013	0.051	0.027	**0.020**	-0.014	-0.002	**-0.008**	**0.011**
	Bootstrap LB 2.5%	0.759	0.649	0.263	0.554	**0.556**	0.510	0.636	**0.573**	**0.562**
	Bootstrap median	0.935	0.817	0.452	0.707	**0.727**	0.703	0.807	**0.755**	**0.737**
	Bootstrap UB 97.5%	1.136	1.031	0.718	0.980	**0.966**	0.796	0.970	**0.883**	**0.939**
MM	$\hat{\beta}$	0.939	0.791	0.458	0.738	**0.732**	0.669	0.807	**0.738**	**0.734**
	Standard error $\hat{\beta}$	0.096	0.083	0.087	0.103	**0.092**	0.059	0.081	**0.070**	**0.085**
	Bootstrap $\hat{\beta}$	0.937	0.790	0.461	0.736	**0.731**	0.669	0.806	**0.738**	**0.733**
	Bootstrap S.E. $\hat{\beta}$	0.094	0.087	0.094	0.096	**0.093**	0.057	0.081	**0.069**	**0.085**
	Bootstrap bias	-0.002	-0.001	0.002	-0.002	**-0.001**	0.000	-0.001	**0.000**	**-0.001**
	Bootstrap LB 2.5%	0.748	0.62	0.273	0.546	**0.547**	0.557	0.642	**0.600**	**0.564**
	Bootstrap median	0.939	0.790	0.462	0.736	**0.732**	0.669	0.808	**0.738**	**0.734**
	Bootstrap UB 97.5%	1.113	0.957	0.645	0.925	**0.910**	0.779	0.962	**0.870**	**0.897**

Table 21 Summary of bootstrap simulated statistics of robust estimators (B=10,000, n=261) (Continued)

Model	Estimator	APA	AST	DUE	SKI	Mean of firms	Equally weighted mean	Value weighted mean	Mean of portfolios	Mean of firms & portfolios
T-S	$\hat{\beta}$	0.916	0.775	0.445	0.718	**0.714**	0.650	0.779	**0.714**	**0.714**
	Standard error $\hat{\beta}$ [1]	-	-	-	-	**-**	-	-	**-**	**-**
	Bootstrap $\hat{\beta}$	0.912	0.775	0.447	0.718	**0.713**	0.649	0.778	**0.714**	**0.713**
	Bootstrap S.E. $\hat{\beta}$	0.099	0.086	0.097	0.105	**0.097**	0.065	0.084	**0.075**	**0.089**
	Bootstrap bias	-0.004	0.000	0.001	0.000	**-0.001**	-0.001	0.000	**-0.001**	**-0.001**
	Bootstrap LB 2.5%	0.713	0.607	0.261	0.514	**0.524**	0.516	0.609	**0.563**	**0.537**
	Bootstrap median	0.916	0.776	0.447	0.719	**0.714**	0.65	0.779	**0.714**	**0.714**
	Bootstrap UB 97.5%	1.096	0.944	0.636	0.923	**0.900**	0.773	0.937	**0.855**	**0.885**

720. The above tables (Table 19, Table 20 and Table 21) provide the ERA with confidence in the robustness of the β estimates.

721. The ERA's analysis, using the updated dataset to 2018, indicates that the use of an equity beta value of 0.70 is appropriate.

722. The ERA's view is that the above method used to estimate equity beta has proved to be robust, with sound theoretical and empirical backing.

723. The equity beta will be fixed over the period of the guidelines. Fixing the equity beta during the guidelines will promote stability, predictability and consistency of the allowed rate of return consistent with the National Gas Rules.

13 Debt and equity raising costs

724. Debt and equity raising costs and debt hedging costs are the administrative costs and other charges incurred by businesses when obtaining and hedging finance.

725. This chapter outlines the ERA's approach to determining debt and equity raising costs used to calculate the rate of return.

13.1 Approach

13.1.1 Debt raising costs

726. Debt raising costs are a component in the rate of return on debt.

727. However, these debt raising costs should only include the direct cost components recommended by the Allen Consulting Group in its 2004 report to the Australian Competition and Consumer Commission (ACCC).[273] The recommendations in this report have been generally accepted by Australian regulators since its publication.

728. These direct costs will be recompensed in proportion to the average annual issuance, and will cover:

- gross underwriting fees;
- legal and roadshow fees;
- company credit rating fees;
- issue credit rating fees;
- registry fees; and
- paying fees.

729. Indirect costs should not be included in the estimate of debt raising costs and will not be compensated.

730. An estimate of 0.100 per cent per annum (exclusive of hedging costs, which are discussed separately below) is currently the most accurate estimate of debt raising costs for the benchmark efficient entity.

731. The debt raising cost allowance will be added to the return on debt.

13.1.2 Debt hedging costs

732. An annual swap allowance of 0.114 per cent will be provided to firms to compensate for the cost of conducting hedging for exposure to movements in the risk free rate.

733. The hedging cost allowance will be added to the return on debt.

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[273] The Allen Consulting Group, *Debt and Equity Raising Transaction Costs: Final Report*, December 2004.

13.1.3 Equity raising costs

734. The ERA will provide an allowance for equity raising transaction costs in the capex building block, and so these costs do not form part of the rate of return.

13.2 Reasoning

13.2.1 Debt raising costs

735. Regulators across Australia have typically included an allowance to account for debt raising costs in their regulatory decisions.

736. Debt raising costs may include underwriting fees, legal fees, company credit rating fees and any other costs incurred in raising debt finance. A company has to pay debt raising costs over and above the debt risk premium. Such debt raising costs are likely to vary between each issuance of debt depending on the borrower, lender and market conditions.

737. Australian regulators use benchmark estimates when determining debt raising costs. In doing so, regulators attempt to derive an estimate of debt raising costs that mimics debt raising costs that would be incurred by a well-managed efficient benchmark business operating in a competitive market.

738. Based on the advice from the Allen Consulting Group in December 2004, the ACCC reaffirmed that debt raising costs were a legitimate expense that should be recovered through the revenues of a regulated utility.[274] This conclusion was consistent with the ACCC's decisions on the issue of debt raising costs in its regulatory decisions prior to 2004.[275]

739. The costs included in the estimates of the debt raising costs, as indicated by the Allen Consulting Group in its 2004 estimate and adopted by the ACCC, are outlined below:

- *gross underwriting fee*: this includes management fees, selling fees, arrangement fees and the cost of an underwriter for the debt;
- *legal and road show fee*: this includes fees for legal documentation and fees involved in creating and marketing a prospectus;
- *company credit rating fee*: a credit rating is generally required for the issue of a debt raising instrument, a company is charged annually by the credit rating agency for the services of providing a credit rating;
- *issue credit rating fee*: a separate credit rating is obtained for each debt issue;
- *registry fee*: the maintenance of the bond register; and

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

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

- *paying fee*: payment of a coupon and principal to the security holder on behalf of the issuer.

740. In addition, in its report to the ACCC in December 2004, the Allen Consulting Group considered that some debt transaction costs would continue to be incurred for the whole value of the investment.[276] It also took the view that the most appropriate means of recovering these debt raising costs would either be as an addition to the estimated weighted average cost of capital or as a direct allowance to operating expenses.[277]

741. The debt raising allowance is treated differently by different regulators. For example, the AER has considered this allowance as an operating expense, whereas State-based regulators, including the ERA, have generally incorporated this allowance in the rate of return calculations.

742. The Allen Consulting Group's 2004 study determined debt raising costs based on long-term bond issues, consistent with the assumptions applied in determining the costs of debt for a benchmark regulated entity. Debt raising costs were based on costs associated with Australian international bond issues and for Australian medium-term notes sold jointly in Australia and overseas.[278]

743. The ERA and several other Australian regulators have adopted an estimate of debt raising costs of 12.5 basis points per annum in previous regulatory decisions. As shown in Table 22, while some regulators have continued to apply a figure of 12.5 basis points per annum (including the ERA in its past decisions), the ACCC, AER and Queensland Competition Authority (**QCA**) have elected to use somewhat lower estimates.

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276 Allen Consulting Group, *Debt and equity raising transaction costs: Final report to ACCC*, December 2004, p. xiii.

277 Allen Consulting Group, *Debt and equity raising transaction costs: Final report to ACCC*, December 2004, p. xix.

278 Allen Consulting Group, *Debt and equity raising transaction costs: Final report to ACCC*, December 2004, p. 53.

Table 22 Debt raising costs in Australian regulatory decisions

Regulator	Year	Allowance (bppa)
ERA[279]	2018	10.0
AER[280]	2017	8.4 – 9.2
ERA[281]	2016	12.5
ESCOSA[282]	2016	12.5
ACCC[283]	2014	9.8 – 10.9
IPART[284]	2014	12.5
QCA[285]	2014	10.8

Source: Compiled by the ERA

744. The ERA has investigated the allowances provided by various Australian regulators, and has given particular attention to research underpinning the QCA's 2014 *Cost of debt estimation methodology*.[286] In this report, the QCA reviewed the Allen Consulting Group's 2004 findings and the origins of the 12.5 basis points per annum estimate.

745. The QCA found that the 12.5 basis points per annum figure was based on figures provided to the ACCC by Westpac in 2002.[287] This figure was discussed in the Allen Consulting Group's report in 2004, which noted that an allowance of 12.5 basis points per annum was likely to have been overstated. Specifically, the Allen Consulting Group stated that:

- the ACCC had inappropriately included a dealer swap margin in 2004, resulting in a double-count;[288] and
- without a swap margin, the ACCC's estimate would have been about 7.5 basis points per annum (which was closer to other estimates sourced by the ACCC from banks at the time).[289]

279 ERA, *Draft Decision on Proposed Revisions to the Access Arrangement for the Western Power Network – Appendix 5 Return on Regulated Capital Base*, May 2018, p. 55.

280 Australian Energy Regulator, *Draft Decision: AusNet Services Gas access arrangement 2018 to 2022 – Attachment 3 – Rate of return,* July 2017, p. 3-446.

281 ERA, *Final Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline 2016 – 2020: Appendix 4 Rate of Return*, 2016, p. 177.

282 Essential Services Commission of South Australia, *SA Water Regulatory Determination 2016 Final determination*, June 2016, p. 122.

283 Australian Competition and Consumer Commission, *AusNet Services Gas access arrangement: 2018 to 2022 Attachment 3 – Rate of return (Draft Decision)*, March 2014, p. 56.

284 Independent Pricing and Regulatory Tribunal, *New Approach to Estimating the Cost of Debt: Use of the RBA's Corporate Credit Spreads*, February 2014, p. 2.

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

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

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

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

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

746. The QCA also noted that the AER had updated its debt raising allowance, based on a 2011 analysis of debt raising costs by PricewaterhouseCoopers.[290]

747. The QCA had concerns about the inclusion of the swap margin and the age of the 12.5 basis points per annum estimate. Consequently, it engaged PricewaterhouseCoopers to prepare updated advice on debt raising costs. PricewaterhouseCoopers found that debt raising costs were within the range of 9.9 to 10.8 basis points per annum. PricewaterhouseCoopers' method used the same cost categories identified by the Allen Consulting Group in 2004.[291]

748. The ERA is not aware of any new alternatives to the Allen Consulting Group method. Other estimates of debt raising costs – including Deloitte's 2010 estimate,[292] PricewaterhouseCoopers' 2011[293] and 2013[294] estimates, and the ERA's own estimate in 2013[295] – have adopted essentially the same approach taken the Allen Consulting Group. The approach set out in the Allen Consulting Group's 2004 study appears to still be relevant and fit-for-purpose. This approach is robust and has been adopted by many Australian regulators over the last 10 years.

749. Therefore, a debt raising cost allowance of 10.0 basis points per annum is appropriate. This falls within the range provided in the 2013 PricewaterhouseCoopers study, is comparable with estimates now used by the ACCC and QCA and is slightly higher than the most recent estimate adopted by the AER. This allowance does not include the swap margin, which is captured separately in debt hedging costs.

13.2.2 Debt hedging costs

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

751. Hedging costs involved in converting from a typical 10-year fixed debt to the regulated 5-year fixed rate will involve four legs:

- swapping 10-year fixed for a base floating rate at the time of issuance – paying floating and receiving 10-year fixed; and
- swapping the base floating rate at the time of the regulatory reset for 5-year fixed – receiving floating and paying 5-year fixed.

290 Queensland Competition Authority, *Cost of debt estimation methodology: final decision,* August 2014, p. 12.

291 Queensland Competition Authority, *Cost of debt estimation methodology: final decision,* August 2014, p. 12.

292 Deloitte, *Envestra Limited: Debt Financing Costs*, September 2010, p. 4.

293 PricewaterhouseCoopers, *Debt and Equity Raising Costs: Report for Powerlink Queensland (Appendix K)*, 2011, p. 20.

294 PricewaterhouseCoopers, *A cost of debt methodology for businesses regulated by the Queensland Competition Authority*, June 2013.

295 Economic Regulation Authority, *Explanatory Statement for the Rate of Return Guidelines*, 16 December 2013, p. 202.

752. For each set of two legs, the following costs may be incurred:

- *a credit and capital charge* – compensates for the risk of the counterparty and will depend on the credit rating and the potential default loss; and
- *an execution charge* – compensates the swap intermediary for the costs associated with transacting the swap.

753. The benchmark efficient entity would potentially engage in four different transactions in hedging the base of its portfolio of debt:[296]

- 5-year floating to fixed Australian dollar swaps at start of an access arrangement for full amount of debt portfolio;
- bond issuance potentially made up of three different issue types and hence requiring three different swap considerations:
- foreign currency bonds, requiring a cross-currency swap into floating Australian dollars; and
- fixed-rate Australian dollar bonds, requiring a fixed-float Australian dollar swap.

754. No swap will be required for floating rate Australian dollar notes.

755. In 2016, the ERA engaged Chairmont Consulting to advise on the cost of undertaking swaps. Chairmont Consulting made estimates based on its own inquiries and on recent hedging transaction costs identified by the ERA.[297] Chairmont estimated the following costs:[298]

> *5-year swaps at the start of the [access arrangements].* The different submissions provide a range of estimated costs, i.e. Evans and Peck (2015) 5bp; UBS <5bp; Jemena <5bp (i.e. less than half of the total 8-10bp, as a 5-year swap costs less for capital and credit charges). This suggests approximately 4bppa is appropriate. This is also supported by informal discussions held by Chairmont with two banks in late 2014.
>
> *Cross-currency swaps*. There was only one estimate provided and that was by UBS which reported 18bp. Chairmont's discussions with the banks suggest that this estimate is at the high end of costs and is likely to overstate a swap in relation to a new issuance. It is important to understand that banks tend to be more aggressive on swap pricing when linked to other business. A lower level of 10bp appears to be reasonable, so for further calculation a mid-point of 14bp is used.
>
> *10-year AUD fixed-floating swaps.* The submissions are Evans and Peck (2015) 8bp; UBS 5bp; Jemena and Authority (implied) 5-7bp. Taking a mid-point such as 6bp appears reasonable for this component.

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296 Chairmont Consulting, *ERA Hedging Costs in the Cost of Debt*, 13 May 2015, p. 5.

297 These were sourced from Evans & Peck (2015), UBS (2014), and Jemena (2013), as detailed in: Economic Regulation Authority, *Draft Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline 2016-2020: Appendix 4 Rate of Return*, 22 December 2015, p. 134.

298 Economic Regulation Authority, *Draft Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline 2016-2020: Appendix 4 Rate of Return*, 22 December 2015, p. 135.

756. Only a proportion of debt is raised overseas, thereby requiring overseas credit and executions costs. For example, Competition Economists Group presents evidence that regulated energy companies had about 65 per cent of debt issued in Australian dollars in 2013, with the remainder in foreign currencies.[299] Further, it has found that 24 per cent of debt amounts outstanding is already floating (typically bank loans).[300]

757. Based on Chairmont Consulting's advice and work by the Competition Economists Group, the ERA calculates the weighted cost of hedging as follows:

- 5-year swap floating for fixed for the full amount of debt = 4 bppa x 100 per cent = 4.0 bppa; plus
- 10-year cross currency swaps for (100 – 65 =) 35 per cent of debt issuance = 14 bppa x 35 per cent = 4.9 bppa; plus
- 10-year fixed-float Australian dollar swaps for (65 – 24 =) 41 per cent of debt issuance = 6 bppa x 41 per cent = 2.5 bppa.

758. That sum gives a total cost of hedging of 11.4 basis points per annum. Accordingly, the ERA will allow hedging costs of 11.4 basis points per annum.

13.2.3 Equity raising costs

759. Firms may need to issue new equity in order to maintain the benchmark debt-to-equity ratio following increases in the regulated asset base.

760. The issuance of new equity will have transaction costs, depending on the way in which the equity is raised.

761. The ERA will account for these transaction costs as a part of the capex building block. Consequently there is no allowance for equity raising costs in the rate of return.

[299] Competition Economists Group, *Debt strategies of utility businesses*, June 2013, p. 23.

[300] Competition Economists Group, *Debt strategies of utility businesses*, June 2013, p. 22.

14 Inflation

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

763. A nominal rate of return incorporates the real rate of return, compounded with a rate that reflects expectations of inflation. In line with the requirements of the National Gas Rules, the ERA will use a nominal vanilla rate of return for its decisions.[301]

764. The size of the inflation component will have an impact on the nominal prices set for gas distribution and transmission networks. To ensure pricing meets the objectives of the National Gas Law and the National Gas Rules, the ERA must establish a method for estimating the inflation rate that will prevail over the 5 years of the relevant access arrangement.

765. The resulting estimate of the expected inflation rate will be an input to the nominal modelling of the rate of return, as well as of other components of revenue. In particular, the expected rate of inflation will be required:

- for the roll forward of the regulatory asset base and for indexing purposes to determine annual depreciation allowances;[302] and
- to back out the expected inflation underpinning the nominal building block allowances in the tariff variation mechanism, to allow accounting for subsequent actual inflation.

766. The expected rate of inflation will also allow stakeholders to observe the real rates of change in tariffs and in the real rate of return, which is itself an important contributor to the real changes in tariffs.

767. This chapter outlines the ERA's approach to determining inflation.

14.1 Approach

768. The ERA will estimate the expected inflation rate using the Treasury bond implied inflation approach. This approach uses the Fisher equation and the observed yields of 5-year Commonwealth Government Securities (which reflect a market-based estimate of the nominal risk free rate) and 5-year indexed Treasury bonds (which incorporate a market based estimate of a real risk free rate).[303]

769. The ERA will estimate the expected inflation rate consistent with the estimate of the risk free rate by adopting an averaging period of 20 trading days. The averaging period must be nominated in advance and must be close to, and prior to, an access arrangement determination.

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301 National Gas Rules 87(4).

302 This is a requirement to achieve 'economic depreciation' rates in a nominal model. See, for example, the Australian Energy Regulator's Post Tax Revenue Model (Australian Energy Regulator, *Amendment: Electricity transmission network service providers: Post tax revenue model*, 2010).

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

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

770. The ERA will use linear interpolation to derive the daily point estimates of both the nominal 5-year risk free rate and the real 5-year risk free rate, for use in the Fisher equation.[304] The term of the resulting average expected inflation rate is 5 years, consistent with the length of the access arrangement period.

771. In this approach, estimates of both the nominal and real risk free rates of return are directly observed from the financial markets, so reflect the market expectation for inflation.

14.2 Reasoning

772. The ERA matches the term of the expected rate of inflation with that of the risk free rate in order to ensure consistency across the WACC parameters. It is therefore appropriate that the term of the expected inflation rate be 5 years.

773. It is also appropriate to match the averaging period for estimating the risk free rate – being 20 days – to ensure consistency.

774. The ERA uses the Treasury bond implied inflation approach to estimate the inflation rate expected to prevail over the course of a regulatory control period.

775. Australian regulators have adopted two methods for estimating expected inflation: (i) the Treasury bond approach; and (ii) the RBA inflation forecast approach. The choice of the two methods is influenced by the term of expected inflation to be forecast.

776. Table 23 contains a summary of the approaches used by Australian regulators in recent regulatory decisions for estimating the expected inflation rate.

[304] It is not common to observe a CGS bond with an expiry date that exactly matches that of the regulatory period end. To overcome this, two bonds are selected that fall on either side of the end day of the regulatory period. The dates on these bonds are referred to as the 'straddle' dates. Linear interpolation estimates the yields on the regulatory period end date by assuming a linear increase in yields between the straddle dates on the two bonds observed.

Table 23 Estimating the expected inflation rate in Australian regulatory decisions

Regulator	Year	Industry	Method	Term of expected inflation
ERA[305]	2018	Electricity network	Treasury bond implied inflation method	5 years
QCA[306]	2018	Various	RBA inflation forecast and mid-point of RBA inflation target range	5 years
AER[307]	2017	Gas and electricity networks	RBA inflation forecast and target band method	10 years
IPART[308]	2017	Various	RBA inflation forecast and target band method	10 years
ESCOSA[309]	2016	Water, sewerage, stormwater drainage and other services	RBA inflation forecast and target band method	10 years
ACCC[310]	2015	Fixed Line Services (Telecommunications)	RBA inflation forecast and target band method	10 years

Source: Compiled by the ERA.

14.2.1 The Treasury bond implied inflation approach

777. The Treasury bond implied inflation approach derives the expected inflation rate using the Fisher equation from observed yields of, for example:

- 5-year Commonwealth Government Securities – which reflect market estimates of the nominal risk free rate; and
- 5-year indexed Treasury bonds – which reflect market estimates of the real risk free rate.

778. The ERA uses linear interpolation to derive both the nominal risk free rate and the real risk free rate. A moving average – often 20 days – of the nominal risk free rate and the real risk free rate is used to reduce the volatility of the estimate.

779. This approach is based on the premise that yields on Commonwealth Government Securities and Treasury indexed bonds differ only by an inflation component.

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305 ERA, *Draft Decision on Proposed Revisions to the Access Arrangement for the Western Power Network – Appendix 5 Return on Regulated Capital Base*, May 2018, p. 60.

306 Queensland Competition Authority, *Seqwater Bulk Water Price Review 2018-21,* March 2018, p. 55.

307 AER, *Regulatory treatment of inflation – Final position,* December 2017.

308 Independent Pricing and Regulatory Tribunal, *WACC Biannual Update*, February 2018, p. 1.
Method detailed in *New approach to forecasting the WACC inflation adjustment,* March 2015.

309 Essential Services Commission of South Australia, *SA Water Regulatory Determination 2016 Final determination*, June 2016, p. 126.

310 Australian Competition and Consumer Commission, *Public inquiry into final access determinations for fixed line services – Final Decision*, October 2015, p. 72.

780. The yield on Commonwealth Government Securities can be decomposed into three components:

- the real yield, the compensation bond-holders demand for foregoing consumption;
- the expected inflation, the compensation for a reduction in purchasing power caused by the expected inflation rate; and
- premia, the compensation for changes in the real yield (known as the term premium) or changes in the inflation rate (known as the inflation premium) during the term of the bond.[311]

781. In comparison, the yield on Treasury indexed bonds contains only the real yield and a term premium.

782. By using the Fisher equation, the ERA can estimate the inflation rate and the inflation premium component of the Commonwealth Government Securities.

783. This method assumes efficient pricing of the Treasury indexed bonds, in that observed yields must reflect the value that the market places on these instruments at a given moment in time. The period around the global financial crisis saw a decrease in liquidity for Treasury indexed bonds. Lack of frequent trading meant that observed yields were not likely to reflect efficient pricing. As a consequence, the ERA discontinued the use of this method in its regulatory decisions in 2009.[312]

784. In recent years, however, the market liquidity for the Treasury index bonds has improved, and the ERA has again adopted the Treasury bond approach in deriving the estimate for expected inflation over a future regulatory control period.

785. One criticism of the Treasury bond approach is that it has an inherent bias, due to investors demanding an inflation premium to compensate for being exposed to the uncertainty around the future inflation rate.[313]

786. Another criticism of this approach is the relatively small quantity of Treasury indexed bonds with maturities every five years on issue.[314] This contrasts with the large quantity of Commonwealth Government Securities currently on issue. As a consequence, the interpolation of Treasury indexed bonds is significantly less accurate than the corresponding interpolation for Commonwealth Government Securities.

787. However, now that the liquidity of index bonds has improved and apparent liquidity premiums have subsided, on balance, the implied bond approach produces more accurate estimates of inflation for the next 5 years.

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311 The Australian Treasury, *Measuring market inflation expectations*, August 2012.

312 ERA, *Final Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline*, 31 October 2011, p. 158.

313 The Australian Treasury, *Measuring market inflation expectations*, August 2012.

314 RBA, *Extracting Information from Financial Market Instruments,* March 2012.

788. The ERA is aware of other potential issues that have been raised with the use of the 10 year bond yield approach.[315] However, the ERA considers the size of these biases, if they exist, are particularly small. Furthermore, using a shorter 5-year period may likely further reduce the size of these potential effects. Therefore, the ERA considers that these biases do not detract the bond yield's ability to forecast inflation relative to other methods.

789. The ERA considers that the Treasury bond implied inflation approach is the most robust measure of inflation expectations for a regulatory period. This method is consistent with and most appropriately aligns with the ERA's 5-year term.

14.2.2 Alternative methods

14.2.2.1 RBA inflation forecast and target band method

790. Regulators that have taken a longer 10-year view of inflation expectations have used the RBA inflation forecast and target band method.

791. This approach estimates the expected inflation rate using:

- the mid-point of the RBA's headline inflation rate forecast range for years 1 and 2 years from the most recent *Statement on Monetary Policy*; and
- the mid-point of the RBA's target inflation band of 2 to 3 per cent for years 3 to 10.

792. In most cases, regulators use a 10 year geometric annualised average that is taken from the above 10 inflation points to determine the expected inflation rate over the regulatory period.

793. Given the weight placed on the mid-point of the RBA's target inflation band, the inflation forecast remains relatively constant overtime and will not reflect changing inflation expectations.

794. There is evidence that the RBA inflation forecast and target band method has not responded to the changing inflation environment and leads to an overestimate of expected inflation.[316]

795. Given the lag in the RBA inflation forecast method, it can result in a negative real risk free rate when the Fisher equation is used.[317] An expected negative real risk free rate is likely to have adverse regulatory implications, since investors would be unwilling to lend funds with an expected negative real rate of return, when withholding investment offers a zero per cent rate of return.

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315 ACCC/AER Working Paper # 11, *Considerations of best estimates of expected inflation: comparing and ranking approaches,* April 2017, pp. 33-36.

316 CEG, *Best Estimate of Expected Inflation*, September 2016, p. 33.

317 See, for instance: ERA, *Final decision on proposed revisions to the access arrangement for Western Power*, 2012 p. 328.

796. Negative expected real rates of return may occur when the RBA overestimates the expected inflation rate. Applying the nominal risk free rate observed from the market, in conjunction with the inflation forecast from the RBA, to the Fisher equation will return a negative real risk free rate under these circumstances.[318]

[318] The Fisher equation solved in terms of the real risk free rate is: $r = \frac{(1+i)}{1+\pi^e} - 1$. A negative real risk free rate of return will occur if the expected inflation rate exceeds the nominal risk free rate, $\pi^e > i$.

15 Value of imputation credits (gamma)

797. The National Gas Rules require the ERA to set out its approach to estimating the value of imputation credits (gamma), a parameter in the post-tax revenue model.

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

799. The gamma parameter accounts for the reduction in the effective corporate taxation that is generated by the distribution of franking credits to investors. As a general rule, investors who are able to utilise franking credits will accept a lower required rate of return, before personal tax, on an investment that has franking credits, compared with an investment that has similar risk and no franking credits.

800. This chapter outlines the ERA's approach to determining gamma.

15.1 Approach

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

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

803. In estimating the distribution rate, the ERA relies on Lally's estimate of 0.83 for the distribution rate from financial reports of the 20 largest ASX-listed firms.[319]

804. The ERA considers that the distribution rate is at least 0.83. As detailed by Lally, the three energy network businesses for which data is available produce a higher distribution rate of 1. However, relying on so few observation can be subject to manipulation. Addressing the problems of limited available data and ability for manipulation, the ERA considers the use of the 20 largest ASX listed firms as the best proxy for the distribution rate for the benchmark efficient entity.

805. The utilisation rate is the value to investors of utilising imputation credits per dollar of imputation credits distributed. The ERA considers that the utilisation rate is a market-wide rather than a firm wide parameter.

806. In estimating the utilisation rate, the ERA relies on the equity ownership approach to determine the percentage of domestic investors in the Australian equity market. The utilisation rate is estimated for all Australian equity from the National Accounts of the Australian Bureau of Statistics (**ABS**). The ERA considers that a utilisation rate of 0.60 is appropriate.

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

807. The ERA estimates gamma as the product of the distribution rate and the utilisation rate to provide a gamma of 0.5.

808. This gamma value will be fixed over the period of the guidelines.

15.2 Reasoning

15.2.1 Imputation credits in utility regulation

809. National Gas Rule 87A accounts for the ability of imputation credits to reduce the effective corporate tax rate for equity investors.

810. National Gas Rule 87A requires that the estimated cost of corporate income tax of a service provider for each regulatory year of an access arrangement period (ETC_t) is to be estimated in accordance with (equation 21).

$$ETC_t = (ETI_t \times r_t)(1-\gamma) \qquad \text{(equation 21)}$$

where

ETC_t is an estimate of the taxable income for that regulatory year that would be earned by a benchmark efficient entity as a result of the provision of reference services if such an entity, rather than the service provider, operated the business of the service provider;

ETI_t is the estimated taxable income for the regulated entity;

r_t is the expected statutory income tax rate for that regulatory year as determined by the regulator; and

γ is the value of imputation credits.

811. Any value generated by the presence of franking credits in the Australian tax system must be accounted for in the return to equity – and hence the weighted average cost of capital – estimated for regulated businesses.

812. Officer proposed a theoretical framework that detailed how franking credits alter the after-tax cost of capital.[320] This framework is widely accepted by Australian regulators. It states that the value generated by franking credits is represented by the parameter gamma, which is a product of two components:

- *distribution rate* - the fraction of imputation credits created that are assumed to be distributed to shareholders; and
- *utilisation rate* - the market value of imputation credits distributed as a proportion of their face value.

[320] Officer, *The Cost of a Company under an Imputation Tax System, Accounting & Finance*, May 1994 pp. 1-17.

813. It follows that gamma can be represented by the formula set out in (equation 22) below.[321] This is known as the Monkhouse formula.

$$\text{gamma} = \text{distribution rate} \times \text{utilisation rate} \qquad \text{(equation 22)}$$

814. Experts differ in their interpretation of the best approach to estimating gamma in the regulatory setting. This is particularly the case for the value of the utilisation rate.

815. Table 24 summarises recent Australian regulatory decisions on gamma.

Table 24 Estimates of gamma adopted by Australian regulators

Regulator	Year	Gamma
QCA[322]	2018	0.46
AER[323]	2018	0.4
IPART[324]	2018	0.25
ERA[325,326]	2016	0.4
ESCOSA[327]	2016	0.5
ACCC[328]	2015	0.45

Source: Compiled by the ERA.

15.2.2 Recent litigation on the value of imputation credits

816. The Australian Competition Tribunal has viewed the estimate of gamma as an 'ongoing intellectual and empirical endeavour'.[329]

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

322 Queensland Competition Authority, *Seqwater Bulk Water Price Review 2018-21,* March 2018.

Consistent with the Queensland Competition Authority, *Draft report Seqwater Bulk Water Price review 2018-21,* November 2017, p. 56

323 AER, *ElectraNet transmission final determination 2018-23 – Overview,* April 2018, p. 21.

324 Independent Pricing and Regulatory Tribunal, *Review of our WACC method*, February 2018, p. 1.

325 ERA, *Final Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline 2016 – 2020: Appendix 5 Gamma*, 2016, p. 47.

326 ERA, *Final Decision on Proposed Revisions to the Access Arrangement for the Goldfields Gas Pipeline*, 2016, p. 343.

327 Essential Services Commission of South Australia, *SA Water Regulatory Determination 2016*, June 2016, p. 136.

328 Australian Competition and Consumer Commission, *Public inquiry into final access determinations for fixed line services – Final Decision*, October 2015, p. 66.

329 Australian Competition Tribunal, *Application by Energex Limited (Gamma) (No 5) [2011] ACompT 9*, 12 May 2011, paragraph 45.

817. The estimate of gamma under the National Electricity Rules and National Gas Rules has been the subject of several limited merits reviews by the Tribunal, with the following outcomes.

- In February 2016 the Tribunal found in favour of the New South Wales networks Ausgrid, Endeavour Energy and Essential Energy that gamma should be 0.25. In March 2016 the AER applied to the Federal Court for judicial review of the Tribunal decisions to set aside the New South Wales and Australian Capital Territory electricity and gas distribution network revenue determinations. In May 2017, the Full Federal Court upheld the AER's appeal in respect of the Tribunal's construction of the rules regarding gamma.[330]
- In June 2016 the Tribunal found in favour of ATCO Gas Australia that gamma should be 0.25. At that time in 2016 there was no final determination of the Full Federal Court appeal of the AER decision.
- In October 2016 the Tribunal found in favour of the AER, against SA Power Networks, that gamma should be 0.4. SA Power Networks appealed the Tribunal decision to the Federal Court. In January 2018 the Full Federal Court also affirmed the AER's decision on gamma for a value of 0.4.[331]

818. The ERA's gamma decision in the most recent DBNGP access arrangement decision was appealed by DBNGP and the matter is currently before the Tribunal.

15.2.3 Definition of the domestic capital market

819. For the purpose of these Guidelines, the ERA has adopted a domestic Capital Asset Pricing Model (**CAPM**), while allowing for the presence of foreign investors.

820. As discussed in *Chapter 4 - The benchmark efficient entity*, the boundary should account for the full domestic data set, including any direct influences on the cost of capital for Australian domiciled firms. This may include the influence of international investors in Australian markets for equity or the influence of international lenders supplying debt finance directly to Australian firms.

821. Therefore, to maintain internal consistency, the ERA views that the estimate of gamma needs to take into account the presence of international investors in the Australian domestic capital market.

822. The role of foreign investors is discussed in more detail below.

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

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

15.2.4 Interpretation of gamma

823. (equation 22) interprets franking credits in the context of the Officer CAPM framework.[332] Officer adjusts CAPM to incorporate the value of imputation credits.

824. As indicated by the AER,[333] Gray[334] and Handley,[335] the Officer framework, and specifically Officer's definition of a nominal vanilla rate of return, provides the basis for the rate of return framework underpinning the National Gas Rules.

825. The AER's position is that imputation credits should be valued on a pre-personal tax and pre-personal costs level to be consistent with the Officer model.[336]

826. The ERA has sought to maintain consistency with the Officer framework in its estimation of gamma.

827. The ERA interprets the benefit arising from imputation credits as the proportion of franking credits distributed multiplied by the proportion of these that are utilised by the representative investor.[337]

828. The AER highlights the challenges inherent in estimating gamma.[338]

> Estimating the value of imputation credits is a complex and imprecise task. There is no consensus among experts on the appropriate value or estimation techniques to use. Further, with each estimation technique there are often a number of ways these may be applied resulting in different outcomes. Conceptually, the value of imputation credits must be between 0 and 1, and the range of expert views on the value of imputation credits is almost this wide.

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332 Officer assumes all dividends and imputation credits are fully paid out each period. Monkhouse allows some retained earnings and imputation credits (Officer, *The Cost of Capital of a Company under an Imputation Tax System, Accounting and Finance*, May 1994; Monkhouse, *The Valuation of Projects Under the Dividend Imputation Tax System*, *Accounting and Finance*, 36, 1996.)

Handley notes that this assumption is unrealistic, such that any estimate of gamma that ignores retained credits will be an underestimate (J.C. Handley, *Advice on the Value of Imputation Credits*, 29 September 2014, p. 13).

It is well understood that the value of a retained imputation credit is less than the value of a distributed imputation credit due to the delay in distribution – but the difficult question is how much less. Unfortunately the answer is unclear as there is currently no empirical evidence on the value of a retained credit. Any value attributable to credits retained in a period would be reflected in the observed capital for that period but there is no known method to identify that component. The suggestion that retained imputation credits are worthless is somewhat implausible.

Estimates of gamma using the traditional approach will, therefore, be downward biased to the extent that retained imputation credits have value. Although it is not possible to reasonably estimate the magnitude of the bias, the ERA considers its direction is clear.

333 AER, *TasNetworks distribution determination 2017-18 to 2018-19 – Attachment 4 – Value of imputation credits*, April 2017, p. 4-18.

334 SFG, *Response to submissions on the rule change proposals, Report for the AEMC*, 5 November 2012, para. 2.

335 J. Handley, *Report prepared for the Australian Energy Regulator: Advice on the value of imputation credits*, 29 September 2014, pp. 7-8.

336 AER, *TasNetworks distribution determination 2017-18 to 2018-19 – Attachment 4 – Value of imputation credits*, April 2017, p. 4-23.

337 ERA, *Draft Decision on Proposed Revisions to the Access Arrangement for the Mid-West and South-West Gas Distribution System*, 14 October 2014, p. 210.

338 AER, *TasNetworks distribution determination 2017-18 to 2018-19 – Attachment 4 – Value of imputation credits*, April 2017, p. 4-10.

829. In this regard, to deal with these challenges in estimating gamma the ERA has used multiple estimation techniques in the past.

830. The AER has recently released a discussion paper on gamma to facilitate consultation.[339] In addition, to help inform the AER's consideration of gamma:

- the AER has engaged Lally to review gamma, including previous information, the AER's views, expert views and submissions;[340] and
- the AER has sought clarification from the ATO on the use of tax statistics.

831. On the basis of this new information, the ERA has been able to review and reassess its approach to estimating both the distribution rate and the utilisation rate, with a view to creating a more robust and reliable approach to estimating gamma.

15.2.5 Distribution rate

832. The distribution rate is the fraction of imputation credits created that are assumed to be distributed to shareholders.

833. The ERA's past approach to estimating the distribution rate was based on data for the cumulative payout ratio from ATO franking account balances, and related to listed and unlisted equity.

834. To estimate the distribution rate, the following issues must be considered:

- whether the data set used to estimate the distribution rate must be consistent with that used to estimate the utilisation rate;
- if consistency is not essential, the principles that should guide the choice of data for estimating the distribution rate;
- whether to use data for listed equity or all equity; and
- if listed equity is used, whether to use ATO data or data from the financial statements of companies.

835. The distribution rate is the proportion of a firm's imputation credits that are distributed, and therefore is a firm-specific parameter. Thus, the distribution rate can be estimated using firm, industry or market-wide data according to which is judged to provide the best estimate for this firm-specific parameter.[341]

836. In contrast, the utilisation rate is a market specific parameter and can be estimated using market-wide data.[342]

837. Therefore, consistency between the data sources to estimate the distribution rate and the utilisation rate is not essential, but nor is it precluded.

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339 AER, *Discussion paper – Valuation of imputation credits*, March 2018.

340 Lally, *Review of the AER's views on gearing and* gamma, May 2018.

341 Lally, *Review of the AER's views on gearing and* gamma, May 2018, p. 18.

342 Lally, *Review of the AER's views on gearing and* gamma, May 2018, p. 17.

838. For the principles that should guide the choice of data, Lally has explained the trade-offs.[343] At one extreme, one could use data from the firm in question but, if the firm's dividends are fully franked, then it will be able to manipulate (raise) its price or revenue cap by reducing its dividends. Reducing its distributed credits lowers its distribution rate and therefore raises its cost of capital estimated from the Officer model used by regulators.

839. An alternative would be to examine a set of large private-sector Australian firms that contain significant regulated businesses. However, the set of firms is not large and therefore the choice of whether or not to include certain marginal cases is likely to materially affect the resulting estimate.

840. All of this points to the use of some type of market-wide data. However, there is considerable variation in the distribution rate across firms and therefore any market-wide average could be a poor indicator of the situation for any firm.

841. Taking account of these competing considerations, the ERA favours the use of some type of market-wide data. This matches the ERA's general practice to date.

842. When deciding to use all equity or only listed equity, Handley, for example, found that the choice is significant when using ATO tax data. His estimate for the distribution rate for listed companies is about 80 per cent,[344] while that for unlisted companies is about 50 per cent, leading to an estimate for all companies of about 70 per cent.[345] Lally argues that, since it is always sensible to distribute credits if possible, and the only restriction on doing so is the size of the firm's cash dividends, the presumed cause of the difference in distribution rates between listed and unlisted firms is lower dividend payout rates in unlisted companies.[346]

843. Lally goes on to argue that the factors determining dividend policy in listed and unlisted businesses are different. Many unlisted companies are sole traders who have corporatised to reduce their tax rate (but only if they retain rather than distribute the profits), and many others are closely held entities with dividend policy considerations quite different to those of listed companies. Furthermore, all of the privately-owned regulated businesses in Western Australia are listed firms or subsidiaries of listed firms, and this is typical across Australia.[347] Handley similarly argues for the use of only listed firms because unlisted businesses "by definition are financed in entirely different ways".[348]

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343 Lally, *The Estimation of Gamma*, 23 November 2013, section 4.2.

344 Following the same cumulative payout ratio approach used by Hathaway and NERA for all equity, Handley developed an estimate for only listed equity, based on ATO tax data, of 0.8 (see J. Handley, *Advice on the value of imputation credits*, 29 September 2014, p. 28).

345 Handley, *Advice on the NERA Report: Estimating Distribution and Redemption Rates from Taxation Statistics*, 20 May, 2015, p. 11.

346 M. Lally, *Gamma and the ACT Decision*, 23 May 2016, p. 26.

347 The privately owned businesses are the DBP, which is owned by the Australian Gas Infrastructure Group (which is owned by CK Infrastructure Holding, which is listed in Hong Kong), the GGP, which is 88% owned by APA (listed in Australia), and the Midwest South West Gas Distribution System, which is owned by ATCO Gas Australia who in turn is owned by the ATCO Group (listed in Canada).

348 J. Handley, *Advice on the Value of Imputation Credits*, 29 September 2014, p. 28.

844. The ERA has reviewed the arguments for using listed equity in estimating the distribution rate and considers that the above points make a strong case for the use of listed equity.

845. If listed equity is to be used, the final question is whether to use ATO data or data from the financial statements of listed firms.

846. Using the ATO data, the distributed credits, and hence the distribution rate, could be estimated using either tax data or dividend data. The results from these two approaches are markedly different. Hathaway provides estimates of 71 per cent and 47 per cent using these two approaches, and notes that the difference has not been reconciled.[349] This undermines the credibility of both figures.

847. In addition, the ATO data distribution rate is estimated for all firms, which is inappropriate for regulated businesses and would underestimate their distribution rate.[350]

848. As part of the AER's 2018 review of its guidelines, it sought clarification from the ATO on the use of tax statistics. In May 2018, the AER was advised that the ATO is of the view that the taxation statistics data should not be used for detailed time series analysis of the imputation system. The ATO would not recommend using taxation statistics data as the basis of a detailed macro analysis of Australia's imputation system.[351]

849. Given the credibility of the ATO data and the opinion expressed by the ATO, the ERA considers it inappropriate to use ATO data to determine the distribution rate.

850. Therefore, the alternative data source is from the financial statements of listed firms.

851. Lally explains how data from the financial statements of listed firms does not have the same problems as the ATO data.[352]

- The financial statement data is audited.
- Researchers are able to personally identify the source data rather than having to rely upon the aggregation carried out by the ATO.
- Financial statement data is internally consistent, that is, there are no unexplained discrepancies in the financial statement data whereas there are major inconsistencies in the ATO data, which casts doubt on all of it.
- Data from listed firms will not include the effects of dividend policies associated with unlisted firms.

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349 N. Hathaway, *Imputation Credit Redemption: ATO data 1988-2011: Where have all the credits gone?* September 2013, section 1.3.

350 Lally, *Review of the AER's views on gearing and gamma,* May 2018, p. 37.

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

352 Lally, *Estimating the Distribution Rate for Imputation Credits*, July 2015, p. 3.

852. As a proxy for the benchmark efficient entity's distribution rate Lally uses the 20 largest ASX firms. Using data from the financial statements of the 20 largest ASX firms Lally estimates the distribution rate at 0.83.[353]

853. While recognising the limitations of using individual firm or industry data to set the distribution rate, Lally's recent analysis confirms that the appropriate estimate for the distribution rate of the benchmark efficient entity is at least 0.83.

- Lally examined the distribution rates of firms within the industry over the last 10 years. The three energy network businesses for which data is available produce a distribution rate of 1. This suggests that the distribution rate may be above 0.83.[354]

- Lally also details that for the purposes of estimating the distribution rate a benchmark efficient entity should be defined, and the distribution rate then estimated, from a set of firms that approximately match with the definition of the benchmark efficient entity. The benchmark efficient entity does not have foreign operations. Lally removes firms with significant foreign operations from the list of 20 firms and calculates a distribution rate of 0.92.[355] This also suggests that the distribution rate may be above 0.83.

854. On the basis of the above analysis, the ERA considers the use of the 20 largest ASX-listed firms as the best proxy for the distribution rate for the benchmark efficient entity.

855. The ERA considers a distribution rate of 0.83 to be appropriate.

15.2.6 Utilisation rate (theta)

856. The benefit of distributed imputation credits relies on the proportion of franking credits received that are used by the representative investor. The estimate of this proportion is known as the utilisation rate or theta.

857. The utilisation rate is the value to investors of utilising imputation credits per dollar of imputation credits distributed.

858. The ERA's past approach to estimating the utilisation rate used three methods with different weightings given to each of the approaches. These three methods were the equity share approach, the taxation statistics approach and the dividend drop off method.

859. The utilisation rate must be defined in accordance with a derivation of the Officer model. Therefore, the utilisation rate is a market-level parameter of all investors in the Australian market, meaning that the same value applies to all firms.[356]

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353 Lally, *Estimating the Distribution Rate for Imputation Credits*, July 2015, Table 1.

354 Lally, *Review of the AER's views on gearing and gamma,* May 2018, pp. 19-20.

355 Lally, *Review of the AER's views on gearing and gamma,* May 2018, p. 34.

356 Lally, *Review of the AER's views on gearing and gamma,* May 2018, pp. 17-18.

860. Individual investors have different utilisation rates. Investors who are able to fully use tax credits are assigned a value of one, while investors who cannot are assigned a value of zero. These individual utilisation rates may be weighted to produce the required market-level utilisation rate.[357,358]

861. Therefore, the utilisation rate is a complex weighted average over all investors holding risky assets, where the weights incorporate each investor's investment in risky assets and their level of risk aversion.

862. The estimate of the utilisation rate has attracted significant debate in the context of utility regulation. In estimating the utilisation rate, regulators and academics have used a variety of approaches, including the equity share approach, the taxation statistics approach and various market-based approaches (such as the dividend drop-off method).

863. Three approaches are discussed below: the equity share approach, the taxation statistics approach and use of implied market value studies (including the dividend drop-off method).

864. On the basis of the information detailed below, the ERA considers that the equity share approach is the most robust method to calculate the utilisation rate. The ERA will rely solely on the equity share approach to estimate the utilisation rate.

15.2.6.1 Equity ownership approach

865. The utilisation rate, by definition, is a complex weighted average over the utilisation rates of individual investors. Utilisation rates for individual investors are one if they can fully use the credits to reduce their personal tax obligations and zero if they cannot use the credits. The weights recognise the proportion of risky assets held by each investor and other unobservable terms.

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357 Lally, *The Estimation of Gamma,* Report for the AER*,* November 2013, p. 11.

Lally. and van Zijl, *Capital Gains Tax and the Capital Asset Pricing Model*, *Accounting and Finance,* vol.43, 2003, pp. 187-210.

358 The normal source of the definition of a parameter within a model is the definition provided in the paper that derives the model. However, in this case, the seminal Officer paper has been interpreted by experts in different ways. However, the ERA considers that Lally and van Zijl provide a rigorous derivation of the Officer model.

In this derivation, the utilisation rate is a complex weighted-average over the utilisation rates of individual investors, where the utilisation rates for individual investors are 1 if they can fully use the credits to reduce their personal tax obligations and 0 if they cannot use the credits. The weights involve the proportion of risky assets held by each investor and other unobservable terms (Lally, *The Estimation of Gamma,* Report for the AER, November 2013, p. 11; and Lally. and van Zijl, *Capital Gains Tax and the Capital Asset Pricing Model*, *Accounting and Finance*, vol.43, 2003, pp.187-210.).

Lally notes that the unobservable terms may vary over investors but do not lend themselves to estimation and therefore one could act as if they are equal across investors in which case the utilisation rate is the proportion of risky assets held by investors who can use the imputation credits (Lally, *Gamma and the ACT Decision*, May 2016, p. 16).

866. If these other terms are equal across investors, then the market utilisation rate is the proportion of Australian risky assets held by investors who can use the imputation credits. Furthermore, since this assumption cannot be confirmed or rebutted, because these other terms are unobservable, then pragmatically the utilisation rate should be treated as if it is the proportion of risky assets held by those investors who can use the credits.

867. Assuming that all local investors can fully use the credits and foreign investors cannot use the credits, it follows that the utilisation rate is the proportion of Australian risky assets held by local investors. Accordingly, an estimate of the proportion of Australian equities held by local investors is an estimate of the utilisation rate.

868. There have been views expressed that the Officer model assumes national equity markets are fully segregated and therefore the only investors in the model would be local investors. This would result in an utilisation rate of one.

869. Lally expands on this by recognising that when applying a purely theoretical CAPM, and the Officer model, two limiting steps have been taken. The first is to assume that the assets available to any investor are only local assets, this is called market segmentation. The second limiting step in the model is to treat a portfolio compromising only equities as the local market portfolio. Lally goes on to explain that the belief that investors to which the CAPM, and the Officer model, relate include foreigners is inconsistent with these models.[359]

870. However, Lally states that the Officer model assumes complete segregation whilst the empirical reality is otherwise, but there is no suitable model for addressing partial integration. So, there is no easy solution to this problem. The usual approach has been to use the Officer model combined with parameter estimates for the utilisation rate that reflect the fact of partial integration.[360]

871. The ERA and AER have both taken such a partial integration approach when estimating the utilisation rate.

872. Lally details that it does not follow that the AER is wrong to include foreign investors in estimating the utilisation rate. This might be done to pragmatically incorporate the empirical reality of foreign investors into a model that implicitly precludes them, in the belief that this produces more realistic results.[361]

873. Consistent with the AER approach, the ERA views it as pragmatic to interpret this definition to recognise the existence of foreign investors. This approach therefore defines the utilisation rate as a weighted average over the utilisation rates of all investors in the Australian market, both foreign and local investors.

874. Taking such an approach to defining the utilisation rate also has the benefit of providing an estimator that can be fairly reliably estimated, which contrasts with difficulties associated with other approaches to estimating the utilisation rate.

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359 Lally, *Review of the AER's views on gearing and gamma,* May 2018, pp. 21-23.

360 Lally, *Review of the AER's views on gearing and gamma,* May 2018, p. 32.

361 Lally, *Review of the AER's views on gearing and gamma,* May 2018, p. 23

875. Lally favours the use of all equity rather than only listed equity. This aligns with the CAPM model and does not rule out using it to estimate the cost of equity for an unlisted company (and some regulated businesses are unlisted).[362] [363]

876. ABS information on equity ownership obtained from the Australian National Accounts can be used to estimate the utilisation rate.[364]

877. The ABS has undertaken some quality assurance work for this historical data through its reviews of compilation methods and source data across the National Accounts. The time series was opened back to 1998 in this review. The Finance and Wealth publication has incorporated revisions as a result of the review.[365]

878. Based on ABS data for all Australian equity, Lally favours an estimate for the utilisation rate of 60 per cent.[366]

879. The ERA has updated the equity ownership data for September 2017 after ABS published the National Account revision.

880. The ERA has also refined the equity share ownership estimates consistent with the method set out by the AER.[367] The method:

- excludes from the calculation entities that are wholly owned by the public sector – including equity issued by the 'central bank', 'central borrowing authorities', 'national public non-financial corporations' and 'state and local public non-financial corporations';
- sums the equity held by those classes of domestic investor that are eligible to use imputation credits – 'households', 'pension funds', and 'life insurance corporations';
- sums the equity held by those classes of investor that are not eligible to use imputation credits – 'state and local general government', 'national general government' and the 'rest of the world'; and
- determines the share of equity held by investors eligible to use imputation credits as a proportion of the equity held by domestic investors that either use or waste imputation credits.

881. The resulting domestic ownership for all equity has tended to lie in the range between 58 per cent and 70 per cent much of the time, with an average of 62 per cent over 118 quarterly observations.

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362 Lally, *Review of Submissions to the QCA on the MRP, Risk-Free Rate and Gamma,* March 2014, pp. 34-35.

Lally, *Gamma and the ACT decision*, May 2016, p. 18.

363 Lally, *Review of the AER's views on gearing and gamma,* May 2018, p. 18.

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

365 A technical note which provides details about the major quality assurance work that was undertaken can be found at: http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/5232.0Technical+Note1Sep%202017

366 Lally, *Review of the AER's views on gearing and gamma,* May 2018, p. 18.

367 AER, Tas Networks 2017-19 – Attachment 4 – Value of imputation credits, April 2017, p. 161

882. On the basis of this analysis, the ERA considers Lally's recommended 60 per cent estimate for the utilisation rate is appropriate.

15.2.6.2 Taxation statistics approach

883. Tax statistics estimate the use of imputation credits, which is a measure of the imputation credits redeemed by shareholders. This method uses Australian Taxation Office (ATO) statistics to observe the proportion of distributed imputation credits that have been used by investors to reduce their personal taxation liabilities. It follows that the average market value of a franking credit is equal to the proportion of franking credits redeemed.[368]

884. This approach implicitly assumes that the market value of a redeemed franking credit is equal to its face value, whilst an unredeemed franking credit has no value.

885. The redemption rate for one year therefore is the total credits redeemed divided by the total credits issued. If all credits issued to investors who can use them are redeemed, it follows that the redemption rate is the total credits issued to investors who can use them divided by the credits issued to all investors. In addition, if investors who can use the credits choose Australian stocks with the same ratio of imputation credits to equity value as do investors who cannot use the credits, the redemption rate would be the proportion of Australian equities held by investors who can use the credits. As discussed earlier, essentially this is the utilisation rate.[369]

886. In the past, regulators have considered two studies – performed by Hathaway and Officer (2004) and Handley and Maheswaran (2008) – when estimating the utilisation rate.[370] These reports relied on company statistics published by the ATO.[371]

887. Hathaway and Officer (2004) used ATO company statistics to estimate the proportion of redeemed imputation credits from 1988 to 2002.[372] They calculated that 71 per cent of company tax payments had been distributed as imputation credits on average and estimated that 40 per cent to 50 per cent of the distributed credits were redeemed by taxable investors.[373]

888. Handley and Maheswaran (2008) used the same data to examine the reduction in individual tax liabilities due to imputation credits from 1988 to 2004.[374] Their study found that 67 per cent of distributed imputation credits were used to reduce personal taxes between 1990 and 2000, and this increased to 81 per cent over 2001-2004.

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368 NERA Economic Consulting, *The Value of Imputation Credits*, A report for the ENA, Grid Australia and APIA, 11 September 2008, p. 23.

369 Lally, *Gamma and the ACT Decision*, 23 May 2016, pp. 18-19.

370 ERA, *Explanatory Statement for the Rate of Return Guidelines: Meeting the Requirements of the National Gas Rules*, 16 December 2013, p. 212.

371 Hathaway, *Imputation credit redemption ATO data 1988-2011, Where have all the credits gone?* September 2013, p. 6.

372 Hathaway & Officer, *The Value of Imputation Tax Credits,* working paper, Melbourne Business School, 2004, p. 14.

373 Hathaway & Officer, *The Value of Imputation Tax Credits,* working paper, Melbourne Business School, 2004, p. 14.

374 Handley and Maheswaran, *A Measure of the Efficacy of the Australian Imputation Tax System*, *The Economic Record*, Vol. 84, No. 264, 2008, pp. 82-94.

889. However, Hathaway cautions that greater reliance should be placed on estimates derived from post-2004, given reliability problems with ATO statistics from years prior to 2004.[375]

890. Hathaway provides more recent estimates, using data for 2004 to 2011 – of 44 per cent or 62 per cent – depending upon whether ATO franking account balance data or ATO dividend data are used.[376] Rather than using ATO company statistics, which are subject to double counting errors, Hathaway provides separate estimates based on ATO franking account balance data and ATO dividend data,[377] and highlights the large, and apparently non-reconcilable, discrepancy between the two datasets.[378]

891. Hathaway has expressed concern with the ATO data, and the pointed caution about relying on it for estimating utilisation rates:

> Unfortunately, there are too many unreconciled problems with the ATO data for reliable estimates to be made about the utilisation of franking credits. The utilisation rate of franking credits is based on dividend data (from the tax office) and I have demonstrated that this data is questionable.[379]

892. Lally has also noted that the ATO data from which the redemption rate is estimated contains significant unexplained discrepancies that give rise to two significantly different estimates of the redemption rate.[380]

893. Hathaway gives more weight to the estimate based on ATO franking account balance data, stating that:[381]

> …I have more faith in the [ATO franking account balance] data than in the dividend data. The dividend data appears to be missing about $87.5 billion and the ATO has had substantial problems with the dividend data in the past.

375 Hathaway, *Imputation credit redemption ATO data 1988-2011, Where have all the credits gone?* September 2013, para 32.

376 Hathaway, *Imputation credit redemption ATO data 1988-2011, Where have all the credits gone?* September 2013, section 1.3.

377 Hathaway & Officer, *The Value of Imputation Tax Credits,* working paper, Melbourne Business School, 2004, p. 14.

378 Hathaway, *Imputation credit redemption ATO data 1988-2011, Where have all the credits gone?* September 2013, p. 4.

379 Hathaway, *Imputation credit redemption ATO data 1988–2011: Where have all the credits gone?*, September 2013, p. 39.

380 Lally, *Review of the AER's views on gearing and gamma,* May 2018, p. 18.

381 Hathaway, *Imputation credit redemption ATO data 1988-2011, Where have all the credits gone?* September 2013, p. 39.

894. Hathaway's estimate using ATO franking account balance data has also been updated by various parties since it was originally calculated. NERA uses data for 2004 to 2012 and updates Hathaway's estimate using tax data for one additional year to 45 per cent.[382] Similarly, Gray uses data from 2004 to 2013 to arrive at an estimate of 46 per cent[383] and the AER uses data from 2004 to 2014 to arrive at an estimate of 48 per cent.[384]

895. As part of the AER's 2018 review of its guidelines, it sought clarification from the ATO on the use of tax statistics. In May 2018, the AER was advised that the ATO is of the view that the Taxation Statistics data should not be used for detailed times series analysis of the imputation system. The ATO would not recommend using Taxation Statistics data as the basis of a detailed macro analysis of Australia's imputation system.[385]

896. Given the credibility of the ATO data and the opinion expressed by the ATO, the ERA considers it inappropriate to use ATO data to determine the utilisation rate.

15.2.6.3 Implied market value studies and the dividend drop-off method

897. Implied market value studies infer the value of distributed imputation credits from market prices.

898. Implied market value studies can potentially be used to estimate the utilisation rate, based on empirical market data. Unlike the equity share approach and taxation statistics approach, they provide an observed market value of franking credits.

899. Implied market value techniques include:

- simultaneous price studies for individual stocks;
- simultaneous price studies for share indexes;
- time series analysis of returns; and
- dividend drop-off studies.

900. Simultaneous price studies for individual stocks are not appropriate for estimating the utilisation rate at the current time because these studies have examined only a small number of stocks.[386]

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382 NERA, Estimating Distribution and Redemption Rates from Taxation Statistics, March 2015, section 4.

383 Frontier Economics, *The Appropriate Use of Tax Statistics when Estimating Gamma*, 6 January 2016, pp. 31-32.

384 Australian Energy Regulator, *TasNetworks distribution determination 2017-18 to 2018-19 – Attachment 4 – Value of imputation credits*, April 2017, p. 4-15.

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

386 ERA, *Explanatory Statement for the Rate of Return Guidelines*, 16 December 2013, p. 214.

901. Simultaneous price studies for share indexes, overcome this concern with studies dealing with individual stocks. However, there is only one such study, using data from 2002-2005, and the resulting estimates of the coefficient on imputation credits are 0.52 and 0.55 from two different specifications.[387]

902. NERA has conducted time series analysis of returns, regressing returns on the imputation credit yield and various control variables, using data from 2000 to 2012 and estimating the coefficient on the credits at -1.95.[388] Since credits are at worst worthless, the highly negative estimate is implausible as noted by Ainsworth, Partington and Warren.[389] Accordingly, the ERA gives this study no weight.

903. Dividend drop-off studies have been more widely used than simultaneous price studies or time series analysis of returns.

904. Dividend drop-off studies examine how share prices change on ex-dividend days after distribution of both cash dividends and attached franking credits. The amount by which the share prices change (on average) is assumed to reflect the value investors place on the cash dividend and imputation credit as separate from the value of the shares. Econometrics can then be used to distinguish the component of the price drop off due solely to the value of the franking credits. An average market valuation of franking credits can be obtained, by performing this analysis over a long period of time and across a large number of dividend events.

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

906. The primary advantage of dividend drop-off studies is that they can be used to provide an estimate of the observed market value of dividends and imputation credits. However, dividend drop-off studies have substantial measurement and estimation issues.

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387 Cummings and Frino, *Tax Effects on the Pricing of Australian Stock Index Futures*, *Australian Journal of Management*, Vol. 33, 2008, pp. 391-406, Table 2 and Table 4.

388 NERA, *Imputation Credits and Equity Prices and Returns*, 2013, section 3 and Table 3.5.

389 Ainsworth, Partington and Warren, *Do franking credits matter? Exploring the financial implications of dividend imputation*, June 2015, CIFR Working Paper No. 058/2015, p. 17.

390 As explained previously, investors incur costs in obtaining franking credits, which result in franking credits and net dividends being valued at less than their face value. These costs include transaction costs, risk, lack of international diversification for domestic investors and international investors' inability to utilise franking credits.

907. A paper by McKenzie and Partington has highlighted the imprecision inherent in the dividend drop off method.[391] The authors showed that the drop-off ratio can vary considerably, depending on the particular specification or regression technique applied. As such, they are of the view that it is appropriate to consider the estimates of utilisation rate from various dividend drop-off studies.

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

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

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

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

- Dividend drop-off studies may not accurately separate out the effect of taxation benefits associated with imputation credits on the share price change from the effect of the cash dividend. Multiple statistical models can be used and the results can be quite sensitive to a small number of outlying observations.[392]

- There is considerable evidence of anomalous share price behaviour around ex days, which raises the possibility that any estimate of the utilisation rate from a dividend drop-off analysis will simply reflect that anomalous behaviour.[393]

- Estimates of the market value of credits from methods other than dividend drop-off studies produced markedly different results, undermining the credibility of such market-based estimates.[394]

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

392 Lally, *The Estimation of Gamma,* Report for the AER, November 2013, section 3.5.

393 Lally, *The Estimation of Gamma,* Report for the AER, November 2013, section 3.5.

394 Lally, *The Estimation of Gamma,* Report for the AER, November 2013, Table 2.

910. Lally summarises the difficulties with using market based estimates well.

> …market based estimates are unreliable estimates of the average utilization rate because they are affected by the actions of tax arbitrageurs, there are very wide range of such results, they are very sensitive to a number of methodological choices, and data around ex-dividend dates are known to be afflicted by anomalous behaviour.[395]

911. For these reasons, the ERA places no weight on the dividend drop-off estimates and on the range of applied market value estimates more generally.

15.2.7 Estimation of gamma

912. The value of imputation credits (gamma) is estimated as the product of the distribution rate and the utilisation rate.

913. On the basis of the above analysis, the ERA considers that an appropriate estimate for:

- the distribution rate is 0.83; and
- the utilisation rate is 0.60.

914. Therefore the ERA's estimate of gamma is 0.50.

915. This gamma value will be fixed over the period of the guidelines.

15.2.8 Consistency with the National Gas Law and National Gas Rules

916. The Officer framework provides the basis for the rate of return framework in the National Gas Law and the National Gas Rules. It follows that estimating the value of imputation credits consistent with the Officer framework will best promote the national gas objective and the other requirements of the National Gas Rules.

917. The ERA has also taken into account the revenue and pricing principles. The revenue and pricing principles provide, amongst other things, that:

- a service provider should be provided with a reasonable opportunity to recover at least the efficient costs the operator incurs providing regulated services and complying with regulatory obligations;
- a service provider should be provided with effective incentives in order to promote economic efficiency with respect to the regulated services it provides; and
- a price, charge or tariff for the provision of a regulated service should allow for a return commensurate with the regulatory and commercial risks involved in providing the regulated service.

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

918. Therefore, the value of imputation credits, gamma, determined in these guidelines will promote the achievement of the National Gas Objective (via its application in the estimated cost of corporate income tax building block) if it takes into account the revenue and pricing principles, being:

- not too low, in that it contributes to providing a reasonable opportunity to recover at least efficient corporate tax costs; and
- not too high, in that it contributes to a return that is not excessive and is commensurate with the relevant risks.

919. The ERA is satisfied that the gamma value balances the opportunity for service providers to recover at least the efficient costs the service provider incurs in providing the reference services.

920. The ERA therefore considers that its estimate is fit for purpose.

Appendix 1 Summary of main changes from previous guidelines

921. The following table summarises the main changes between the rate of return guidelines last published by the ERA in 2013, and this current iteration of the rate of return guidelines.

Parameter	Has there been changes since 2013 rate of return guidelines?	Details of change
The benchmark efficient entity	Yes	Benchmark sample of firms has been updated to reflect current available firms and data.
Gearing	Yes	Gearing moves from 60% to 55% to reflect updated data. Gearing to remain fixed over the guidelines.
Return on debt	No	Method remains the same.
Risk free rate of return	Yes	Averaging period moves from 40 days to 20 days.
Benchmark credit rating	Yes	Credit rating moves from the BBB band to BBB+ to reflect updated data. The credit rating is to remain fixed over the guidelines.
Debt risk premium	Yes	Consistent with the approach in the Dampier to Bunbury Pipeline decision moved to the revised bond yield approach and a hybrid trailing average.
Return on equity	Yes	Moved from the five step approach to estimating the return on equity to reliance on Sharpe-Lintner CAPM.
Market risk premium	Yes	Places less weight on the dividend growth model. Considering different approaches for the current regulatory framework and under a binding rate of return framework, in the event it is introduced.
Equity beta	No	Method remains the same. Equity beta to remain fixed over the guidelines.
Debt and equity raising costs	Yes	Move from 12.5bppa for debt raising costs to 10bppa. This removes an identified double count. Consistent with the Dampier to Bunbury determination, debt hedging costs increase from 2.5bppa to 11.4bppa to recognise actual types of costs incurred. Debt raising and hedging costs to remain fixed over the guidelines.
Inflation	No	Method remains the same.
Gamma	Yes	The 2013 guidelines had a gamma range of 0.25 to 0.385. While the Dampier to Bunbury Pipeline determination is a gamma of 0.4. Gamma changes to 0.5. The processes for estimating the distribution rate and utilisation rate have been reviewed as ATO data can no longer be used. For the distribution rate the ERA relies on Lally's estimate of 0.83. For the utilisation rate the ERA relies on the equity ownership approach. Gamma is remain fixed over the guidelines.

Appendix 2 Automatic updating formulas for the return on debt

1. The ERA will construct the cost of debt as the sum of the:

    - the bank bill swap rate;
    - debt risk premium; and
    - relevant debt raising and hedging transaction costs.

2. The bank bill swap rate is estimated with the same term as the regulatory period, being five years. The bank bill swap rate is estimated once every five years at the start of the regulatory period, and so does not require annual updating

3. The debt risk premium is estimated using a 10-year trailing average. The trailing average consists of a debt risk premium for the current year and a debt risk premium for each of the nine prior years (and so must be updated each year).

4. Each year's debt risk premium is:

    - based on a term to maturity of ten years;
    - based on the BBB credit rating band prior to 2019;
    - Based on the BBB+ credit rating band from 2019;
    - estimated using the ERA's revised bond yield approach; and
    - estimated using the corresponding 10-year bank bill swap rate estimation.

5. The revised bond yield approach uses international bonds with a country of risk identified by Bloomberg as Australia to estimate the cost of debt each year. The debt risk premium represents the risk spread of the cost of debt estimated over the 10-year bank bill swap rate estimate in any given year.

6. The debt raising and hedging transaction costs are estimated once at the start of the regulatory period and do not require annual updating.

7. This appendix sets out the methods and the automatic formulas for updating the debt risk premium for each regulatory year. The annual update will contribute to the revised tariff that is published at each annual tariff variation.

Averaging period

8. The averaging period for each year's debt risk premium estimates will be 20 consecutive trading days.[396]

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396 Trading days are defined as days that Australian Commonwealth Government Security mid-rate data is available in the RBA's F16 statistical table.

9. This averaging period must fall within a window at least two months prior to, but no longer than six months before the regulatory period.

10. The averaging periods must be nominated prior to the ERA's Final Decision. The ERA does not require the nominated 20 trading day averaging period for each of the four years to be identical periods – only that they occur in the above window in each period.

Method for estimating the debt risk premium

The simple equally weighted trailing average

11. The estimate of the debt risk premium for each year will be a simple trailing average.

12. The trailing average estimate of the debt risk premium will weigh the most recent ten years of annual debt risk premium estimates that have been estimated.

13. Annual updates of the resulting 10-year trailing average will involve adding the most recent estimate of the debt risk premium, and dropping the estimate from ten years ago. The weights for a simple hybrid trailing average debt risk premium estimate will be 10 per cent each.

14. The automatic formula for the equally weighted trailing average of the debt risk premium to apply in any regulatory year is shown below:

$$TA\ DRP_0 = \frac{\sum_{t=0}^{-9} DRP_t}{10}$$

where

$TA\ DRP_0$ is the equally weighted trailing average of the DRP to apply in the following year as the annual update of the estimate used in the current year; and

DRP_t is the DRP estimated for each of the 10 regulatory years $t = 0, -1, -2 \ldots, -9$.

15. All years are in the same convention as year *0*. For example, if year *0* is the regulatory year 2016, $t = -9$ is the calendar year 2007, because 2016 is a calendar year in the relevant access arrangement. Similarly, if year *0* is the regulatory year 2017, $t = -9$ is the calendar year 2008.

16. Using the same logic, if year *0* is regulatory year 2014-15, $t = -9$ is the financial year 2005-06.

17. So, for example, the debt risk premium trailing average estimate for a calendar year 2016 regulatory year will be:

$$\begin{aligned} TA\ DRP_{2016} = {} & 0.1 \times DRP_{2016} + 0.1 \times DRP_{2015} + 0.1 \times DRP_{2014} \\ & + 0.1 \times DRP_{2013} + 0.1 \times DRP_{2012} + 0.1 \times DRP_{2011} \\ & + 0.1 \times DRP_{2010} + 0.1 \times DRP_{2009} + 0.1 \times DRP_{2008} \\ & + 0.1 \times DRP_{2007} \end{aligned}$$

Estimates of the forward-looking debt risk premium for inclusion in the trailing average debt risk premium estimate

18. The *forward-looking* estimates of the debt risk premium for each year will be estimated using the ERA's revised bond yield approach.

19. Resulting estimates of the debt risk premium will be included in the trailing average.

20. For example, say that the first estimate is made for the 20-day period ending 30 September 2019, which has been included in the estimate of the debt risk premium for calendar year 2020 in a given access arrangement decision.

21. The next estimate made would fall in the period 1 July to 31 October 2020 (DRP_{2021}) and would be incorporated in the trailing average debt risk premium to apply in 2021 (that is, $TA\ DRP_{2021}$).

22. The automatic formulas would apply, and would remain unchanged for the duration of the access arrangement period, and hence would apply for the estimates made for DRP_{2021}, as well as for the estimates for DRP_{2022}, DRP_{2023}, and DRP_{2024}.

Techniques to estimate the forward-looking debt risk premium

23. As detailed in the guidelines, the ERA will use the following three techniques as part of the automatic process to estimate the debt risk premium contributing to the annual updates:

- the Gaussian Kernel method;
- the Nelson-Siegel method; and
- the Nelson-Siegel-Svensson method.

24. Each of these techniques is discussed in turn below.

The Gaussian Kernel method

25. The Gaussian Kernel method is used by the RBA. This method assigns a weight to every observation in the bond sample – informed by the distance of the observation's residual maturity from the target tenor – according to a Gaussian (normal) distribution centred at the target tenor.

26. Formally, the Gaussian Kernel average credit spread estimator *S(T)* at target tenor *T* (say, five years) for a given rating (say, BBB+ bonds) and date is given by the following equation:

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

where

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

S_i is the observed spread on the i^{th} bond in the sub-sample of N bonds with the given broad rating; and

σ (sigma), which is measured in years, controls the weight assigned to the spread of each observation based on the distance between that bond's residual maturity and the target tenor. Sigma is the standard deviation of the normal distribution used to assign the weights. It determines the effective width of the window of residual maturities used in the estimator, with a larger effective window producing smoother estimates.

27. The weighting function is as follows:

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

where

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

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

28. The Gaussian Kernel may then be defined as:

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

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

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

31. Where a bond is issued in a foreign currency, weighting in the ERA's Gaussian Kernel estimate uses the principal amount converted into an Australian dollar amount. This currency conversion uses the closing exchange rate on the date of the bond's issues.

The Nelson-Siegel method

32. The Nelson-Siegel method assumes that the term structure of the debt risk premium has the parametric form shown below:

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

where

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

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

33. The Nelson-Siegel method uses observed data from the bond market to estimate the parameters $\beta_{0t}, \beta_{1t}, \beta_{2t}, \lambda$ by using the observed debt risk premium and maturities for bonds.

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

The Nelson-Siegel-Svensson method

35. The Nelson-Siegel-Svensson assumes that the term structure of the debt risk premium has the parametric form shown below:

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

where

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

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

36. The Nelson-Siegel-Svensson method is estimated in the same way as the Nelson-Siegel method, except that it uses a different parametric form.

Automatic method for annual updating of the estimate of the debt risk premium

37. The ERA will use the following method to implement the automatic process for estimating the debt risk premium for each annual update:

- develop the benchmark sample under the revised bond yield approach: (i) including corporate bonds denominated in domestic currency (Australian dollars) and foreign currencies including US dollars, euros and British pounds where the country of risk is Australia; and (ii) exclude bonds issued by the financial sector, duplicates, inflation-linked, called and perpetual instruments;
- convert the foreign currency bond yields into hedged Australian dollar equivalent yields;
- estimate the yield curves on the 20-day averages of the Australian dollar yield data applying the Gaussian Kernel, Nelson-Siegel, and Nelson-Siegel-Svensson methods;
- use the simple average of these three yield curves' 10-year cost of debt estimates to arrive at the market estimate of the 10-year cost of debt; and
- subtract the corresponding 10-year bank bill swap rate to estimate the debt risk premium.

Estimates prior to commencement of forward-looking DRP method

38. The RBA's data provides an available source of historic credit spreads for 10-year non-financial corporate bonds.

39. The ERA has determined to adopt RBA credit spread estimates for the historical debt risk premium estimates – up to 31 March 2015 – for incorporation in the trailing average.

40. The monthly RBA estimates are interpolated to daily estimates and a simple average of each year of daily observations in then made.

41. In this case, the DRP_t is estimated as shown below:

$$DRP_t = \frac{\sum_{D=1}^{Days\ in\ year} DRP_D}{Days\ in\ year}$$

where

DRP_D is the DRP for day D in regulatory year t.

42. An example is discussed below.

- The average of daily debt risk premia for the period 1 July 2005 to 30 June 2006 provides the estimated annual debt risk premium for 2005-06, which gives the first term DRPt, (DRP2005-06) in the trailing average debt risk premium estimate for 2014-15, TA DRP2014-15.

- The final term DRP2014-15 in the trailing average debt risk premium estimate for 2014-15, TA DRP2014-15, is given by the daily interpolated RBA estimates for the period 1 July 2014 to 30 March 2015, with daily estimates for the final period of the financial year for 1 April 2015 to 30 June 2015 given by the ERA's 2 April 2015 estimate of the debt risk premium. The resulting year of daily estimates is averaged to give the debt risk premium estimate for 2014-15 for including in the trailing average estimate to apply for the six months July to December 2014.

- Similarly, the average of daily debt risk premia for the period 1 January 2006 to 31 December 2006 provides the estimated annual debt risk premium for 2006, which gives the first term DRP2006 in the trailing average debt risk premium estimated for 2015, TA DRP2015.

- Given the automatic formula for the trailing average, the term DRP2006 in the average trailing debt risk premium estimate for 2015 would drop out of the trailing average estimate for 2016, TA DRP2016 and be automatically replaced by the term DRP2016.

- The final term, DRP2015 in the trailing average debt risk premium estimate for 2015, TA DRP2015, is given by the daily interpolated RBA estimates for the period 1 January 2015 to 30 March 2015, with daily estimates for the final period of the financial year for 1 April 2015 to 31 December 2015 given by the ERA's 2 April 2015 estimate of the debt risk premium. The resulting year of daily estimates is averaged to give the debt risk premium estimate for 2015 for inclusion in the trailing average estimate to apply for calendar year 2015. This is shown in detail in the next section.

Composition of the debt risk premium estimators for a regulatory period

43. As noted above, the annual update of the trailing average debt risk premium component of the rate of return in each year of an access arrangement period is to be calculated using the following automatic formula:

$$TA\ DRP_0 = \frac{\sum_{t=0}^{-9} DRP_t}{10}$$

where

$TA\ DRP_0$ is the equally weighted trailing average of the DRP to apply in the following year as the annual update of the estimate used in the current year; and

DRP_t is the DRP estimated for each of the 10 regulatory years $t = 0, -1, -2 \ldots, -9$.

Appendix 3 Glossary

Acronym	Full text
ABS	Australian Bureau of Statistics
ACCC	Australian Competition and Consumer Commission
ACT	Australian Competition Tribunal
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
ATCO	ATCO Gas Australia
BHM	Brailsford, Handley and Maheswaran
bppa	Basis points per annum
DBP	Dampier Bunbury Pipeline (and DBNGP (WA) Transmission Pty Ltd)
DRP	Debt Risk Premium
ERA	Economic Regulation Authority
ENA	Energy Networks Association
EUAA	Energy Users Association of Australia
GGT	Goldfields Gas Transmission
IPART	Independent Pricing and Regulatory Tribunal (of NSW)
MRP	Market risk premium
WAMEU	Western Australian Major Energy Users Inc
NER	National Electricity Rules
NERA	NERA Economic Consulting
NEL	National Electricity Law
NEM	National Electricity Market
NGL	National Gas Law
NGO	National Gas Objective
NGR	National Gas Rules
NSW T Corp	New South Wales Treasury Corporation
QTC	Queensland Treasury Corporation
RAB	Regulatory Asset Base
RBA	Reserve Bank of Australia
RPP	Revenue and Pricing Principles (Section 24 of the NGL)
SFG	Strategic Finance Group Consulting
WACC	Weighted average cost of capital