Explanatory Statement for the Rate of Return Guidelines

Meeting the requirements of the National Gas Rules

16 December 2013

Economic Regulation Authority
WESTERN AUSTRALIA

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1 Introduction

1. The Authority's responsibilities under the National Gas Law (**NGL**) and the National Gas Rules (**NGR**) relate to approving third party access arrangements in Western Australia for the Dampier to Bunbury Natural Gas Pipeline, the Goldfields Gas Pipeline and the Mid-West and South-West Gas Distribution System.

2. Under the recent changes to the NGR, the Authority is required to produce rate of return guidelines at least every three years.[1] The guidelines provide an opportunity to undertake a comprehensive review of approaches for determining the rate of return on capital.

3. The companion to this document – the Rate of Return Guidelines – sets out the Authority's proposed approach to meeting these requirements. This Explanatory Statement sets out the Authority's reasoning for the positions contained in the Rate of Return Guidelines. A further companion document provides the set of Appendices referred to in this Explanatory Statement.

4. Inquiries on any matter related to the Explanatory Statement and Rate of Return Guidelines may be addressed to:

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[1] NGR 87(13)

1.1 The requirement

5. The new NGR require that the rate of return guidelines set out:[2]

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

6. In what follows, the Authority interprets that:

   - A rate of return 'approach' refers to the systems of methods used in development of the rate of return guidelines, and encompasses the subsidiary methodologies, estimation methods, financial models, market data and other evidence.
   - 'Estimation methods' provide for the procedures used for estimating the rate of return, including through financial models.
   - 'Financial models' refer to those mathematical and statistical representations that are used to inform the rate of return, such as, for example, the Sharpe Lintner Capital Asset Pricing Model.
   - 'Market data' refers to any input data that is utilised for the rate of return, and may include, for example, financial data, or sample data from firms comparable to the benchmark.
   - 'Other evidence' may be broad ranging, but needs to be 'relevant' to the estimation of the rate of return to be considered.
   - The term 'estimation material' may be used to refer to any of the relevant information relating to estimation methods, financial models, market data and other evidence.

7. The rate of return guidelines will provide guidance for subsequent gas access decisions of the Authority for the three Western Australian gas pipelines and networks. However, the rate of return guidelines are not mandatory.[3] The Authority 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 NGL and NGR, is provided at the time of the review.

1.2 Developing the rate of return guidelines

8. The development of the rate of return guidelines has allowed the Authority to review its approach to setting the rate of return for covered gas pipeline and network access arrangements.

[2] NGR (14)

[3] NGR (18)

9. As part of the consultation process:

- the Authority published an issues paper in December 2012, and received nine submissions from stakeholders on the paper;
- the Secretariat attended public workshops relating to the rate of return guidelines, held by the Australian Energy Regulator, in the first half of 2013;
- the Secretariat released a working paper on the return on debt, held a workshop on 3 July 2013 on the topic, and the Authority received four subsequent submissions from stakeholders relating to the topic;
- the Authority released its draft guidelines and explanatory statement on 6 August 2013, and received 11 submissions from stakeholders on the draft guidelines;
- the Secretariat held a workshop on rate of return aspects on 7 November 2013, supported by two background papers, and the Authority received eight submissions from stakeholders on the topics discussed.

10. The Authority in its review has maintained a focus on the overall methodologies, estimation methods, financial models, market data and other evidence for developing the rate of return. The focus has sought to ensure consistency with the requirements of the NGL and the NGR.

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

2 The broad regulatory framework

12. This chapter sets out the Authority's views on the regulatory framework that informs the development of the rate of return guidelines. It first sets out the origins of, and the current broad approach to, regulation of energy utilities in Australia. It then summarises the requirements of the National Gas Law (**NGL**) and the National Gas Rules (**NGR**), and draws on these to articulate a framework for the rate of return regulatory decision making process.

13. The chapter then draws on this framework to develop a set of criteria that the Authority considers are consistent with the requirements of the NGL and the NGR. The Authority will use the criteria as a means to communicate to readers its decisions, particularly where it is required to exercise judgment.

2.1 Incentive regulation

14. Incentive regulation has a reasonably short history in Australia. Up until 1990, public ownership of monopoly infrastructure was common, largely a legacy of historic decisions by government relating to development. Public ownership gave governments the scope to control output, to ameliorate monopoly rents through pricing, and to influence levels of investment and operating costs.

15. However, it came to be recognised that this approach often entailed significant economic loss, as it did not provide the expected discipline on inefficient investment and operating expenditures.

16. This situation contrasted with that in the United States, where private ownership and statutory monopoly regulation through independent 'cost of service' (or rate of return) regulation had existed for much of the 20th Century. Nevertheless, it was recognised during the 1960s that this approach could also lead to inefficiencies, such as the tendency to invest capital unnecessarily (the 'Averch Johnson' effect). Some economists suggested that the outcomes were no better than unregulated monopoly.

17. By the 1980s, new regulatory approaches were being developed:[4]

> Beginning in the 1980s, theoretical research on incentive regulation rapidly evolved to confront directly imperfect and asymmetric information problems and related contracting constraints, regulatory credibility issues, dynamic considerations, regulatory capture, and other issues that regulators have been trying to respond to for decades but in the absence of a comprehensive theoretical framework to guide them.

18. This led to a rapid change in approach from the late 1980s to adopt 'incentive regulation:[5]

> What do we mean by incentive regulation? In particular, it means that the regulator delegates certain pricing decisions to the firm and that the firm can reap profit increases from cost reductions. Incentive regulation makes use of the firm's information advantage and profit motive. The regulator thus controls less behaviour but rather rewards outcomes.

[4] Joskow P. 2006, *Incentive Regulation in Theory and Practice: Electricity Distribution and Transmission Networks*, Cambridge Working Papers in Economics 0607, http://ideas.repec.org/s/cam/camdae.html.

[5] Vogelsang I. 2002, Incentive Regulation and Competition in Public Utility Markets: A 20-Year Perspective, *Journal of Regulatory Economics*; 22:1, p. 6.

> Worldwide, the introduction of incentive regulation has been part of the regulatory reform movement, consisting of privatization, liberalization and deregulation...
>
> ...The most important types of incentive regulation have been price caps, rate case moratoria, profit sharing, banded rate of return regulation, yardstick regulation, and menus. Overall, price caps have become the most widespread...
>
> ...Price caps are defined by an index of the regulated services that is adjusted annually by (1) an inflation factor that takes care of the economy-wide price level or of the level of input prices, (2) an X-factor that reflects efficiency improvements of the firm, and (3) a Y-factor that allows for pass-through of specific cost items outside the firm's control. The index is further adjusted in regulatory proceedings over the longer-term.

2.1.1 Incentive regulation in Australia

19. The policy response in Australia was to initiate and adopt the recommendations of the 1993 National Competition Policy Review, by the 'Hilmer' Independent Committee of Inquiry, which set out a comprehensive program of microeconomic reform for the monopoly utility sector.[6] The Hilmer review's proposed reforms for competition policy included the restructuring of public sector monopoly businesses, and the arrangements to facilitate third party access to nationally significant infrastructure. The intent was to introduce the discipline of competitive markets wherever possible, and to regulate for efficiency in the remaining monopoly elements.

20. These proposals were subsequently broadly implemented by the Council of Australian Governments, through the Competition Principles Agreement of 1995 and associated reforms. In addition, under clause 2 of the Competition Principles Agreement, states and territories undertook to establish independent sources of price oversight for their monopolistic business enterprises.

2.1.2 Incentive regulation for gas infrastructure

21. These arrangements, once established, continued to evolve. In the case of gas, the updated 2009 National Gas Law (**NGL**) provides for a legislated uniform national framework governing access to monopoly gas infrastructure, and arrangements for prices oversight. The national gas objective (**NGO**) sets out the aim of the NGL:[7]

> 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.

22. The Authority notes that it is clear that the NGL and the NGO is intended to promote economic efficiency:[8]

> 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

[6] For a summary, see http://ncp.ncc.gov.au/pages/reform.

[7] Western Australian Government Gazette 2009, *National Gas Access (WA) Act 2009*, www.slp.wa.gov.au, p. 76.

[8] National Gas (South Australia) Bill 2008, *Second Reading Speech*, www.ret.gov.au, p. 4.

> 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.

23. A number of revenue and pricing principles (**RPP**) in the NGL give effect to the objective.[9] The RPP establish that the NGO is to be promoted by targeting economically efficient outcomes, through effective incentives for efficient investment in infrastructure and efficient provision of services and the use of the infrastructure, specifically:[10]

> 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.

24. This specification of 'effective incentives in order to promote economic efficiency' in the RPP is entirely consistent with the incentive regulation approach. Incentive regulation provides an opportunity for the regulated utility to perform better than the regulator's ex ante forecasts of its costs. Subsequent savings are then shared between the utility and consumers. This is recognised as creating incentives for outcomes that are more efficient, and hence in the long term interests of consumers.

25. With regard to rate of return, the Australian Energy Market Commission has established the allowed rate of return objective in the National Gas Rules (**NGR**):[11]

> 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

26. In this context, the AEMC stated in its final rule determination that the new allowed rate of return objective is intended to be consistent with the National Electricity Objective (**NEO**), the NGO and the RPP:[12]

> 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 NEO, the NGO and the RPP.

2.1.2.1 Other elements in the new National Gas Rule 87

27. The 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:

> NGR 87(5) In determining the allowed rate of return, regard must be had to:

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9 Ibid.

10 NGL 24(3).

11 Australian Energy Market Commission 2012, *National Gas Rules*, www.aemc.gov.au, clause 87(3); or, in shorthand NGR 87(3).

12 Australian Energy Market Commission 2012, *Rule Determination: National Electricity Amendment (...) Rule 2012*, www.aemc.gov.au, 29 November, p. 23.

(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

(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.

28. In addition, the NGR 87 sets out a number of additional requirements for the allowed rate of return, including that:[13]

- 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));
  - 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));[14]
- results in a return on debt for a regulatory year which 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));
- 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)).

[13] The following points are paraphrased – see the NGR for exact language.

[14] 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.

2.1.3 Implications for the regulator

29. The anchor for any regulatory decision will be the regulatory approach that is considered to best deliver the requirements of the NGL, NGR, NGO, RPP and the allowed rate of return objective. The Authority considers that this requirement may be summarised in terms of an objective function, and a number of constraints:

    a) The primary 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'.[15] Related objectives include a need to achieve the allowed rate of return:

        i) for each of the regulatory years;[16]

        ii) incorporating effective incentives to promote efficient investment;[17] and

        iii) that is in the long term interests of consumers.[18]

    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 which gives the efficient service provider 'reasonable opportunity' to recover at least the efficient costs it incurs over the regulatory period.[19]

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

30. 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.

31. An implication of point a) 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.[20]

32. 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:

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15 National Gas Rule 87(3) – the allowed rate of return objective.

16 National Gas Rule 87(4).

17 National Gas Law 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 NEO, the NGO and the RPP' (Australian Energy Market Commission 2012, *Rule Determination: National Electricity Amendment Rule 2012*, www.aemc.gov.au, 29 November, p. 23.

18 As per the National Gas Objective.

19 National Gas Law 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'.

20 This is consistent with the 'NPV=0' condition. For more detail, refer to Appendix 2 – The present value principle.

- The benchmark firm's efficient cost of finance will reflect the prevailing conditions in capital markets for the cost of debt and equity, taking into account its risk. 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.
- In addition, 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 high powered 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 its bears the relevant losses.

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

34. An implication of the subsidiary objective of point a)(i) relating to regulatory years is that the allowed rate of return objective looks forward to the actual regulatory years of the access arrangement period.

35. An implication of the subsidiary objective of point a)(ii) relating to 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. A portion of the out-performance resulting from this incentive regime ultimately may be shared with consumers.

36. An implication of point a)(i) and point b) 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.[21]

37. An implication of point c) is that regulators are reluctant to revisit the returns to the firm too frequently, particularly where this significantly increases the transactions 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.

2.2 Criteria for application of regulatory discretion

38. The Authority consider that 'criteria' will help to inform stakeholders of its reasoning where it is applying regulatory discretion in determining the best approach for meeting the allowed rate of return objective and related NGR for the rate of return.

[21] National Gas Law 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...'.

39. The Authority considers that the criteria necessarily need to be consistent with the requirements of the NGL, the NGO, the NGR and the allowed rate of return objective. The requirements of the NGL, the NGO, the NGR and the allowed rate of return objective have primacy at all times. The criteria allow the Authority to articulate its interpretation of those requirements in the NGL and the NGR.

40. With this in mind, in the criteria, the Authority does not repeat the NGR in the key criteria sub-heading which follow.

2.2.1 Approach

41. The following criteria do not supplant the NGL and NGR; rather they are subordinate to the requirements set out in the two instruments. That said, the Authority considers it desirable if the proposed rate of return methods are:

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

2.2.2 Reasoning

42. The Authority notes that some stakeholders have consistently stated through the consultation process that they do not consider that criteria are necessary.[22] These submissions set out the view that the revised NGR already contains sufficient criteria for the exercise of regulatory judgment.

43. However, the Authority considers that the requirements of the allowed rate of return objective and the related NGR are quite broad. In addition, the elements that the regulator is required to have 'regard' to are not necessarily prescriptive of particular outcomes. Rather they set out the matters that the regulator is required to take into account when making a determination.

44. It is feasible that various relevant estimation methods, financial models, market data and other evidence may meet some, but not all, of the provisions of the new NGR 87, that the Authority is required to have regard to. To this end, it is likely that these potential approaches may address the NGR provisions well in some areas, and less well in others.

45. This broad framework permits the regulator considerable flexibility in determining the allowed rate of return. To provide a greater degree of certainty and transparency for its future determinations, the Authority considers it helpful to outline a set of criteria that will guide stakeholders as to its decision making with respect to assessing or determining what approaches, methods and sources of information can be used to satisfy the allowed rate of return objective.

46. The Authority's detailed consideration of the criteria is at Appendix 1 – Criteria for informing regulatory judgment.

2.2.2.1 Implementation

47. ATCO Gas Australia submitted that it interpreted the Authority as suggesting that the criteria be used as a type of filter to remove methods or data from its consideration.[23] This inference is not intended.

48. However, the Authority considers that the guidelines do need to 'filter' out those estimation methods, financial models, market data and other evidence that are not considered to meet the requirements of the NGL and the NGR, or which are judged to not perform as well in meeting those requirements as preferred methods. The criteria, on the other hand, are intended to provide a structure for the Authority's logic in considering how it will achieve the requirements of the NGL, the NGO, the NGR and the allowed rate of return objective. Thus it is the latter which provide the filter, while the criteria assist in communicating the Authority's thinking.

49. 'Ideal' methodologies – comprising estimation methods, financial models, market data and other evidence – would strongly meet all the requirements of the NGL, the NGO, the NGR and the allowed rate of return objective. However, this may not always occur in practice.

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[22] See for example, Goldfields Gas Transmission Pty Ltd 2013, *Submission on the Economic Regulation Authority's Draft Rate of Return Guidelines,* www.erawa.com.au, 7 October; DBNGP (WA) Transmission Pty Ltd 2013, *ERA Cost of Debt and Equity Workshop Papers: DBP Response*, www.erawa.com.au, 19 November; ATCO 2013, *Economic Regulation Authority's Draft Rate of Return Guidelines: response to discussion papers and stakeholder workshop*, www.erawa.com.au, 19 November.

[23] ATCO Gas Australia 2013, *Response to Authority consultation paper on rate of return guidelines*, www.erawa.com.au, Section 3.

50. Rate of return estimate materials – the estimation methods, financial models, market data and other evidence – would need to be broadly consistent with the requirements of the NGL, the NGO, the NGR and the allowed rate of return objective to be considered relevant. Some estimation materials may perform better on some requirements and less well on others, and yet may still be considered relevant. Accordingly, the assessment is whether, on balance, estimation materials are consistent with the requirements of the NGL, the NGO, the NGR and the allowed rate of return objective.

51. Nevertheless, estimation materials would need to pass a threshold of adequacy to be considered relevant. To the extent that estimation materials failed the adequacy threshold, then they would be rejected. This rejection would be consistent with the AEMC's purpose for the guidelines, which is to narrow down the set of estimation materials that are considered to meet the NGL and the NGR:[24]

> In order for the guidelines to have some purpose and value at the time of the regulatory determination or access arrangement process, they must have some weight to narrow the debate.

52. Once over the threshold for adequacy, then, as noted, any particular estimation material may meet the requirements of the NGL, the NGO, the NGR and the allowed rate of return objective to a greater or lesser degree. With this mind, the criteria would then be used as a means to articulate the Authority's evaluation of the estimation materials, in terms of how they performed in meeting the requirements of the NGL, the NGO, the NGR and the allowed rate of return objective. In this way, the criteria are intended to assist transparency around its exercise of judgement.

53. The criteria must draw their relevance from, and be consistent with, the NGL and the NGR. APIA notes in this context:[25]

> In approaching the task of developing the principles, it is appropriate to be cognisant of the hierarchy of objectives that must be met when determining the allowed rate of return. In the case of gas decisions, the overarching priority is meeting the National Gas Objective (NGO). Under the NGO sits the Revenue and Pricing Principles (R&PP). Then there are the requirements of the National Gas Rules, primarily set out in rule 87.
>
> A high level set of principles for the rate of return are already set out by 87(5) of the NGR and its NER equivalent. This is further supported by specific principles for the return on equity (87(6)-(7)) and debt (87(8)-(12)) already provided.
>
> Any further subset of principles regarding the rate of return developed by a regulator should be explicitly referenced back to the principles contained in the rules and be focussed on how the decision maker intends to ensure its thought process in making rate of return decisions is rigorous and meets the requirements of the rules.
>
> It is not useful for any principles developed for the Guideline to repeat any matters dealt with in higher order objectives.
>
> In addition, APIA would also caution against the development of principles which gives greater priority to one or some of the principles in the rules at the expense of other principles in the rules.

54. The Authority agrees that the criteria should not supplant the NGL and the NGR. Rather, the criteria will be used to inform stakeholders of the Authority's reasoning

[24] Australian Energy Market Commission 2012, *Rule Determination, National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012*, www.aemc.gov.au, 29 November, p. 58.

[25] The Australian Pipeline Industry Association 2013, Rate of Return Review, www.erawa.gov.au, p. 40.

as to how it intends to achieve the requirements of the NGL and NGR, particularly where it is exercising discretion.

3 Overall rate of return

55. The Authority is required to adopt a 'nominal vanilla' weighted average cost of capital (**WACC**) in developing the allowed rate of return for the benchmark efficient entity.[26]

56. A vanilla WACC would not include any adjustment for tax impacts, for example, in relation to the effect of imputation credits on the rate of return. The impact of tax on the returns would need to be accounted for separately, as an explicit deduction from the relevant cash flows. A vanilla WACC is therefore a 'post-tax' framework.

57. The nominal vanilla WACC provides for a simple weighted average of the nominal post-tax return on equity and the nominal return on debt. A range of issues may be considered in this context, including:

- the term of the return on equity and the return on debt;
- whether to adopt ranges or point estimates; and
- reasonableness checks.

58. In what follows, each of these elements is considered.

3.1 Approach

59. The Authority will adopt the following approach for its future regulatory decisions.

3.1.1.1 A nominal post tax model

60. The Authority will apply an explicit nominal post tax modelling approach for its future decisions estimating the allowed rate of return.

61. The Authority considers that the Australian Energy Regulator's Post Tax Revenue Model (**PTRM**), or a similar model, will provide a basis for future access arrangement determinations.[27] The PTRM will enable the Authority to utilise a nominal vanilla rate of return.

62. The PTRM deals with tax explicitly through operating cash flows, which is therefore consistent with the use of the nominal vanilla rate of return.

3.1.1.2 Components of the rate of return

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

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

[26] NGR 87(4)..

[27] As noted in the Authority's Consultation Paper, there will be a number of transitional issues in moving from a real model to a nominal model, particularly with regard to tax depreciation. However, these issues are outside the scope of this Rate of Return Guideline.

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

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

3.1.1.3 The term of the rate of return

64. The term of the estimates for the rate of return will be, as far as possible, consistent with the term of the regulatory period (see Appendix 2 – The present value principle).

65. Accordingly, as the regulatory period for the Authority's gas pipeline and networks decisions is five years, the term of its estimates for the rate of return will generally be five years (see Chapter 6 – Return on debt).

3.1.1.4 Point estimates or ranges?

66. The Authority will establish point estimates at the parameter level. These point estimates may be determined from within a range, or derived directly. Such point estimates would then inform a single point estimate for an estimation method or financial model.

67. Similarly, the Authority will seek to establish point estimates at the level of the return on equity and the return on debt. These point estimates may be derived from a single estimation method, or from a range informed by multiple estimation methods, financial models, market data or other evidence.

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

69. The use of a single point estimate for the return on equity and the return on debt will lead to a single point estimate for the rate of return. The single point estimate of the rate of return will be facilitated by a single point estimate of the gearing level.

3.1.1.5 Requirement to meet the allowed rate of return objective

70. The Authority will evaluate its estimate of the allowed rate of return in terms of the requirements of the allowed rate of return objective and the NGR more broadly. In particular, the Authority 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.

3.2 Reasoning

71. The Authority notes that the National Gas Rules (**NGR**) specify the WACC that is to apply in any regulatory year is to be comprised of a weighted average of:[28]

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

72. This specification is in turn 'subject to' the requirement that it achieves the allowed rate of return objective.[29] 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'.[30]

73. Issues relating to the definition of the benchmark firm and the approach to addressing the requirement for a similar degree of risk are therefore important considerations. These issues are considered in the next chapter.

3.2.1 Implementing a post tax nominal vanilla rate of return

74. The Authority applied a pre-tax real estimate of the rate of return in its recent decisions on access arrangements for the Dampier to Bunbury Natural Gas Pipeline and the Mid-West and South-West Gas Distribution System. The Authority also accepted a proposal to apply a pre-tax nominal estimate of the rate of return by GGT for the Goldfields Gas Pipeline.

75. More recently, the Authority adopted an explicit post-tax approach to deriving the return on equity in its Western Power decision.[31] This approach estimated tax liabilities as nominal cash flows, before deflating these for inclusion within the Authority's real building block model. A real vanilla post tax estimate of the return on equity was then utilised for determining the WACC. As such, the Authority's approach was a 'hybrid' of nominal and real building block models.

76. The Authority recognises that its previous approaches to estimating the rate of return are not consistent with the requirements under the new NGR 87.

77. The Authority will need to apply an explicit nominal post tax modelling framework for its future decisions. To this end, the Consultation Paper noted that the Authority could adopt the Australian Energy Regulator's (**AER**) Post Tax Revenue Model (**PTRM**). The AER's PTRM provides a full nominal building block approach to estimating the revenue requirement for the service provider.

78. The PTRM's nominal framework means that the building block revenue forecasts include estimates of expected inflation. The revenue allowances are therefore estimated in nominal dollar terms. In particular, when calculating the 'rate of return on capital' element in the building block, the regulatory asset base is indexed in

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

[29] NGR 87(2).

[30] NGR 87(3).

[31] Economic Regulation Authority 2012, *Further Final Decision on Proposed Revisions to the Access Arrangement for the Western Power Network*, www.erawa.com.au.

each year by expected inflation. This is multiplied by a nominal rate of return that includes expected inflation.

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

80. The Authority considers that the AER's PTRM, or a very similar model, will provide a basis for future access arrangement determinations.[32] The PTRM will enable the Authority to utilise a nominal vanilla WACC.

3.2.2 Components of the rate of return

81. As noted above, the new NGR specify that the rate of return should be a weighted average of the cost of equity and cost of debt (new 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.

82. The resulting weighted average cost of capital (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.

83. The approach to estimating the gearing, the return on equity and the return on debt are discussed in more detail in following chapters.

3.2.3 The term of the WACC

84. The NGR require the Authority 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'.[33]

85. The present value principle is a key consideration for 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 the expenditure stream (plus or minus any efficiency rewards or penalties).[34] This will result in the so-called Net Present Value equals zero condition (**NPV=0**).

86. The Authority is of the view that the regulatory return is likely to most closely match to 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 more detail, refer to Appendix 2 – The present value principle).

87. This outcome is in the long term interests of consumers, as it is consistent with economic efficiency. The Authority considers that the condition is met when the estimates of the return on equity and the return on debt are based on the prevailing

[32] As noted in the Authority's Consultation Paper, there will be a number of transitional issues in moving from a real model to a nominal model, particularly with regard to tax depreciation. However, these issues are outside the scope of this Rate of Return Guideline.

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

[34] Lally M .2012, The risk free rate and the present value principle, www.aer.gov.au, p. 8.

conditions. This view accords with that of Lally, who considered the application of the present value principle under conditions of risk, noting:[35]

> In summary, the Present Value principle applies equally to risk free and risky situations and, in the latter case, requires both a risk free rate and a risk premium that are defined over the regulatory period and based upon conditions prevailing at the start of that period.

88. Accordingly, as the term of the regulatory period for the Authority'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 exceptions will be with regard to the return on debt, where (see Chapter 6 – Return on debt for more detail):

- annual updating will require a one-year term in order to be consistent with the present value principle; and
- the term of the debt risk premium will be based on that observed through the bond yield approach, in order to account for the efficient financing of the benchmark efficient entity.

3.2.4 Point estimates or ranges for estimates?

89. Under the new NGR, there is now greater scope for the regulator to use judgment, in order to ensure that the allowed rate of return objective is achieved. This exercise of judgment may extend to the determination of point estimates within potential ranges for the rate of return. The option of using ranges, or judgment to determine point estimates within ranges, can occur at different 'levels' of the estimation process. The key 'levels' are the estimation of the:

- parameter values;
- return on equity or the return on debt;
- overall rate of return.

90. The Authority considers each of these levels in what follows.

3.2.4.1 The parameter level

91. The Authority has in the past utilised ranges to inform estimates at the parameter level. For example, the Authority in its Western Power decision, considered ranges for the benchmark credit rating, the market risk premium and the equity beta.

92. In this context, ranges have either been used to combine estimates from a number of different approaches, or to represent uncertainty determined through statistical analysis.

93. For example, in estimating the market risk premium, the Authority in its recent decision on Western Power's access arrangement considered four different approaches. These approaches gave overlapping estimates, which together delivered a range, from which the Authority selected a single point estimate for use in estimating the return on equity.[36]

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[35] Lally M. 2013, *The Present Value Principle: Risk, Inflation, and Interpretation*, www.aer.gov.au, p. 6.

[36] Economic Regulation Authority 2012, *Final Decision on Proposed Revisions to the Access Arrangement for the Western Power Network*, www.erawa.com.au, p. 379.

94. Similarly, in estimating the equity beta, the Authority undertook statistical analysis of market data for a sample of benchmark comparators, from which it established a range. The Authority then used its judgment to select a single point estimate.[37]

95. A range is not always required. For example, the gearing ratio has been based on a single point estimate derived from the average of observations from comparator firms.

96. The Authority notes that other Australian regulators adopt similar approaches for determining parameter estimates.

97. The Authority considers that establishing ranges for parameters may be appropriate in some circumstances, while elsewhere a single point estimate may be readily obtained. The Authority considers that it is reasonable to continue with this approach at the parameter level.

3.2.4.2 The return on equity and the return on debt

98. The Authority's practice to date has been to establish single point estimates for each parameter, which are then utilised to estimate the return on equity and the return on debt.

99. The alternative could be to utilise ranges for parameters, which then inform a range for the return on equity and the return on debt.

100. The Authority considers that use of single point estimates for parameters is preferred. Point estimates allow stakeholders to readily compare outcomes with other reference points, for example from other sources. In the case of a particular estimation method or financial model, this use of point estimates for parameters would then necessarily lead to a single point estimate for the return on equity and the return on debt. The Authority considers that this gives greater clarity in terms of the means used to estimate the return on equity and the return on debt, which might otherwise be lost if the point estimate was determined at the higher level.

101. However, where multiple estimation methods, financial models, market data or other evidence are used, then this could lead to a range for the return on equity or the return on debt. In this case, the Authority considers that it would determine a point estimate at the level of the return on equity or the return on debt. Again, such point estimates would provide for ready comparison between sources, and for clarity of approach.

102. The Authority therefore will establish point estimates at the parameter level, whether determined from within a range, or derived directly. Such point estimates would then facilitate a single point estimate outcome from each estimation method or financial model.

103. Similarly, the Authority will seek to establish point estimates at the level of the return on equity and the return on debt, whether these are derived from a single point estimate, or from a range informed by multiple estimation methods, financial models, market data or other evidence.

[37] Economic Regulation Authority 2012, *Final Decision on Proposed Revisions to the Access Arrangement for the Western Power Network*, www.erawa.com.au, p. 398.

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

3.2.4.3 The overall rate of return

105. The development of single point estimates for the return on equity and the return on debt will lead to a single point estimate for the rate of return. A single point estimate will be facilitated by the single point estimate of the gearing level.

3.2.5 Requirement to meet the allowed rate of return objective

106. Under the NGR, additional considerations are also required to 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 Authority's rate of return approach needs to be assessed broadly against the allowed rate of return objective;[38] 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).

107. The Authority will evaluate its estimate of the allowed rate of return in terms of the requirements of the allowed rate of return objective and the NGR more broadly. In particular, the Authority 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.

108. The Authority will consider other relevant material to assist this evaluation (see Appendix 29 – Other relevant material).

[38] 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'.

4 The benchmark efficient entity and compensation for risk

109. The allowed rate of return objective is set out at National Gas Rule (**NGR**) 87(3):[39]

> 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 (the allowed rate of return objective).

4.1 Approach

110. The wording of the allowed rate of return objective requires that the rate of return is to be based on:

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

111. The Authority's approach to each of these elements is defined in what follows.

4.1.1 Efficient financing costs

112. Financial markets will provide the observations required to evaluate the efficient financing costs of the benchmark efficient entity.

113. The Authority will constrain the estimation boundaries for the rate of return to domestic financial markets.

4.1.2 The benchmark efficient entity

114. The Authority defines the benchmark efficient entity as:

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

115. The Authority 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.

4.1.3 Accounting for risk

116. The Authority 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, in order to account for any material and substantiated difference in risks identified by

[39] Australian Energy Market Commission 2012, *National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012 No. 3,* www.aemc.gov.au, 87(3).

the regulated entity relating to providing the reference services, as compared to the risks associated with the benchmark efficient entity.

4.2 Reasoning

117. In what follows, the Authority considers:

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

4.2.1 Efficient financing costs

118. The new NGR 87 refines the financing cost requirements that were implicit in the previous gas rules. The Authority notes that the benchmark weighted average cost of capital (**WACC**) targets an efficient cost utilising a mix of equity and debt for the benchmark firm. The allowed rate of return for a regulatory year comprises a weighted average of the return on equity and the return on debt for that year. Consistent with this approach, NGR 87(4) requires that the allowed rate of return for the access arrangement period in which the regulatory year occurs, be derived from a WACC, provided that it achieves the allowed rate of return objective (through NGR 87(2)).

119. Network infrastructure requires large investments in physical assets. The returns on those assets will be spread over the associated long economic lives.

4.2.1.1 Efficient financing

120. Productive investments yield revenue that offsets their costs and provides a return. The revenue to be derived and, consequently, the rate of return from those investments, is not certain, and is therefore risky. The rate of return for an investment may be compared with those for alternative competing investments, once adjusted for risk. Riskier investments have higher costs of funding, both for equity and debt.

121. Modern portfolio theory (**MPT**) suggests that investors seek to minimise risk for a given level of expected return. In MPT, an asset's return is modelled as a random variable with a finite mean and variance. The variance of an asset's return measures the likely divergence from the expected return, and is taken as the measure of risk arising from holding the asset. MPT assumes, among other things, that investors are rational and markets are efficient. The Authority has summarised the assumptions underpinning MPT in Appendix 9 – Modern portfolio theory.

122. Furthermore, if financial markets are complete, then investors will be able to diversify all but systematic risk. Portfolios which minimise systematic risk for any given return are efficient. In a general equilibrium, across all investors, there will exist an efficient portfolio that is consistent with economic efficiency more generally. Such an efficient portfolio will be consistent with the first and second welfare theorems of economics, in particular that competitive markets will tend to achieve

and sustain a Pareto efficient allocation of resources.[40] Theory suggests that the efficient portfolio may be determined from the Capital Asset Pricing Model (**CAPM**), as it will be a combination of risk free and risky assets.[41]

123. Goldfields Gas Transmission (**GGT**) considers that the National Gas Law (**NGL**), and in particular the National Gas Objective (**NGO**) is not about economic efficiency in the broad, noting that the NGO only refers to efficient investment and the long term interests of consumers.[42] GGT acknowledges that the term economic efficiency is referred to in the Revenue and Pricing Principles, but suggests that it refers to 'practical behaviours in the context of developing, operating and using a specific pipeline system'.[43] That is, the boundary of the analysis is at the edge of the pipeline system and its users, rather than extending out into the economy more broadly.

124. However, the Revenue and Pricing Principles are clear that 'a service provider should be provided with effective incentives in order to promote economic efficiency with respect to reference services... *which includes*' efficient investment in, and efficient use of, a pipeline. This is squarely aligned with generally accepted principles of economic efficiency. This implies that the allocative efficiency implications extend out into the economy more broadly, consistent with the achievement of the economic concept of 'general equilibrium'; economic efficiency cannot be maximised by only considering a 'partial equilibrium' relating to a subset of the economy. The interactions of upstream and downstream users with the broader economy will influence the economic efficient use of the pipeline, and vice versa.

125. GGT also suggests that economic efficiency, in terms of Pareto optimality, is an ideal, which does not reflect outcomes in reality. GGT suggests that economic theory has no notion of 'efficiency improvement', invoking the theory of the second best.[44]

126. The theory of the second best provides a cautionary tale about the unknown economic welfare effects of policy changes. For example, removing monopoly constraints on gas networks might lead to net welfare losses if costs associated with resulting increases in air pollution outweighed the benefits of the increased consumption of gas. However, it is generally accepted that removing monopoly pricing has net economic benefits, and this provides the rationale for the NGL. The theory of the third best further amplifies that such significant first best policy approaches are likely to be welfare enhancing, despite lack of information about second best optima.[45]

127. The Authority therefore considers that its task under the NGL is to minimise the risk of monopoly pricing, with a view to maximising economic efficiency from the broad economic perspective (see Chapter 2 for more detail on the Authority's consideration with regard to economic efficiency requirements of the NGL and the

[40] A Pareto efficient allocation of resources means that no person can be made better off, without making at least one other person worse off.

[41] Brealey R.A. and Myers S.C. Principles of Corporate Finance, McGraw-Hill, pp. 173 – 180.

[42] Goldfields Gas Transmission 2013, *Submission on the Economic Regulation Authority's Draft Rate of Return Guidelines*, www.erawa.com.au, 7 October, p. 5.

[43] Goldfields Gas Transmission 2013, *Submission on the Economic Regulation Authority's Draft Rate of Return Guidelines*, www.erawa.com.au, 7 October, p. 5.

[44] Goldfields Gas Transmission 2013, *Submission on the Economic Regulation Authority's Draft Rate of Return Guidelines*, www.erawa.com.au, 7 October, p. 6.

[45] Ng Y-K 1977, Towards a theory of third best, *Public Finance*, Vol. 32(1), pp. 1-15.

NGR). The requirement for efficient financing costs is consistent with the broad efficiency considerations that the regulator is required to account for under the NGO and the Revenue and Pricing Principles. The Authority notes in this context that the explicit intent of the NGL and the NGO was to promote economic efficiency in the long term interests of consumers:[46]

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

128. GGT suggests that financial market efficiency does not imply economic efficiency.[47] GGT bases this conclusion on an article by Stiglitz, which suggests that efficient finance markets (in the Fama semi-strong sense that prices fully reflect available information) are neither necessary nor sufficient for the Pareto optimality of the economy.[48] Stiglitz considers the informational role of finance markets is different to the more classical role of pricing:[49]

> In financial markets, prices serve two roles; not only do they clear markets, they also convey and aggregate information. Thus prices perform a quite distinct role from that ascribed to them in traditional competitive analysis, and the optimality theorems which have been proved for that case do not directly apply here.

129. The core of Stiglitz's argument that follows is that the information efficiency of markets does not necessarily drive economic efficiency. Such prices do not lead to efficient investment decisions, as these latter decisions are contingent on the decisions of managers, which are only loosely controlled by financial market prices, if at all:[50]

> This argument suggests that control over the managers of firms is not exercised so much by the shareholders, the suppliers of equity (although they nominally have "voting rights," these are not very effective), as by the lenders, who are in a position to withdraw their capital if the firm 'misbehaves'. But it is also clear that the policies which the bankers would like the firm to pursue are not, in general, consistent with firms maximizing their value.

130. This criticism of the link between efficient financing costs and economic efficiency is primarily related to the efficiency of investment. As such, it is more about dynamic efficiency, as opposed to allocative efficiency relating to the use of existing infrastructure, although in the long run, the two cannot be separated.

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[46] National Gas (South Australia) Bill 2008, *Second Reading Speech*, www.ret.gov.au, p. 4.

[47] Goldfields Gas Transmission 2013, Submission on the Economic Regulation Authority's Draft Rate of Return Guidelines, www.era.com.au, 7 October, p. 19.

[48] Stiglitz J.E.1980, The Allocation Role of the Stock Market: Pareto Optimality and Competition, *Journal of Finance*, 36(2), p. 236.

[49] Stiglitz J.E.1980, The Allocation Role of the Stock Market: Pareto Optimality and Competition, *Journal of Finance*, 36(2), p. 244.

[50] Stiglitz J.E.1980, The Allocation Role of the Stock Market: Pareto Optimality and Competition, *Journal of Finance*, 36(2), p. 249.

131. More recent literature suggests that well functioning stock markets and banks, which result in efficient financing, do play an important role in ensuring investment efficiency. Dow and Gorton write:[51]

> We have identified two roles for stock prices in the allocation of investment capital. First, the prospective role is to provide information to the manager. If there is relevant information for the investment decision that is not already contained within the firm, then in equilibrium the manager will use stock prices to help make the investment decision and stock prices will themselves reflect this. Second, the retrospective role for stock prices allows managerial compensation contracts to be linked to performance. ...Having a model with these ingredients allows us to study the relationship between economic efficiency and stock price efficiency.

132. Dow and Gorton find that, provided managers and traders produce information, then:[52]

> ...the stock market serves both to guide investment decisions and to reward managerial performance. Both of these roles of the stock market depend on the efficiency of stock prices. Prospective prices reflect traders' signals and guide investment decisions, while retrospective prices reflect traders' signals and are used to link pay to managerial performance. ...[we derive] an economically efficient equilibrium in which the stock price indirectly performs the allocative role discussed by Hayek (1945). This could be interpreted as a confirmation that Hayek's insight into the function of the competitive market system remains valid in the case where the economy is based on a secondary stock market for the shares of firms with a separation of ownership and control.

133. Dow and Gorton also conclude that banks can play a similar role through efficient lending practices.[53]

134. A necessary condition but not sufficient condition for financing costs to be efficient is that they are consistent with efficient financing costs applying elsewhere in the economy, taking account of risk. Financing costs that did not reflect this broader condition would not be efficient. This suggests that the regulator, in seeking to achieve the requirements of the allowed rate of return objective with regard to the efficient financing costs of the benchmark efficient entity, is required to look to financial markets and prevailing conditions for evidence. This has been the practice to date.

135. While this may appear straightforward, the regulator needs to be mindful of a number of challenges in observing outcomes from domestic financial markets.

136. First, it is often the case that information derived from markets is conditioned by the model used to interpret observations. As such, the performance of the resulting empirical assessment of financial market costs often cannot be separated from the performance of the underlying theoretical model. It is for this reason that any estimate of the rate of return should be judged on its theoretical soundness, as well as its performance. This insight is relevant for the allowed rate of return objective, and helps to inform the criteria set out in chapter 2.

137. Second, there is a significant debate about the underlying efficiency of financial markets, particularly the degree to which market information is reflected in returns.[54]

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[51] Dow J. and Gorton G. 1997, Stock market efficiency and economic efficiency: is there a connection?, *The Journal of Finance*, Vol. 52, No. 3, p. 1105, p. 1107.

[52] Ibid, p. 1108.

[53] Ibid, p. 1114.

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, up to the point where it is cost effective to do so. Despite inter-temporal lags in adjustment and periodic distortions in effective functioning, financial markets ultimately provide a strong basis for estimating efficient financing costs. Importantly, the prevailing costs of funds in financial markets are faced by all firms in the economy, which is a key consideration for a regulator, given the efficiency objectives referred to above. These are the commensurate efficient financing costs, which need to inform the rate of return for the benchmark efficient entity under the allowed rate of return objective.

138. Third, there are also potential issues with regard to the depth of markets, which can create difficulties for estimating actual market outcomes over short periods, particularly where parameters are more volatile. Practical means to address these problems involve either:

- extending the period of observation, giving more of a historic average; or
- drawing on a broader data set.[55]

139. The criteria relating to good practice, robustness and transparency are important considerations in assessing options which achieve the allowed rate of return objective by managing these issues well.

140. For the above reasons, the Authority concludes that 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. As noted by Brealey and Myers, 'the concept of an efficient [financial] market is simple and generally supported by the facts'.[56]

4.2.1.2 Domestic or international financial markets

141. In seeking to observe the efficient financing costs of regulated firms operating in Australia, the question arises as to the degree to which international capital markets influence the cost of capital in Australia. Relevant considerations include the degree to which:

- foreign investors seek to invest equity in Australian firms, augmenting domestically-sourced investment;
- Australian firms seek to raise capital for their Australian investments on overseas capital markets, to supplement capital raisings in Australia; and

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[54] Fama states that the weaker, economically sensible version of the market efficiency hypothesis relates to the idea that 'security prices fully reflect... information to the point where the marginal benefits of acting on information (the profits to be made) do not exceed the marginal costs' (Fama E. F. 1991, Efficient Capital Markets: II, *The Journal of Finance*, Vol. XLVI, No. 5, p. 1575).

[55] For example, see DBNGP (WA) Transmission Pty Ltd 2013, *Response to Consultation Paper*, www.erawa.com.au, Att. 4 (Brattle Group 2013, *Estimating the Cost of Debt*), p. 11 & p. 20.

[56] Brealey R.A. and Myers S.C. 1996, *Principles of Corporate Finance*, McGraw-Hill, p. 346.

It is worth noting in this context the 'efficient markets hypothesis' has been strongly debated in recent decades (Dimson E. and Mussavian M. 2000, Market Efficiency, *The Current State of Business Disciplines*, Vol. 3, p. 967):

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.

- there is arbitrage between Australia's financial markets and those overseas.

142. These different strands reflect the extent to which foreign investors participate within the Australian domestic capital market.

143. At the outset, the Authority notes that where a particular finance market boundary is adopted, then it is desirable that the same boundary be applied across the full rate of return calculation, so as to ensure internal consistency. For example, the practice to date has been to estimate efficient finance costs for the Australian domestic capital market. Under the Authority's recent approaches to estimating the rate of return, observations of finance market outcomes have had a bearing on:

- for the cost of equity:
- the expected market risk premium;
- the equity beta;
- for the cost of debt:
- the nominal risk free rate;
- the expected debt risk premium; and
- the assumed utilisation of imputation credits (gamma).

144. To the extent that the boundary was expanded to encompass international data, then these estimates would also need to be based on the wider data set.

Markets for equity

145. In evaluating the cost of equity, the past practice of Australian regulators has been to adopt a domestic CAPM. In the process, regulators have recognised the influence of foreign investors, where they invest domestically and thus contribute to market outcomes within Australia. So for example, estimates of the assumed utilisation of imputation credits have taken account of the estimated participation of foreign investors in Australian equity markets, consistent with Officer's framework.[57]

146. On this basis, regulators in Australia have been satisfied that a Sharpe Lintner CAPM, based on domestic data, has met the requirements of the NGL and NGR. For these reasons, Australian regulators have not in the past accounted for equity models that are based on international data.

Markets for debt

147. With regard to the cost of debt, the Authority recognises that regulated Australian firms raise debt both domestically and overseas. More than 70 per cent of

[57] As noted by the AER, the Officer WACC framework assumes 'full segmentation', whereby (see Australian Energy Regulator 2009, *Explanatory Statement: Electricity transmission and distribution network service providers: Review of the weighted average cost of capital (WACC) parameters*, www.aer.gov.au, p. 52):

> The assumptions underpinning the use of a fully segmented (domestic) CAPM is that the domestic capital markets completely segregated from international capital markets, and therefore domestic investors hold a combination of the domestic risk free rate and domestic market portfolio. Under this framework, only domestic systematic risk is priced for determining the WACC and the appropriate measure of an asset's non-diversifiable risk is the beta of the asset to the domestic portfolio. In contrast, the fully integrated (international) CAPM assumes that global capital markets are fully integrated, and that therefore investors hold a fully diversified global portfolio of assets. Under this approach, the non-diversifiable risk is the beta of the asset to the global market portfolio and the appropriate market risk premium and risk free rate will be that which is relevant to the global market portfolio.

Australian utility fixed coupon bonds outstanding at March 2013 were denominated in foreign currencies, while around 10 per cent of floating rate bonds were issued in overseas markets.[58]

148. The Brattle Group has suggested in the context of estimating the cost of debt that:[59]

> ...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.

149. The Authority notes, however, that Australian markets for debt are closely linked to international markets, reflecting the policy of unrestricted capital mobility. With arbitrage, the cost of debt in Australia is similar to that in other developed countries, once all risk factors, including exchange rate risk, are taken into account.[60]

Evaluation

150. The Authority has given consideration to expanding the boundaries of the data set used for efficient financing costs – from just incorporating data from the Australian capital market – to account for outcomes in other overseas markets. Such a change would recognise that Australian firms are exposed to global financial markets, and that it is efficient for Australian firms to take account of the global costs of capital.

151. In weighing up the costs and benefits, the Authority considered the following factors:

- availability and tractability of data:
  - expansion to account for international markets would enhance the sample size for many estimates;
  - however, there would be a question as to how to select and evaluate what would be very large data sets from international markets;
  - there would also be a need to consider whether the international firm from which observations are derived has similar risk as the benchmark firm in Australia;
  - expansion to account for international markets could increase the regulatory cost of estimation significantly;

[58] The Authority in April 2013 examined all bonds issued by Australian utilities for the period from 1996 to 2013.

A sample of 123 bonds was collected. Data was provided by Bloomberg.

In this sample, 92 bonds were fixed coupon bonds, 29 bonds were floating with the remaining 2 being other instrument types. Of the 92 fixed rate bonds, only 25 bonds were denominated in Australian dollars. Of the 29 floating rate bonds, three were issued in the Euro and United States markets.

[59] DBNGP (WA) Transmission Pty Ltd 2013, *Response to Consultation Paper*, www.erawa.com.au, Att. 4 (Brattle Group 2013, *Estimating the Cost of Debt*), p. 2.

[60] For example, McBrady et al note (McBrady M.R., Mortal S. and Schill M.J. 2010, Do Firms Believe in Interest Rate Parity? *Review of Finance* 14 (4), p. 695):

> Interest rate parity is a bedrock assumption of international finance. It asserts that debt yields are equivalent across currencies when considering expected movements in exchange rate spot rates (uncovered parity) or prevailing forward exchange rates (covered parity). Given its importance to international finance, the academic literature on interest rate parity is justifiably vast.

- cost of equity:
  - it would be a major task to account for equity risk on a consistent basis;
  - for example, there would be a need to determine whether there are specific factors relating to country systematic risk that influence outcomes for the rate of return;
  - it may be difficult to incorporate Australian and international data together; yet without Australian data the estimates may not reflect the true costs of equity for Australian firms;
- cost of debt:
  - expansion to account for international markets would require that the Authority evaluate, for the Australian benchmark firm, the efficient proportions of debt from each market, whether sourced in Australia or overseas;
  - however such data may not be publicly available;
  - as Australian markets for debt are closely linked to international financial markets, it is unlikely that the cost of debt would differ markedly, once converted into Australian dollar terms;[61]
- tax:
  - an expansion to international markets would require account to be made of differing tax treatment, which could further add to the costs of the assessment.

152. The Authority considers that while an expansion of the boundaries to allow international data could have benefits, there would likely be significant costs, as well as potential for error. On balance therefore, the Authority stated in the Draft Guidelines that it was of the view that it should continue to constrain the estimation boundaries to domestic financial markets.

153. A number of submissions were critical of this position. Dampier to Bunbury Pipeline (**DBP**) suggested that there would be benefit in utilising overseas comparators, to determine the efficiency of Australian regulated firms.[62] GGT suggested that a 'benchmark' should include data from businesses operating outside Australia.

154. However, for the reasons set out above, the Authority remains of the view that a boundary relating to the domestic market is reasonable and consistent with the NGO and NGR. To go outside this boundary would require every aspect of the resulting overseas rate of return to be considered, as it is not consistent to take only one element in that return into consideration. So for example, credit ratings and betas cannot be excluded from gearing levels, and after tax rates of return require tax regimes to be adjusted for. A partial analysis would be meaningless and indeed contrary to rule 87 of the NGR.

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[61] Otherwise there would be opportunity for arbitrage, as noted in the previous footnote. To the extent that differences remain, then these are likely to reflect differences in the circumstances of the Australian market as compared to the overseas markets.

[62] For example, DBNGP Transmission Pty Ltd 2013, *ERA Draft Guidelines Response*, www.erawa.com.au, 7 October, p. 10; Goldfields Gas Transmission 2013, *Submission on the Economic Regulation Authority's Draft Rate of Return Guidelines*, www.erawa.com.au, 7 October, p. 21.

155. In addition, the Authority notes that setting the boundary at the domestic border is a constraint. To the extent that firms were able to access finance outside that boundary, then financing costs could only be lower, or the firms would remain with the domestic option.[63] On this basis, the Authority views maintaining the domestic boundary as a conservative, but reasonable, constraint.

156. In summary, the Authority's position is that the boundary should account for the full domestic data set, including any direct influences on the cost of capital for Australian domiciled firms. This may include the influence of international investors in Australian markets for equity, or the influence of international lenders supplying debt finance directly to Australian firms.

157. 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. Those chapters set out approaches that deliver estimates of the return on equity and the return on debt, based on domestic data, which meet the requirements of the rules and perform best against the criteria. On this basis, the Authority considers that domestic markets best meet the requirements of the rules.

4.2.1.3 Conclusion

158. Financial markets will provide the observations required to evaluate the efficient financing costs of the benchmark efficient entity.

159. There are a range costs and benefits to be evaluated when considering whether to adopt a domestic or international form of any particular model of the rate of return or its components. On balance, the Authority considers that there would likely be significant net costs with moving to an international approach. Therefore, the Authority is of the view that it should continue to constrain the estimation boundaries for the rate of return to domestic financial markets.

160. The requirement for internal consistency means that a single definition of the finance market is relevant. The Authority considers that it is desirable that all parameters of the rate of return be estimated based on the Australian domestic market.

4.2.2 Benchmark efficient entity

161. Identification of the benchmark efficient entity is central to the determination of the allowed rate of return objective of rule 87 of the NGR. 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 applying in respect of the provision of the reference services. This requirement reflects the NGR 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.

162. 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.

[63] This follows Le Chatelier's principle as applied in economics, that in the long run – as short run constraints are loosened – the absolute response of a decision variable to a change in parameter is increased (see www.dictionaryofeconomics.com).

163. In practical terms, as there is no definition of a benchmark efficient entity in the NGR, there is a need to quantify the key characteristics of the benchmark efficient entity. The Draft Guidelines noted that, generally, this involves establishing a conceptual definition for the benchmark efficient entity, and then gathering evidence from actual 'comparator' entities which resemble the conceptual entity, as a means to inform the benchmark parameters for the cost of equity and the cost of debt.

164. GGT contend that through this approach the Authority has 'conflated' two required tasks. The first task GGT considers is required is a determination of the risks of the service provider, so as to establish the risk profile of the benchmark efficient entity, thereby ensuring that these are 'similar'. The second is the evaluation of the financial market recompense for the risks borne by the benchmark efficient entity. Generally, this is an issue about multiple benchmarks (see below), and the way in which the risk of the reference service is determined.

165. In response, the Authority notes that it is starting from a presumption that the risks of gas pipelines within Australia are generally similar. On this basis, the Authority would draw on the financial characteristics of the gas networks industry.

166. Nevertheless, the Authority is open to the potential for some risks of the regulated entity to be materially different from the industry standard benchmark efficient entity. In this case, the Authority considers that it is the proponent's task to make the case for differences in risks.[64] The idea that the regulator would have the resources or the information to identify every risk for the regulated entity is misplaced. The appropriate incentive in this case, under the propose-respond model, is for the proponent to provide that information, and to make that case.

4.2.2.1 Conceptual issues

167. The Authority notes that the efficient benchmark need not reflect the exact financial characteristics of the service provider. Instead, the benchmark efficient entity should reflect the most efficient financial means to deliver the reference services. This provides incentive for the firm to move towards efficient financing, or to improve on those outcomes, in terms of the risk/cost of capital trade-off.

168. Hence, the task for the regulator is to establish the efficient financing practices that would be adopted for delivery of the reference services, which would take account of the degree of risk associated with that delivery.

169. Risk is a key consideration, as the NGL and the NGR recognise. The elements of risk that need to be accounted for in the definition of the benchmark efficient entity – for the specific gas infrastructure regulated by the Authority – are considered in the next section. Here we refer to the more general considerations associated with defining the benchmark efficient entity.

4.2.2.2 Defining risk

170. Under MPT, the risk factors influencing the expected returns of a benchmark efficient entity can be separated into systematic risks and non-systematic risks. This is an important risk categorisation, which helps to inform those risks which need to be compensated in the rate of return and those which do not.

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[64] The Authority notes that APIA recommend, drawing on the Brattle Group's work, a step in determining the rate of return of so-called 'risk positioning' (see APIA 2013, *Response to Issues Paper*, www.erawa.com.au, 20 February, p. 18).

171. Systematic risk relates to factors exogenous to firms – often associated with prevailing economic conditions – which will have an impact on all firms, to a greater or lesser degree.[65] Regulators need to be concerned with systematic risk in setting the rate of return, as this risk exposure is non-diversifiable and will influence the risk adjusted returns required by investors seeking to invest in the regulated firm. Systematic risks are key to the determination of the cost of equity.

172. Non-systematic risk, or diversifiable risk, on the other hand, relates to risks that are specific to the firm itself, or to the firm as part of a broader industry segment, and which can be either wholly or partially offset by an investor through an appropriate diversified portfolio.[66]

173. With regard to the risks associated with the cost of debt, the Authority notes that investors may be concerned with systematic as well as non-systematic risk. To the extent that the Authority benchmarks the debt risk premium for other networks (see Chapter 9 – Debt risk premium), and these networks have similar risks, then the debt risk premium will capture both the systematic and the non-systematic (idiosyncratic) risk elements required to be recompensed in the cost of debt.[67]

174. The key issue then in assessing risk is to identify whether a risk is systematic or non-systematic, and the degree to which it may be offset. Judgment is required. We classify the range of possible risks in the section below on 'Degree of risk associated with the provision of reference services'.

4.2.2.3 Conceptual definition of the benchmark efficient entity

175. Energy Networks Association (**ENA**) has expressed the view that the following conceptual definition of the benchmark efficient entity should apply:[68]

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

[66] 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.

[67] The Authority considers that firms in the same notch credit rating would have *similar* levels of aggregate risk, irrespective of the composition of the contributing risks. With regard to the debt risk premium, the Authority considers therefore that a pipeline or network is likely to have a similar overall level of systematic and non-systematic risk compared to other firms within the same credit rating band.

DBP argues that somehow this is flawed (see DBNGP Transmission Pty Ltd 2013, ERA Draft Guidelines Response, www.erawa.com.au, 7 October, p. 10):

> Just why the ERA draws information from differing data sets for different rate of return parameters is not clear from the DG [Draft Guidelines]. Presumably the basis for considering the utilities to establish the appropriate credit rating is that they have similar risk levels. If the net then widens to consider firms from elsewhere in the economy with the same credit rating, and this is on the basis that they also have similar risk levels, then why are they not included in the first step? Moreover, if credit rating is directly related to levels of risk in the sense that firms with the same credit rating ought to have the same cost of debt (as the ERA suggests), then what information is being added by considering firms after the first step? Either they have the same cost of debt as the firms in the first step, and thus the average does not change, or they have a different cost of debt, which means that the conclusion that firms with the same credit rating face the same risk level is false. The problem is exacerbated by the wide range of debt costs the ERA deems similar....

In response, the Authority considers that, by widening the number of firms and bonds within the sample, the estimate of the debt risk premium at any point in time is made more robust. Furthermore, while the finance risks of the broader set of firms may not all be the same, in aggregate, they provide a good comparator for the benchmark efficient entity.

[68] Energy Networks Association 2013, *Authority Consultation Paper – Rate of Return Guidelines*, www.erawa.com.au, Attachment, p. 15.

A 'pure-play' regulated electricity or gas network business operating within Australia without parental ownership providing the same scale and scope of standard control / reference services to the same customer base at the current time.

176. GGT was critical that this benchmark efficient entity definition does not refer to the term efficient. The Authority considers that for the avoidance of doubt the term 'efficient' could be added in as the second word in the definition. The term efficiency may then be interpreted to mean efficiency in its broad economic sense, consistent with the NGO, the Revenue and Pricing Principles, and the allowed rate of return objective.

177. Each subsequent element of the proposed definition is considered in what follows.

178. First, the inclusion of the term 'pure play' works to exclude non-regulated activities (including by the regulated business itself) where it is practical to do so. The Authority considers this is appropriate as non-regulated activities may have a different risk profile.

179. Second, the term 'regulated electricity or gas network business' is intended to account for the specific type of business activity being dealt with, and that the business activity is regulated. As the Authority's Guidelines relate to gas, the term electricity would be omitted.

180. Third, 'operating in Australia' is intended to account for country specific factors such as the currency, the level of economic growth and laws affecting business. The Authority considers that this is consistent with its intention to base the rate of return on data from domestic financial markets.

181. Fourth, the element 'without parental ownership' is intended to recognise that some risks associated with the provision of reference services cannot be eliminated, and thus must be compensated. In this event, 'without parental ownership' allows for explicit recognition of those risks, to ensure that these are not simply transferred to the parent, in a way that is not transparent and accountable. However, the Authority notes that this relates only to risks that are systematic, and therefore which are not diversifiable. Risks that are diversifiable may be offset by an investor holding an appropriate portfolio. That investor may be either the parent or an independent investor. That said, the Authority accepts that systematic risks need to be accounted for at the entity level, and so accepts this clause.

182. Fifth, the element 'providing the same scale and scope of standard control/reference services to the same customer base' is intended to recognise specific differences in the risk profile of the reference services. However, the Authority does not accept that differences in scale and scope necessarily lead to material differences in overall systematic risk. While the composition of contributing risks may differ between entities, the overall systematic risk the same. On this basis, other entities – for example involved in the provision of other types of infrastructure or even other types of goods or services in the economy more broadly – could have 'a similar degree of risk' as the benchmark efficient entity.[69] The

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

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

Authority therefore considers that this clause is overly restrictive, as it could unduly narrow the range of relevant information for determining the rate of return for the benchmark efficient entity.

183. The Authority therefore does not accept the ENA's definition in this regard. The Authority considers that this part of the definition should align closely with the text of the allowed rate of return objective, namely 'with a similar degree of risk as that which applies to the service provider in respect of the provision of reference services'.

184. Finally, the term 'at the current time' is intended to reflect prevailing market conditions and to recognise that characteristics of the reference services may change over time. These are reasonable considerations. However, the Authority considers the clause restrictive in this context, and also redundant. It is restrictive because the definition of the benchmark efficient entity should apply over the whole time of the access arrangement. It is redundant, because the benchmark efficient entity is the reference point for the determination of the rate of return for the regulatory years of the access arrangement, as per the allowed rate of return objective and the other clauses of NGR 87. The Authority therefore considers that this term should therefore be omitted.

185. Combining these elements, the Authority considers that the benchmark efficient entity should be defined as:

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

4.2.2.4 Implementation issues

186. The efficient finance practices of the benchmark efficient entity should reflect the actual practices of comparator firms operating in the market with efficient financing costs.[70]

187. In its most recent decisions, for example, the Authority has based its estimates of efficient financing costs on benchmark results from the average of a sample of comparator firms, for:

- gearing;
- the equity beta;
- the credit rating – and the associated debt risk premium;
- the assumed utilisation of imputation credits (gamma).

188. It is desirable that the benchmark not be hypothetical. This means that the benchmark must, as far as possible, reflect achievable financing practices, which reflect the practices of efficient firms exposed to a similar degree of risk as the regulated firm. Importantly, by reflecting achievable efficient financing practices, the benchmark will allow the service provider 'reasonable opportunity' to achieve the efficient parameters determined for the benchmark entity.[71]

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[70] This approach draws on the regulatory literature relating to yardstick competition, whereby the prices of the regulated firm are based on the costs of an average of other similar firms.

[71] 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 term 'similar'

189. 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.[72]

190. The process of developing benchmark estimates therefore involves observing the efficient financing practices of a set of businesses which are 'similar' comparators for the benchmark.

191. 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 in terms of quality and material difference.

192. The Authority recognises that uncertainty in estimation approaches, particularly when it comes to risk assessments, mean that it should not fall into the trap of 'misplaced precision'. The Australian Energy Market Commission (**AEMC**), for example, suggested:[73]

> ...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.

193. The Authority therefore agrees with the Australian Energy Regulator (**AER**), which has noted that larger samples are desirable, unless this would lead to a material bias in the efficient financing costs:[74]

> 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.

Public or private ownership

194. The Authority does not consider that a distinction should be made between public or private ownership. It is important to recognise that the requirement for economic efficiency leads to the interpretation of efficient financing costs as defining the opportunity cost of capital. Efficiency requires that this be the same for all firms in the economy, once adjusted for risk.

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

[73] Australian Energy Market Commission 2012, *Rule Determination National... Rule 2012,* www.aemc.gov.au, p. 67.

[74] Australian Energy Regulator 2012, *Rate of Return Guidelines Issues Paper*, www.aer.gov.au, p. 22.

195. Competitive neutrality principles that apply to state owned utilities reflect this view. State Treasuries are required to adjust the cost of debt to ensure that debt neutrality or government guarantee fees are incorporated in the yield.

196. Such adjustments recognise that without the passing of risk to the government parent, the state owned regulated firm would face the same cost of debt as a private sector regulated firm. This insight highlights that introducing a distinction between public and private ownership would violate the term 'without parental ownership'.

A single benchmark or multiple benchmarks

197. The Authority recognises that the allowed rate of return requires that it account for risks associated with the provision of the reference services. This account may be made either through a single benchmark, which is then adjusted, or through developing multiple benchmarks that are specific to each of the reference services in question.

198. For the reasons identified in Chapter 3 – Benchmark efficient entity, the Authority's preference is to retain a single 'average' benchmark efficient entity for gas pipeline and network service provision in the Australian domestic market. Firms with similar risk characteristics, depending on the parameter in question, would inform the comparator sample. These observations would provide the single benchmark efficient entity financing costs for the provision of gas pipeline and network services in Australia.

4.2.2.5 Conclusion

199. The benchmark efficient entity is defined as:

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

200. The finance practices of the benchmark efficient entity should reflect the actual practices of firms operating in the market which exhibit efficient financing costs. The Authority will base its estimates of efficient financing costs on the observations from a sample of comparator firms with efficient financing costs that are judged to be 'similar' to the single benchmark efficient entity for the provision of gas pipeline and network services in Australia.

201. The Authority will consider proposals to adjust the parameters, the return on equity, the return on debt, or the overall rate of return for the single benchmark efficient entity, in order to account for any material and substantiated risk differential between the benchmark efficient entity and the risks involved in the provision of the reference service in question.

202. In doing so, the Authority would expect to be provided with sufficient information by the service provider, so as to be able to weigh up and account for the relative differences in any risks between the sample of comparators and the regulated entity providing the reference services.

4.2.3 Degree of risk associated with provision of reference services

203. As noted above, 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.

204. As noted above, the Authority considers that it is reasonable to consider risk in terms of whether it is systematic, and hence exogenous, or non-systematic and therefore diversifiable.

205. The Authority considers that a first step is to identify the range of potential risks, and a second step to classify whether those risks are potentially systematic or non-systematic.

206. A further step is to then 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.

4.2.3.1 Identifying and classifying risk

207. The key 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

208. A range of 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;
- downstream demand risk – reflecting the composition of demand and its diversification.

209. 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.

210. 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.

211. 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.

212. 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 CAPM.

213. However, some proportion of the 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.

214. 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 risks

215. The key 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.

216. Industry or regional input cost risks should be diversifiable by investing in other industries or other regions. That is, to the extent that input costs to an industry or region are rising, then input costs to other industries or regions should fall.

217. With regard to inflation, it is noted that input costs for the regulated firm are part of the building block, and 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.

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

Financial risks

219. The key risks may be grouped as:

- refinancing risks;
- interest rate mismatch risks;
- liquidity risks;
- default risks.

220. Re-financing risk relates to the potential 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 re-financed 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 these risks. The investor may also further reduce this risk by diversifying across firms. Nevertheless, some level of re-financing risk will remain, related to general economic conditions, which will need to be compensated. Typically, this risk is captured in the debt risk premium that is applied to the regulated firm.

221. Interest rate mismatch risks, or equivalently, interest rate re-pricing risks, refer to the potential that the firm, when it re-finances, faces interest rates that diverge from those underpinning its pricing, and hence revenue. All firms will face this risk, to a greater or less degree (see chapter 6 and appendix 4). Firms may manage these mismatch risks by hedging, which will reduce the degree of mismatch.

222. 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.

223. Default risk will be influenced by:

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

224. Default risks arise from the potential of the firm to run into cash flow difficulties, such that it is unable to meet its financial obligations and becomes insolvent. All firms have some element of this risk. 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.[75] These credit ratings are a key component informing the debt risk premium required by lenders.

225. 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/regulatory risk

226. The key risks may be grouped as:

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

227. 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.

228. The utility regulatory framework can have an impact on the risks perceived by the investor. For example, the effectiveness of governance arrangements and the associated quality of utility regulation, as well as checks and balances on the regulator itself through provision for appeal of regulatory decisions, will have a bearing on perceptions of the continued 'reasonableness' of regulated returns.

229. 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 human resources or environmental practice, which will be common with those constraints for other firms operating elsewhere in the economy.

230. 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.

231. Overall, the potential for future changes in the regulatory framework will introduce risk for the investor. Such risks may be mitigated by good regulatory governance, for example 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.

232. A significant proportion of regulatory risk will be diversifiable by the investor. This is because any change which increases (decreases) the relative profit of the regulated

[75] 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.

firm will tend to reflect decreases (increases) in the prices of the reference services, decreasing (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.

4.2.3.2 Accounting for risk

233. As noted above, the Authority will be open to any proposal by the service provider regarding the need to adjust estimates of the parameters, the return on equity, the return on debt, or the overall rate of return, determined for the benchmark efficient entity, in order to account for the degree of risk of the regulated services. Such an adjustment would be required to account for any relative risk difference between the risks faced by the benchmark efficient entity, and the specific risks involved in the provision of the reference services in question.

234. In making its adjustment, the Authority will consider any proposed differences in the various risks faced by the sample of comparators as compared the regulated entity in providing the reference services. An adjustment will be considered where it was demonstrated that there was a material and substantiated difference in risk, such that the risks could not be described as being 'similar' and not diversifiable. The set of risks outlined above would provide the framework for this evaluation.

235. In this context, the Authority considers that only those risks which have the potential to introduce significant differences would be considered. A further consideration will be whether those risks are systematic or non-systematic.

Systematic risk

Symmetric

236. Symmetric systematic risks will be compensated. It is uncontroversial that compensation for symmetric systematic risk is central to models for the return on equity, such as the CAPM.

Asymmetric

237. An implication of the assumption of a symmetric distribution of risks in many models of the rate of return – such as the CAPM – is that systematic asymmetric risks may not be captured in the estimated return on equity.

238. An example of an asymmetric systematic risk is the business failure of a customer in an economic downturn. While generally such risks are likely to be small, the Authority recognises that some gas transmission pipelines may be more exposed to asymmetric systematic risks of this type than say, gas distribution networks. The risk may be significant where there are only a few major customers, and where those customers are involved in a similar business segment.

239. However, such risks will be influenced by the contractual arrangements. For example, long term take or pay contracts may mitigate any revenue risks in the event of a significant downturn, or even a business failure.

240. Where asymmetric risks that are systematic are able to be demonstrated, then it would be reasonable for the regulator to consider additional compensation explicitly. This is likely to be best addressed through the cash flows, although may also be accommodated by adjusting the parameters of the CAPM, such as the beta.

Non-systematic risk

Symmetric

241. Symmetric non-systematic risks should not be compensated. These risks are largely diversifiable, or else will even out in effect over the long run.

242. An example in this context could be weather related performance variations around gas pipeline design parameters.

Asymmetric

243. Asymmetric non-systematic risks – where these are significant – are likely to be diversifiable, or managed through operational expenditures. On this basis, compensation would not be required through the rate of return. Before any compensation in the rate of return is allowed to occur, the Authority would expect the service provider to demonstrate the materiality of these risks, the reasons why they should be included in the rate of return, and to propose the level of compensation required.

244. An example might be a risk of pipeline failure. Such an asymmetric risk could require compensation, at least to the extent that the failure did not lead to significant offsetting increases in the volume of another business (which would then provide a diversification opportunity) for an equity investor. Furthermore, in this case, compensation may be best managed through an explicit (certainty equivalent) contingency as an expense in the cash flows, based on evidence relating to maintenance expenses that reduce the risk or insurance expenses. In this event, no compensation would be required through the rate of return.

245. It is worth noting that the Australian Competition and Consumer Commission (**ACCC**) considered this issue in the context of the Longford gas explosion and its impact on the required returns for GasNet in Victoria. The ACCC considered evidence presented by GasNet estimating required insurance premiums but was not convinced this was credible. Rather than incorporating the estimated premiums into the cash flows, the ACCC chose to adjust the beta up towards the top end of the range for a range of reasons, including potential uncertainty relating to downside risks:[76]

> On the basis of evidence presented, the Commission was not convinced that there were significant downside risks that outweighed potential upside benefits which would be on top of profits implied by the target revenue calculations. Nevertheless, the Commission does acknowledge that all of these risks are difficult to quantify. Accordingly it has adopted the suggestion of financial experts at the WACC forum, that they are taken account of by choosing beta estimates towards the top end of the plausible range.

246. Asymmetric non-systematic risk, such as the potential for a default on debt, are unlikely to require compensation in the return on debt, as these types of risks will be reflected in the debt risk premium of the benchmark efficient entity. The debt risk

[76] Australian Competition and Consumer Commission 1998, *Final Decision: Access Arrangement by Transmission Pipelines Australian Pty Ltd...*, www.aemc.gov.au, 6 October, p. 60.

premium will also take into account other asymmetric non-systematic risks, in a total aggregated sense, given the arguments above that although aggregated risks may be the same, the composition of the risks may not reflect the exact risks of the pipeline.

4.2.3.3 Conclusion

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

248. The Authority 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.

249. The Authority will consider in this determination those risks which are substantiated by the service provider as introducing material differences in the service provider's exposure to risk in providing the reference services, as compared to the risks faced by the benchmark efficient entity.

5 Gearing

250. Under the National Gas Rules (**NGR**) 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 that regulatory year occurs and the return on debt for that regulatory year.[77]

251. Gearing refers to the proportions of a regulated business' assets assumed to be financed by debt and equity. Gearing is defined as the ratio of the value of debt to total capital (i.e. including debt and equity), and is used to weight the costs of debt and equity when the regulated weighted average cost of capital (**WACC**) is determined. The relative proportions of debt and equity that a firm has outstanding constitute its capital structure. The capital structure choices differ across industries, as well as for different companies within the same industry.

252. In addition to being used to weight the expected returns on debt and equity to determine the regulated rate of return, the level of gearing of a benchmark efficient business may also be used: (i) to re-lever asset betas for the purposes of analysing the level of systematic risk across businesses in the estimate of equity beta; and (ii) as a factor in determining an appropriate credit rating for deriving the debt risk premium (**DRP**).

5.1 Approach

253. The Authority considers that gearing should be determined from the average gearing level of a benchmark sample of Australian utility businesses subject to similar risk as the regulated entity in providing the reference services.

254. Companies included in the benchmark sample used to derive a benchmark gearing level for gas regulated businesses must be comparable to the benchmark efficient entity and hence of similar risk. The definition of the benchmark efficient entity was set out in Chapter 2 as follows:

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

255. To be consistent with this definition, the Authority considers that in order to inform the gearing of the benchmark efficient entity, comparators for estimating gearing should have the following characteristics:

- *First*, the company must be a network service provider in the gas and/or electricity industry in Australia – the Authority considers that gas and electricity networks have similar risk.
- *Second*, the company must be listed so that the market value of its equity can be estimated using available data sources such as Bloomberg.
- *Third*, data on the values of debt and equity must be available.

256. The Authority's recent analysis, using the updated data set from 2008 to 2012, indicates that a benchmark gearing level of 60 per cent debt is appropriate. This benchmark gearing of 60 per cent has consistently been used by Australian economic regulators over the past decade for their regulatory decisions.

[77] NGR 87(8).

257. The Authority considers that a 60 per cent debt to total capital ratio is fit for purpose, and will meet the allowed rate of return objective.

5.2 Reasoning

258. A benchmark level of gearing is not directly observable. Current Australian regulatory practice indicates that the benchmark gearing – of 60 per cent debt and 40 per cent equity – is derived from the average of actual gearing levels from a benchmark sample of comparable Australian firms.[78]

259. The Authority has adopted a benchmark gearing of 60/40 together with a benchmark credit rating of BBB/BBB+ in all three regulatory decisions for gas businesses in Western Australia.

260. Current Australian regulatory practices in relation to benchmark gearing are presented in Table 1 below.

5.2.1 Theoretical considerations

261. Assuming a perfect capital market,[79] the value of the firm does not depend on its capital structure. As a consequence, increasing the leverage of a firm's capital structure will not increase the total value of the firm. In their seminal paper on capital structure, Modigliani and Miller (1958)[80] argued that an increase in leverage acts to change the allocation of the cash flows between debt and equity holders. They concluded that in a perfect capital market, the total value of a firm is equal to the market value of the free cash flows generated by its assets and is not affected by its choice of capital structure. This is known as *MM proposition I.*[81]

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

[79] Perfect capital markets assume that securities are fairly priced, there are no tax or transaction costs and cash flows arising from a firms activities are not influenced by their financing choices.

[80] Modigliani, F. and Miller, M. "The Cost of Capital, Corporation Finance and the Theory of Investment," *American Economic Review* (1958).

[81] Berk J., DeMarzo P., and Harford J. 2008, *Fundamentals of Corporate Finance*, Pearson International, p. 489.

Table 1 Benchmark gearing in the Australian regulatory decisions

Regulator	Year	Industry	Gearing [Debt/Total Asset]
ACCC[82]	2011	Fixed Line Services (Telecommunications)	40%
AER[83]	2012	Gas Distribution Network	60%
ERA[84]	2012	Electricity Distribution/Transmission	60%
ERA[85]	2011	Gas Transmission	60%
IPART[86]	2012	Water, sewerage, stormwater drainage and other services	60%
QCA[87]	2012	Water, sewerage, stormwater drainage and other services	60%
ESCOSA[88]	2012	Water, sewerage, stormwater drainage and other services	60%

Source: Compiled by the Economic Regulation Authority

262. When the assumption of a perfect capital market is relaxed to remove the assumption of no taxation, increasing leverage can result in an increase in value to the firm. This increase in value arises because interest payments are costs to the firm and attract a tax deduction. The value generated by this mechanism is known as the interest tax shield, which refers to the reduction in taxes paid due to the tax deductibility of interest payments. As a consequence, *MM proposition I* can be modified to include taxation. A new proposition arises that:[89,90]

> The total value of the levered firm exceeds the value of the firm without leverage due to the present value of the tax savings from debt,
>
> $V^L = V^U + PV(InterestTaxShield)$", which is known as MM proposition II.

263. This modified MM proposition suggests that it is optimal for firms to have a 100 per cent gearing level, given the value generated by the interest tax shield. However, in reality, a firm that has difficulty meeting its interest payments will be in financial

82 Australian Competition and Consumer Commission, *Inquiry to make final access determinations for declared fixed line services — Final report*, July 2011, p. 59.

83 Australian Energy Regulator, *Access Arrangement Information for the ACT, Queanbeyan and Palerang gas distribution network*, 1 July 2010 – 30 June 2015 p. 6.

84 Economic Regulation Authority (Western Australia), *Final decision on proposed revisions to the access arrangement for Western Power*, 2012.

85 Economic Regulation Authority, *Final Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline*, 31 October 2011, p. 158.

86 Independent Pricing and Regulatory Tribunal, *Review of prices for Sydney Water Corporation's water, sewerage, stormwater drainage and other services, From 1 July 2012 to 30 June 2016*, p. 197.

87 Queensland Competition Authority, *Final report, Sunwater irrigation price review 2012–17, Volume 1, May 2012*, p. 498.

88 Essential services commission of South Australia, *Advice on a regulatory rate of return for SA Water—Final advice*, February 2012, p. 49.

89 V^L is the levered value of the firm, V^U is the unlevered value of the firm.

90 Berk J., DeMarzo P., and Harford J. 2008, *Fundamentals of Corporate Finance*, Pearson International, p. 499.

distress and, as a consequence, will face significant costs. A firm cannot maximise its value through leverage as it will be constrained by the possible financial distress costs associated with an increase in leverage. Therefore a trade-off exists between the interest tax shield associated with debt and the increase in possible financial distress costs. The theory relating to this trade-off asserts that the value of a geared firm is equal to its value without leverage, plus the present value of the interest tax shield minus the present value of financial distress costs which can be expressed as follows:[91]

$$V^L = V^U + PV(InterestTaxShield) - PV(FinancialDistressCosts) \quad (2)$$

where

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

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

PV is the 'present value'.

264. An alternative theory on capital structure, known as the *Pecking order theory*, relates the adverse selection problem for investors to the capital structure of a firm. Pecking order theory asserts that investors will demand a discount on equity and debt issuance due to the lack of information they possess, relative to the superior information possessed by the managers of the firm. Managers, on the other hand, will avoid selling equity if they have to discount it to find buyers. The adverse selection problem extends to debt issuance but to a lesser extent than equity. As a consequence, in order for a firm to fund its operations, pecking order theory states that mangers will prefer to use retained earnings, followed by debt, and finally, will choose to issue equity only if needed.[92]

5.2.2 Practical considerations

265. The current Australian regulatory practice is to use an average gearing level determined from a benchmark sample of Australian utility businesses. For example, the AER based its estimate of gearing on this approach in its 2009 WACC Review. The Authority is not aware of any proposals to use an alternative approach. The Authority therefore considers that the benchmark gearing level should be determined from the average gearing level observed from the benchmark sample of comparable firms.

266. In its submission, ATCO Gas (**ATCO**) submitted that determining the benchmark gearing level must be guided by rule 87 of the NGR.[93] ATCO submitted that as gearing represents the financial risk, the level of gearing should replicate that of the benchmark efficient firm. ATCO was of the view that they see no obvious alternative to benchmarking with respect to gearing. In addition, ATCO submitted that both the Australian Energy Regulator (**AER**) and the Authority have required, for over a decade, a gearing of 60:40 debt to equity be used in price

[91] Ibid, p. 504.

[92] Ibid, p. 509.

[93] ATCO Gas Australia, "Response to ERA consultation paper on rate of return guidelines", 28 February 2013.

determinations. As a consequence of this requirement, ATCO stated that regulated service providers have aligned their financial structures to be consistent with this assumption. As such, ATCO submitted it would not expect to see a rapid shift away from the assumed 60:40 gearing ratio.[94]

267. In its submission, Dampier to Bunbury Pipeline (**DBP**) has made similar points to ATCO Gas. In addition, DBP argued that the benchmark gearing level should be guided by Rule 87, and not by any criteria external to the regulatory regime of the NGR. As a consequence, DBP submits that the Authority must assess the degree of risk the service provider faces. Specifically, DBP submits that the Authority must focus on the specific risks to which a pipeline service provider is exposed and not the generic risks.

268. Wesfarmers Chemicals, Energy & Fertilisers submitted that the Authority should consider matching as closely as possible the gearing level of the comparator group used in the development of the benchmark gearing level.[95]

269. The Authority agrees with ATCO's submission that the benchmark gearing of 60 per cent debt has been adopted by the Australian economic regulators for a long period of time. However, the Authority is of the view that the determined benchmark gearing may vary in response to prevailing conditions and practices adopted by comparable businesses with regulated firms. As a consequence, empirical evidence is required to determine if the 60 per cent gearing assumption is still appropriate.

270. The Authority is not convinced by DBP's submission that the Authority should focus on the specific risks of the service provider and not the risks of the benchmark efficient entity of similar risk. The Authority is of the view that it is appropriate to consider an efficient benchmark entity, in order to achieve the allowed rate of return objective.

271. The issue of the service provider's specific risk is addressed in more detail in Chapter 3 – Benchmark efficient entity and risk. The Authority notes there that it is open to any proposal by the service provider as to whether it needs to adjust estimates of the parameters, the return on equity, the return on debt, or the overall rate of return, determined for the benchmark efficient entity, in order to account for the degree of risk of the regulated services.

5.2.3 The Authority's estimates of the benchmark gearing

272. The Authority notes that various estimation methods are available for determining benchmark gearing. These estimation methods were previously examined by the AER in its 2009 WACC Review. Each of these methods is discussed in turn below.

273. First, in its report to the AER in 2009 on the estimated value of equity beta, Associate Professor Henry from the University of Melbourne adopted the book value of net debt,[96] instead of using gross debt. As such, gearing is determined as:

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94 ATCO Gas Australia, "Response to ERA consultation paper on rate of return guidelines", 28 February 2013.

95 Wesfarmers Chemicals, Energy & Fertilisers, "Rate of Return Guidelines Review", 28 February 2013.

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

$$\overline{Gearing} = \frac{\overline{Net\ Debt}}{\overline{Net\ Debt} + \overline{MV\ Equity}} \quad (3)$$

where

(**MV**) represents the market values; and

(**BV**) represents book values.

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

$$\overline{Gearing} = \frac{\overline{BV\ Total\ Debt}}{\overline{BV\ Total\ Debt} + \overline{BV\ Equity}} \quad (4)$$

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

$$\overline{Gearing} = \frac{\overline{BV\ Total\ Debt}}{\overline{BV\ Total\ Debt} + \overline{MV\ Equity}} \quad (5)$$

276. Fourth, the Allen Consulting Group (**ACG**) also proposed to the AER in the 2009 WACC Review that the hybrid approach utilised by Bloomberg should be adjusted for "double leveraging"[97] and stapled securities.[98] However, as an extensive search of Bloomberg has not provided data for these double leveraged and stapled securities, the Authority is of the view that this approach is not fit for purpose in the rate of return guidelines.

277. In determining benchmark gearing for the purpose of this rate of return guidelines for gas businesses in Western Australia, the Authority considers that it is appropriate to rely on empirical evidence regarding the appropriate benchmark gearing level. Furthermore, the Authority considers that all available approaches should be used to inform this judgement. However, the approach proposed by ACG will not be considered due to a lack of data.

278. For consistency between the Authority's estimate of equity beta and the benchmark credit rating, the Authority considers that the starting point is to form a benchmark sample from which the benchmark gearing level can be determined. The Authority is of the view that companies included in the benchmark sample must have three

97 A parent holding company raises funds through debt and acquires equity shares in its subsidiaries using the dividends paid to finance interest repayments on the holding company's debt.

98 Where two or more securities are bound together contractually and listed on an exchange so they cannot be traded separately.

characteristics in order to be useful as comparators for the benchmark efficient entity.

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

279. The Authority considers that it is appropriate to utilise the list of Australian rated utilities published by S&P as a starting point. This is also utilised in the Authority's estimate of the benchmark credit rating.

280. The Authority notes that, for the period from 2008 to 2012, the following 6 companies have satisfied the above three criteria. A description of these companies in the benchmark sample is included in Appendix 4 – Descriptions of companies in the sample.

- APA Group

  (Gas Net Australia (Operations) Pty Ltd/APT Pipelines Ltd)
- Diversified Utility and Energy Trusts (DUET) Group
- Spark Infrastructure

  (The Citipower Trust/Powercor Australia, LLC)
- Hastings Diversified Utility Fund (now APA Group in 2013)

  (ElectraNet Pty Ltd)
- Envestra Ltd; and
- SP AusNet Group

281. The Authority notes that these companies were also included in the sample from which the equity beta is estimated in the Authority's recent analysis in 2013 (see Appendix 4).

282. The Authority has considered the length of time over which gearing data should be analysed. The Authority is of the view that a period of five years is appropriate in this case because it is consistent with a regulatory control period.

Table 2 The average gearing level across various methods, 2008 - 2012

Year	Henry (2009)'s Measure	Standard and Poor's Measure	Bloomberg's Hybrid Approach
2008	60%	70%	62%
2009	67%	69%	67%
2010	60%	66%	63%
2011	54%	62%	57%
2012	52%	65%	54%
Average	**58%**	**66%**	**61%**

Source: Data from Bloomberg and the Economic Regulation Authority's estimate

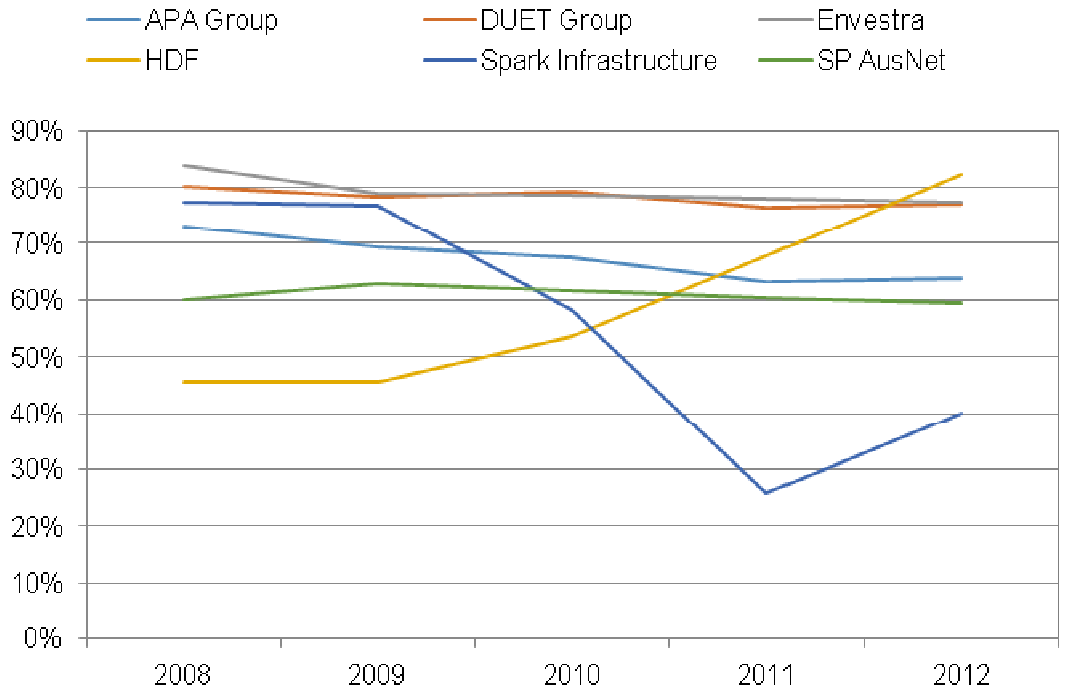
283. Table 2 shows that, over the 5-year period from 2008 to 2012, the average gearing level for the benchmark sample falls within a range of 58 per cent to 66 per cent depending on the approach adopted.

284. Gearing levels for each business in the benchmark sample can vary significantly across years (Figure 1). In addition, it may be observed that the gearing levels utilised in each business can differ quite significantly.

285. DUET group and Envestra have maintained high gearing, with an average gearing over the last 5-year period close to 80 per cent. SP Austnet and APA Group were geared somewhat lower - around 65 per cent. Spark Infrastructure has substantially moderated its gearing level from approximately 75 per cent in 2008 down to approximately 40 per cent in 2012. Conversely, Hasting Diversified Utility Fund (**HDF**) had rapidly increased its gearing from around 45 per cent to over 80 per cent prior to its takeover by APA Group.

286. The Authority notes that there is no significant evidence indicating that the gearing of the benchmark sample has experienced a structural change over the years analysed.

Figure 1 **Gearing for each business in the benchmark sample under the S&P's measure, 2008 - 2012**



Source: Bloomberg

287. Overall, the Authority is of the view that a benchmark gearing level of 60 per cent is appropriate based on the benchmark sample over the last 5 year period. A benchmark gearing of 60 per cent debt has also been consistently adopted by the Authority and other Australian regulators in their previous regulatory decisions.

6 Return on Debt

288. Under the National Gas Rules (**NGR**) the Authority is required to estimate the return on debt in a way that contributes to the achievement of the allowed rate of return objective.[99] Subject to that overarching requirement, the methodology adopted to estimate the return on debt, may, without limitation, be designed to result in the return on debt reflecting:[100]

- 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 when the regulator's decision on the access arrangement for that access arrangement 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.

289. This chapter sets out the approach the Authority will adopt to estimate the return on debt.

6.1 Approach

290. The Authority will base its estimates of the return on debt on a risk premium over and above the risk-free rate, combined with a margin for administrative and hedging costs:

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

Annual update of the return on debt

291. The Authority will annually update the return on debt, to reflect annual updates to the estimate of 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 be set once, at the start of the regulatory period, and apply unchanged for each subsequent regulatory year in the regulatory period.

292. The Authority will publish the resulting return on debt on its website just prior to the commencement of each regulatory year. Revenue and prices to apply in the relevant regulatory year will be adjusted commensurate with the updated return on debt, as part of the annual tariff update, through an automatic update mechanism.

293. The risk free rate will be based on the observed yield of a 5-year term Commonwealth Government Security, averaged over a 40 day period just prior to the regulatory period (see Chapter 7 – Risk free rate of return). This rate will apply in each regulatory year. The 5-year term reflects the present value principle that the term of debt should match the regulatory update period, which is five years.

294. The debt risk premium will be derived from the yield to maturity of an observed sample of bonds issued by comparator firms with similar credit ratings as the

99 NGR 87(8).

100 NGR 87(10).

regulated entity (see Chapter 8 – Benchmark credit rating and Chapter 9 – Debt risk premium). The debt risk premium will be updated annually in recognition that it is difficult for firms to manage risk related to changes in this component of debt, given the lack of hedging instruments.

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

296. As only the estimate of the debt risk premium is updated annually, the approach constitutes a 'partial update' approach. The Authority is of the view that this 'partial update' approach for determining the cost of debt is the approach that best meets the requirements of the National Gas Law (**NGL**), the NGR and the allowed rate of return objective. The approach takes account of the Authority's considerations with regard to efficiency, as well as the stated desire of gas retailers for stability in the return on debt.

Initial revenue path

297. The return on debt estimated for the first regulatory year – based on the sum of the estimates for the first year of the risk-free rate, the debt risk premium and the allowances for debt raising costs and hedging costs – will contribute to the setting of the initial revenue path for remaining years two to five of the regulatory period. As a result, the initial revenue path would be the same as that under the Authority's previous approach, where the return on debt was estimated once – at the start of the regulatory period – and applied for the duration of the regulatory period.

Implementing the annual update

298. The Authority will implement the annual update by setting tariffs – for regulatory years two to five – by including an automatic cash flow adjustment to the 'initial revenue path' in each respective year. The adjustment would account for the difference in revenue arising from the difference in the rate of return on debt under the 'initial revenue path' and the annually updated rate of return on debt in each subsequent, respective regulatory year. The difference in the rate of return on debt will reflect the change in the debt risk premium.

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

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

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 opening Regulated Asset Base in year t; and
t	ranges from year 1 to 5.

300. The 'initial revenue path' would be calculated in line with, among other things, the above formula, using the DRP_t that is estimated for year 1 (that is, DRP_1).

301. 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:

$$\Delta RoD_t = \frac{D}{(D+E)} . \Delta DRP_t . RAB_{Op,t} \quad (6)$$

where

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

302. Under this formula, all return on debt amounts remain unchanged from those provided in the 'initial revenue path' in the final access decision, except for the annual allowance ΔRoD_t reflecting the change in the DRP in the regulatory years 2 to 5.

Alternatives for estimating the return on debt

303. In its review, the Authority considered annual updates of the risk free rate, in addition to the annual updates the debt risk premium, as a means to signal more frequent changes in the cost of debt, and thereby enhance outcomes with respect to economic efficiency.

304. However, the Authority recognised that annually updating the risk free rate could lead to significant fluctuations in tariffs from year to year. The Authority notes that gas retailers have expressed a preference for stable tariffs. This preference has a bearing on the considerations of the Authority with regard to the long term interests of consumers. On this basis, the Authority has decided to only update the debt risk

premium annually, rather than opting for the 'full annual update' of the risk free rate and the debt risk premium.

305. The resulting 'partial annual update' should lead to more stable tariffs through the regulatory period, as it is the risk free rate that drives much of the fluctuations observed over time in the return on debt. The debt risk premium will still be annually updated, but is not expected to change significantly under usual circumstances, such that any resulting volatility in the return on debt over the regulatory period is likely to be reasonably small. The Authority considers that updating the debt risk premium on an annual basis is an important efficiency consideration, given the inability of firms to hedge this component of the return on debt.

306. Nonetheless, the Authority will consider proposals from service providers in their proposed access arrangement revisions for such a 'full annual update', in recognition of the desirable characteristics of this approach with regard to economic efficiency.

307. As changes in the risk free rate drive volatility in the cost of debt most of the time, such a full annual update would be expected to lead to less stable estimates of the return on debt during the regulatory period. The Authority therefore would not expect to accept a full update proposal in place of the partial update approach, unless the service provider was able to demonstrate the widespread support of customer groups. As part of demonstrating customers' support, the Authority expects that the service provider would explore with customer groups a range of alternative, market-based means to manage volatility, as a means to address customer preferences for stability.

308. In the event service providers are able to demonstrate support for the full annual update approach, then:

- the risk free rate would be based on the observed yield of a 1-year term Commonwealth Government Security, averaged over a 40 day period just prior to start of the regulatory year;
  - the 1-year term would be consistent with the present value principle, as the regulatory period on this component would now be one year;
- the debt risk premium will continue to be updated annually;
- the resulting estimate would contribute to the revenue path, and to the automatic annual update formula in each respective regulatory year;
- the Authority will implement the annual update by setting tariffs, for regulatory years two to five, by including an automatic cash flow adjustment to the revenue path in each relevant year, using a similar formula to that set out above at equation 6.

6.2 Reasoning

309. In what follows, the Authority considers the options for estimating the return on debt, and evaluates these in light of the requirements of the NGR.

6.2.1.1 Broad approaches

310. There are three broad approaches for estimating the return on debt:[101]

- observing the cost of debt of companies with comparable risk to the benchmark efficient entity in totality, reflecting either embedded debt costs or the yield on recent bond issuances;
- using analysts' forecasts of the cost of debt relating to the regulated firm;
- estimating the cost of debt for the benchmark efficient entity through a model of the contributing components to their overall cost of debt.

311. With regard to the first approach, the Authority notes that it could observe the total return on debt for companies of comparable risk.[102] However, observations for the total cost of debt will have differing underlying risk free rates, given the different terms to maturity. This matters because the Authority considers that basing the return on debt – as far as possible – on a term equivalent to that of the regulatory period is an important consideration for achieving an allowed rate of return that does not over-compensate or under-compensate the service provider (see Appendix 2 – The present value principle). The resulting differences could be significant over the life of the investment, and would not be consistent with allowing reasonable opportunity for the service provider to recover its efficient costs. As a result, the approach would not be in the long term interests of consumers and so would not achieve the National Gas Objective (**NGO**).

312. While forecasts of the risk free rate component may be available, the Authority notes that forecasts relating to the entire cost of debt are usually not available.[103] Estimation of the return on debt therefore requires the use of a model.

313. This leads the Authority to consider that an estimate based on a model of the cost of debt is likely to best achieve the allowed rate of return objective. The Authority's approach to date has been to base the cost of debt on two components, the risk free rate, and the risk premium over and above the risk free rate, plus an allowance for the administrative costs of issuing debt:

Return on Debt = Risk Free Rate + Debt Risk Premium + Debt raising costs

314. To reflect prevailing conditions, in past decisions the Authority has used an estimate of the risk free rate derived just prior to the regulatory period – the so-called 'on-the-day' approach. The debt risk premium has been derived based on an observed sample of comparator firms with similar credit ratings as the benchmark efficient entity. Debt raising costs have been based on an allowance to reflect the direct costs of the average annual issuance (for further detail on debt raising costs, see Chapter 13 – Debt and equity raising costs).

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101 See, for example, DBNGP (WA) Transmission Pty Ltd 2013, *Response to Consultation Paper*, Attachment 4 (Brattle Group, Estimating the cost of debt), www.erawa.com.au, 13 March, p. 13.

102 In line with this view, a number of stakeholders considered that the NGR explicitly provide for more than one approach to estimating the return on debt (ATCO Gas Australia 2013, *Response to ERA consultation paper on rate of return guidelines*, www.erawa.com.au, 28 February; Energy Networks Association 2013, *Response to the AER Rate of Return Guidelines- Issues Paper*, www.erawa.com.au, February. p. 27). In this context, stakeholders suggested that the risk free rate and debt risk premium do not need to be estimated explicitly.

103 DBNGP (WA) Transmission Pty Ltd 2013, *Response to Consultation Paper*, Attachment 4 (Brattle Group, Estimating the cost of debt), www.erawa.com.au, 13 March, p. 14.

315. Dampier Bunbury Pipeline (**DBP**) submitted that reliance on the credit rating for establishing the debt risk of the benchmark efficient entity is no longer tenable, given the requirements of the allowed rate of return objective.[104] However, the Authority considers that a similar credit rating provides for a similar degree of risk as the benchmark efficient entity in providing the reference services. As noted in Chapter 3 – The benchmark efficient entity and risk, the Authority will consider adjusting the parameters, the return on equity, the return on debt, or the overall rate of return, in order to account for any material difference in risks identified and substantiated by the regulated entity relating to the provision of the reference services, as compared to the risks associated with the benchmark efficient entity.

316. Goldfields Gas Transmission (**GGT**) submitted that the model proposed by the Authority relates to the expected cost of debt, or that otherwise the model is a tautology.[105] However, the model is not based on the expected cost of debt, but rather the proxy for the expected cost of debt provided by prevailing rates and observations of comparator firms. The Authority considers that the model is a widely accepted approach to estimating the return on debt. As noted by the Brattle Group:[106]

> One interpretation of the method is that the current risk-free rate proxies for the expected risk-free rate over the access period and that the debt premium remains constant, so that the sum of these two figures proxies for the forecasted cost of debt. In a sense, the use of the risk-free rate normalizes the cost of debt estimate.

317. Furthermore, the Authority considers that prevailing rates are the best predictor for future rates (see Appendix 5 – The Diebold Mariano test). The Authority considers that prevailing rates are consistent with efficient financing costs and economic efficiency more generally, and hence meet the allowed rate of return objective (this is considered in greater detail below).

318. The estimate of the debt risk premium is provided by the observed sample of bonds through the Authority's bond yield approach. The Authority considers that its bond yield approach provides for an internally consistent method for estimating the debt risk premium (see Chapter 9 – Debt risk premium). The Authority considers that the bond yield approach provides for a current estimate of the prevailing yield to maturity – which in turn is the best proxy for forward looking yield – of the benchmark efficient entity's staggered debt portfolio.[107]

319. The Authority has considered other approaches for estimating the debt risk premium and concluded that these are unlikely to be robust without additional data (see Chapter 9 – Debt risk premium).

320. The Authority remains of the view that the components approach estimates the return on debt in a way that best meets the allowed rate of return objective, consistent with the risks for the benchmark efficient entity.

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104 DBNGP (WA) Transmission Pty Ltd 2013, *Response to Consultation Paper*, www.erawa.com.au, 10 March, p. 14.

105 Goldfields Gas Transmission Pty Ltd 2013, *Submission on the ERA's Draft Rate of Return Guidelines*, www.erawa.com.au, 7 October, p. 65.

106 DBNGP (WA) Transmission Pty Ltd 2013, *Response to Consultation Paper*, Attachment 4 (Brattle Group, Estimating the cost of debt), www.erawa.com.au, 13 March, p. 13.

107 The Authority notes that GGT has questioned whether the term at issuance, rather than the average term to maturity, is relevant for estimating the return on debt. This issue is considered in Chapter 8 – Debt risk premium.

321. GGT also submitted that the Authority is placing excessive reliance on a single model for estimating the return on debt, implying a preference by GGT for multiple methods, which should include a trailing average 'portfolio' approach.[108] The Authority's consideration of the on-the-day versus portfolio approaches is considered in what follows.

6.2.1.2 On-the-day versus portfolio approaches

322. The Authority's current approach to estimating the return of debt is the 'on-the-day' approach, which captures prevailing conditions in markets for debt. The current approach estimates the return on debt from the sum of:

- the 5 year risk free rate, averaged over 20 days just prior to the commencement of the regulatory period; and
- an estimate of the debt risk premium based on yield to maturity of the average of a sample of bonds from firms with similar risk characteristics to the benchmark firm.

323. The recent changes to the National Gas Rules also require the Authority to consider the merits of a 'portfolio' approach, either based on:[109]

- a trailing average cost of debt – a long term average of historic outcomes on the overall cost of debt; or
- a hybrid approach – a base rate derived consistent with the on-the-day approach, plus a longer term trailing average of the debt risk premium.

324. A further consideration flowing from the NGR changes relates to whether to adopt a single estimate once every five years, at the regulatory reset, or to update the cost of debt estimate annually.[110]

6.2.1.3 Efficiency considerations

325. The Authority has considered the efficiency properties of the alternative approaches to estimating the cost of debt (see Appendix 3 – Economic efficiency and the return on debt). This consideration is informed by the requirements of the NGL, the NGO, the Revenue and Pricing Principles, and the allowed rate of return objective in the NGR, which are discussed in Chapter 2 – The broad regulatory framework.

326. The economic efficiency that results from the alternative approaches may be considered in terms of three components:

- Productive efficiency is achieved when firms in the economy produce any given level of output at lowest input cost. The following outcomes will contribute to the achievement of productive efficiency:
  - The regulated firm funds its investments utilising the lowest input cost of debt, which reflects the prevailing interest rates that are consistent with efficient financing costs.[111]

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108 Goldfields Gas Transmission Pty Ltd 2013, *Submission on the ERA's Draft Rate of Return Guidelines*, www.erawa.com.au, 7 October, p. 65.

109 NGR 87(10).

110 NGR 87(9).

111 The Authority agrees with DBP when it states that efficient (least cost) financing is an important component of productive efficiency (DBNGP (WA) Transmission Pty Ltd 2013, *ERA Draft Rate of Return Guidelines Response,* www.erawa.com.au, 7 October, p. 30). However, contrary to DBP's claim, the

- The prevailing cost of capital will also influence the decisions made by the regulated firm with regard to its use of factors of production. While investments in major capital assets owned by the firm are sunk in the short run, it may be possible to substitute capital for labour – at the margin – over the medium term. Appropriate pricing for the cost of capital will contribute to efficient decision making in this regard during the regulatory period.

- Allocative efficiency is achieved when the economy produces only those goods and services which are most valued by society. This occurs at the point where the marginal cost of producing a good or service equals the willingness to pay for that good or service, which will be reflected in marginal revenue.[112]

  - The choice between investment and consumption in the economy needs to be based on the relative value of that investment to society as a whole. This requires that alternative investments throughout the economy, including by the regulated firm, are based on the prevailing cost of funds. The cost of capital used by regulated firms – when deciding to invest in additional infrastructure – needs to be updated as market conditions change.

- Dynamic efficiency is achieved when firms make those investments which maximise the returns to the firm and society as a whole over time.

  - The firm's investment decision should be based on the cost of capital expected to prevail over the life of the investment. Again, the cost of capital used by regulated firms – when deciding to invest in additional infrastructure – needs to be updated as market conditions change.

327. DBP suggested that the Revenue and Pricing Principles – which require the Authority to provide 'effective incentives in order to promote economic efficiency' in investment, provision of pipeline services and use of the pipeline – do not relate to allocative and dynamic efficiency, as 'these are economy-wide concepts; one cannot speak about a firm, in isolation, being allocatively efficient'.[113] GGT and DBP suggested that the NGR do not refer to these concepts, and that too much focus on these 'abstract concepts' can result in not meeting the rules.[114]

328. The Authority considers that all three efficiency elements are important elements of economic efficiency, and therefore are important considerations under the NGL. Consistent with this view, the Authority notes that the Productivity Commission, in

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Authority considers that the prediction performance of the return on debt established by the regulator is important for the broader productive efficiency of the regulated firm (see Section 6.2.1.4).

112 Users of the regulated firm's services - both upstream and downstream – make production decisions that are based on efficient prices for the regulated service. At any particular point in time, the capital used for producing the regulated firm's output is 'sunk', and therefore does not contribute to (variable) marginal costs. To this extent, use of a regulated firm's service therefore should not depend on the cost of debt. However, users need to make efficient investment decisions for the future, and here it is the full cost of the network service input that is relevant, including the fixed as well as the variable costs. On this basis, the prevailing cost of debt is important for users' decision making, and for allocative efficiency.

113 DBNGP (WA) Transmission Pty Ltd 2013, *Submission to the ERA Benchmark Cost of Debt Secretariat Working Paper*, www.erawa.com.au, 1 August, p. 6.

114 DBNGP (WA) Transmission Pty Ltd 2013, *ERA Cost of Debt and Equity Workshop Papers: DBP Response*, www.erawa.com.au, p. 6; Goldfields Gas Transmission, *Submission responding to ERA cost of debt working paper,* July 2013. More recently, DBP seem to accept that economic efficiency concepts are relevant to understanding the rules (see DBNGP (WA) Transmission Pty Ltd 2013, *ERA Cost of Debt and Equity Workshop Papers: DBP Response*, www.erawa.com.au, 19 November, p. 14).

its recent draft report on the National Access Regime, explicitly identified these aspects when considering economic efficiency in relation to monopoly infrastructure.[115]

329. Further, the Authority considers that economic efficiency cannot be considered in terms of a single firm or a single group of consumers. Such a partial approach may be efficient in isolation, but still leave net efficiency gains once the full general equilibrium considerations are considered. The Authority is required to achieve efficient outcomes for the long term interests of consumers of natural gas. Those consumers of natural gas are engaged with the broader economy. Hence their long term interests take into account that engagement with the broader economy. This requires efficient pricing of gas transmission and distribution network services, consistent with outcomes that would be observed in effectively competitive markets.[116]

330. In this context, the Authority also rejects GGT's view that neither NGR 87, nor the National Gas Objective set out in section 23 of the NGL contains any requirement for assessment of the approaches based on efficiency criteria.[117] In response, the Authority notes that it was always intended that the NGL and the NGO promote economic efficiency broadly, as this is in the long term interests of consumers:[118]:

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

331. GGT also noted that prices set for pipeline services are usually multi-part prices, and not prices which equate to the marginal cost of service provision. However, the Authority is of the view that generally the variable part of pricing will rise or fall in response to the overall revenue requirement and hence that efficient financing costs will have an impact at the margin, and consequently on upstream and downstream allocative efficiency.

332. The Authority considers that the longer term interests of consumers, as set out in the National Gas Objective, are clearly served by promoting economic efficiency, not just in terms of investment and supply of pipeline services, but also for upstream and downstream use of energy and efficiency in the economy more broadly.

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115 Productivity Commission 2013, *National Access Regime Draft Report*, www.pc.gov.au, p. 81.

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

117 Goldfields Gas Transmission, *Submission responding to ERA cost of debt working paper,* July 2013.

118 National Gas (South Australia) Bill 2008, *Second Reading Speech*, www.ret.gov.au, p. 4.

6.2.1.4 Prediction performance

333. The Authority considers that the on-the-day approach to estimating the cost of debt has better efficiency properties as compared to either of the portfolio approaches.

334. One reason the on-the-day approach is more efficient is because it is a better forward predictor of the prevailing interest rate for each year of the regulatory period (see Appendix 5 – The Diebold Mariano test). This prediction property has important implications for ensuring efficient investment, as it is the regulated return on debt for the regulatory period that will condition the firm's investment decision, not the firm's actual cost of debt.

335. The firm will apply the expected regulated rate of return to its operating and investment decisions, as this will be its opportunity cost of debt. With regard to investment, it is the regulated return on debt over the regulatory period (and to a lesser degree the regulated return expected over the remaining near future periods), that will have greatest influence on the hurdle rate for investment for longer lived assets.[119]

336. The corollary is that if the firm's actual expected cost of debt at the time of the investment is below the expected regulated rate, then it would expect to receive an extraordinary return, and would have an incentive to over-invest, compared to the economically efficient outcome. On the other hand, if the firm's actual cost of debt at the time of the investment was above the regulated rate, then it would have an incentive to under-invest, compared to the economically efficient outcome.

337. In summary, efficient financing practice requires the financing cost on which an investment is made to be the prevailing forward looking rate. To do otherwise raises the potential that the regulated firm will make investments that are less economically efficient. The clear outcome is that the closer the regulated return on debt is to the prevailing cost of debt in the economy at any point in time, the more effective the incentives, and the more efficient the investment decisions by the regulated firm will be, all other things being equal.

338. The Authority notes that DBP challenged the Authority's assessment – which was based on the Diebold Mariano (**DM**) tests – that the predictive power of the on-the-day approach is superior to the trailing average.[120] However, the Authority rejects this contention (see Appendix 5 – The Diebold Mariano test).[121]

339. DBP also considered that the trailing average is a 'combination of several predictions'.[122] DBP considered that predictive ability depends on the point in the interest rate cycle.[123] Further, DBP stated that:[124]

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119 The cost of new debt relating to any investment in a regulated year will be the firm's actual cost of debt. However, the return on debt will provide the revenue to cover that cost of debt. The regulated firms will make decisions based on the latter, as the regulated return on debt will determine whether the investment provides a normal profit to the firm (or not) in the first instance.

120 DBNGP (WA) Transmission Pty Ltd 2013, *Submission to the ERA Benchmark Cost of Debt Secretariat Working Paper*, www.erawa.com.au, p. 3.

121 A peer review of Appendix 7 by Data Analysis Australia confirmed that the Authority had applied the DM test correctly, and that its findings about the prediction superiority of the on-the-day approach are supported. See Data Analysis Australia 2013, *Review of Risk Free Rate Calculation*, www.erawa.com.au.

122 DBNGP (WA) Transmission Pty Ltd 2013, *Submission to the ERA Benchmark Cost of Debt Secretariat Working Paper*, www.erawa.com.au, p. 12.

> If interest rates are a true random walk, then neither approach will predict accurately, because by definition a random walk is not predictable. If interest rates follow a random walk with a particular linear trend (upwards or downwards), then the information from the several observations in the trailing average is redundant as only the most recent information is useful in predicting where the series will go next. However, if interest rates follow a random walk with a more complex trend (mean-reverting, say, or cyclical) then the greater number of observations in the moving average may actually provide useful information about the future that is missing if only an on-the-day approach is used.

340. However, the Authority considers that it is accepted that the current price is the best predictor of the price in the future where the data follows a random walk. This view is consistent with the Efficient Market Hypothesis (**EMH**). The Authority's statistical analysis supports this finding (refer to Appendix 16 – Is the return on equity stable?).

341. The EMH also provides theoretical support for this view.[125] The EMH concept has its foundations in the idea that capital markets are efficient. This involves the market reacting to new information in an instantaneous and unbiased manner. A corollary of this view is that investors cannot earn abnormal returns by using old 'news' to guide investment decisions. Although it has been acknowledged that the hypothesis has its limitations, it is well accepted. Ball (1994) noted that:[126]

> 'relative to the uninformed views that preceded the immensely valuable work that was done in the 1960s and 1970s we know much, even though the extensive anomalies literature of the 1980s continually reminds us that we also know little.'

342. GGT is of the view that the Authority's use of the DM test confirms what is clear from an inspection of the data: that an on-the day forecast will have a higher predictive power than the trailing average approach in the case where the rate of return has a trend.[127] GGT has concerns with those certain sub-periods within the Authority's data set which have no clear trend. GGT argued that if this were to occur before an access arrangement, no general conclusion could be drawn as to the superior predictive performance of the 'on-the-day' approach. In addition, GGT noted that no analysis has been performed by the ERA on the debt risk premium component of the cost of debt.

343. The Authority's response is that the longest possible period of the risk-free rate was adopted in the DM test to compare the predictive efficiency of various averaging

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123 DBNGP (WA) Transmission Pty Ltd 2013, *Submission to the ERA Benchmark Cost of Debt Secretariat Working Paper*, www.erawa.com.au, p. 13.

124 DBNGP (WA) Transmission Pty Ltd 2013, *Submission to the ERA Benchmark Cost of Debt Secretariat Working Paper*, www.erawa.com.au, p. 12.

125 Fama (1970) reviewed the theory and empirical work on efficient capital markets, defining an efficient capital market as that in which prices always 'fully reflect' all available information (see Fama E.F 1970, 'Efficient Capital Markets : A Review of Theory and Empirical Work', *The Journal of Finance,* Vol 25 No. 2, p. 383-417). The EMH was tested using three information sets:

- weak-form tests used historical prices;
- semi-strong tests used publically available information such as announcements of stock splits, dividends;
- strong-form tests were based on privately available information.

The first two were not rejected based on available evidence, while some evidence existed against strong-form efficiency.

126 Ball, R., (1994), *The development, accomplishments and limitations of the theory of stock market efficiency'*.

127 Goldfields Gas Transmission 2013, , *Submission responding to ERA Cost of Debt Working Paper*, www.erawa.com.au, p. 4.

periods. The Authority also notes that there is limited data to enable an assessment of the historic behaviour of the debt risk premium, but that it is the risk free rate that drives much of the behaviour of the return on debt.[128] The Authority is of the view that the existence of sub-periods of data for the risk free rate with a specific trend is not a concern because the purpose of the DM test is to identify the best approach given the long term behaviour of interest rates. The Authority notes that apparent trends are common in random walk series, ex post, but that we are concerned with prediction, ex ante. Under a random walk, the most recent observation provides the best predictor for the near future.

344. DBP in its submission on the Draft Guidelines acknowledges that the on-the-day approach is superior in terms of allocative efficiency, but considers that the trailing average approach is superior in terms of productive efficiency.[129] DBP suggests that the work of Lipsey and Lancaster on the theory of the second best indicates that the net benefits of any trade off between productive and allocative efficiency are not clear, such that neither approach can be considered superior. The Authority considers arguments in relation to the theory of the second best in more detail in Chapter 3 – Benchmark efficient entity and risk. The Authority notes there that first best policy approaches to correcting market failures that have clear and significant benefits – such as removal of monopoly pricing – are likely to be welfare enhancing, despite lack of information about the exact second best optima.

345. Furthermore, the Authority considers that the on-the-day approach is superior in terms of productive efficiency for the firm, in addition to being more allocatively efficient. The Authority does not agree that there is a trade off. The on-the-day approach is productively efficient because it provides for a prevailing cost of debt which is closer to the fluctuating rates faced by other firms in the economy. As noted above, efficient financing practice requires the financing cost on which an investment is made to be the prevailing forward looking rate. To do otherwise risks the firm making investments in ways that are not productively efficient, and to conduct its operations in ways that might use capital in a less than optimal way, for example by employing other factors of production, such as labour, more or less intensively.[130]

346. Figure 2 and Figure 3 illustrate this point about the potential for portfolio (trailing average) approaches to lead to potential distortions in economic efficiency, by estimating the regulated return on debt under each of the two approaches, for the

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128 The Authority notes some limited evidence since 2001 from Bloomberg Fair Value Curves suggesting stationarity for the overall return on debt (see Appendix 29 – Other relevant material). However, this is too short a period to make inferences as to stationarity. Nevertheless, in the event that the return on debt was stationary, then the debt risk premium, like the market risk premium, would not be a stationary time series, unless the risk free rate and the return on debt were co-integrated. Overall, it is the Authority's view that the debt risk premium for regulated entities are generally stable, and that fluctuations in the prevailing risk free rate drives the fluctuations in the return on debt.

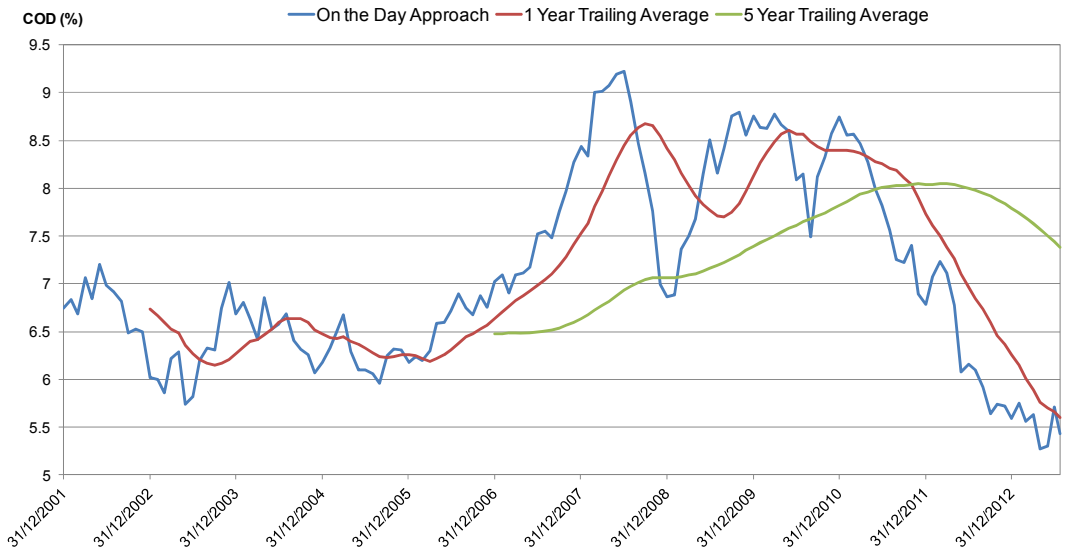
129 DBNGP (WA) Transmission Pty Ltd 2013, *ERA Draft Rate of Return Guidelines Response,* www.erawa.com.au, 7 October, p. 29.

130 As noted by QTC (Queensland Treasury Corporation 2013, *Rate of Return Guidelines Consultation Paper*, www.aer.gov.au, 21 June, p. 8):

> In QTC's view, it is inappropriate to incorporate, by means of simple average return on debt, a bias towards under-investment when rates are above the simple average (and vice versa) given the potential for structural changes in interest rates. The current interest rate at any point in time is the best estimate of future interest rates, not the long term average rate, and any difference between the prevailing rate and the average rate is not evidence of mis-pricing in the market. It is not possible at any point in time to determine whether rates will revert to their long run average, or move to a new level, and a system which compensates borrowings at a historic average is likely to produce situations where investment decisions are inappropriately influenced by the actual cost of debt versus a deemed return on debt based on historical data.

period from 2001 to 2013.[131] The observed gap between a 5-year trailing average, and prevailing rates, for debt with a 5-year term, approached 200 basis points earlier in 2013.[132] This difference, if fully passed on to gas consumers, would reflect the mismatch timing risk that has been transferred.[133]

Figure 2 Estimates of the Cost of Debt: the "On-the-day" Approach versus the 5-year Trailing Average Approach, 2001 - 2013



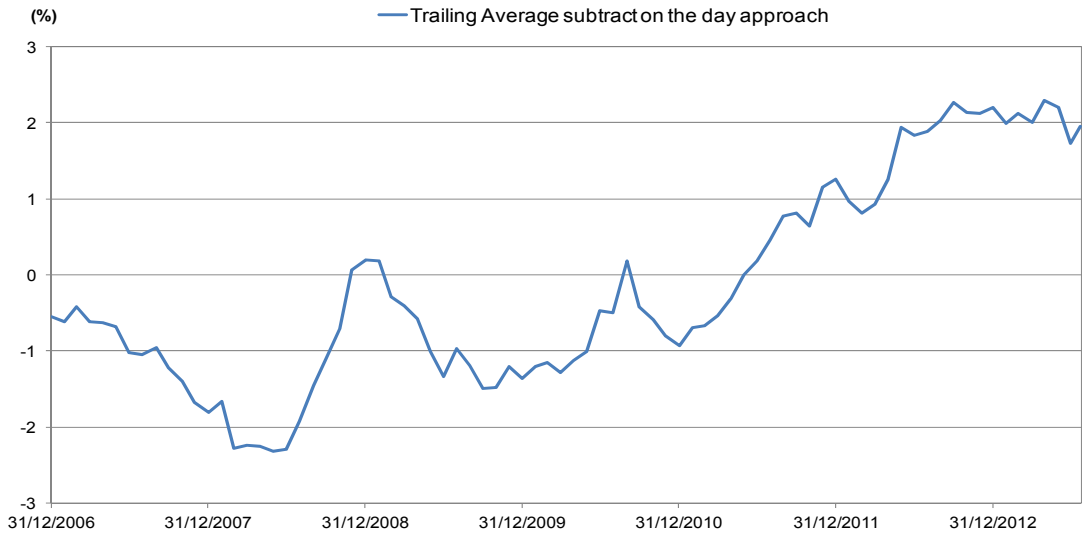
Source: Bloomberg and ERA analysis.

131 This estimate includes a debt risk premium component. To illustrate the difference between the estimates of the cost of debt arising from the 'on-the-day' approach and a 5-year 'trailing average' approach, the Authority used Bloomberg's 5-year BBB Fair Value Curve (Bloomberg Ticker: C3565Y Index – BBB CR 5 YR Index) as a proxy for the cost of debt. The FVC was used for this comparison as Bloomberg currently does not provide a facility for collecting information on historical bonds, and it is difficult to apply the bond yield approach on a historical basis. The Authority calculated the estimates of the cost of debt from the "on-the-day" approach of the Bloomberg's 5-year BBB FVC by using an averaging period of 20 trading days prior to the end of each month. In relation to the 5-year trailing average, the cost of debt is estimated as a simple average of the cost of debt over the period of 5 years. This estimate is then "rolled-over" to include one more month of new data by dropping the oldest month of data in the sample. For example, the first estimate of the 5-year trailing average covers the period from 1 January 2010 to 31 December 2010. The second estimate will cover the 5-year period from 1 February 2010 to 31 January 2011 and so on. The differences between the estimates of the cost of debt using these two approaches for the period from 2001 to 2013 are presented in Figure 2.

132 The Authority notes that using the 5-year trailing average approach would result in a maximum difference of 229 basis points over the prevailing cost of debt, which occurred on 30 April 2013. Conversely, the 5-year trailing average approach underestimated the prevailing cost of debt by up to 230 basis points which occurred on 29 Feb 2008.

133 The Authority notes that the trailing average approach may reduce hedging costs and debt risk premia for regulated firms. Once this was observed in the benchmark sample and passed through, this element of the subsidy to regulated firms would be reduced to a degree.

Figure 3 Differences of Estimates of the Cost of Debt under the Two Approaches



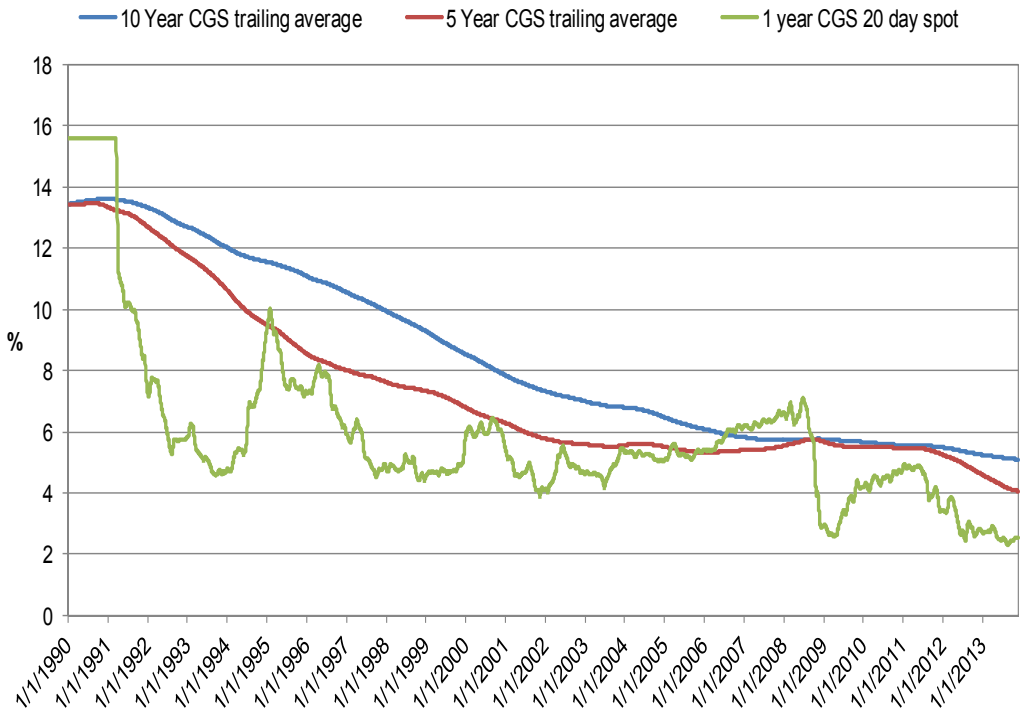
Source: Bloomberg and ERA analysis.

347. The Authority also examined the behaviour of the risk free rate, derived from Commonwealth Government Securities (**CGS**), for:

- a prevailing 40 days averaging period estimate of a CGS with a 1-year term – as would apply under an annual update;
- a five year simple trailing average of a CGS with a 5-year term; and
- a 10 year simple trailing average of a CGS with a 10-year term.

348. The result gives an indication of the differences in the cost of debt that would apply under a prevailing rates approach, annually updated, and a trailing average of between five and 10 years (Figure 4). This is only an indication as it does not include a debt risk premium, so any fluctuations arising from that component are not included. The most recent data for November 2013 suggest a difference exceeding 150 basis points for the five year trailing average and 250 basis points for the 10 year trailing average. Years when the difference exceeded 500 basis points may also be observed in the early 1990s.

Figure 4 Prevailing 1 year CGS index and 5 and 10 year trailing average CGS index



Source: ERA analysis and Bloomberg data

349. The higher interest rate under the trailing average approach in early 2013 would have come at a time when Australian consumers and firms were facing more difficult economic conditions, which prompted the Reserve Bank of Australia to lower the cash rate. It is not clear why shareholders in regulated utilities should be insulated from these risks, via a transfer of the risk to consumers.

6.2.1.5 Staggering of a portfolio of debt

350. The on-the-day approach has been criticised on the grounds that it somehow does not allow firms to establish a debt portfolio with maturities that are staggered over time in order to avoid 'refinancing risk' (staggering is also known as debt laddering).[134] Hence, stakeholders have argued that the approach is not replicable.[135] The Authority considers that this view is incorrect.

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134 The Authority notes DBP's argument that staggered debt is not adopted to avert refinancing risk (see DBNGP (WA) Transmission Pty Ltd 2013, *Submission to the ERA Benchmark Cost of Debt Secretariat Working Paper*, www.erawa.com.au, p. 14). DBP also stated that it considered that refinancing risk is borne by the borrower and that the default risk is born by the lender.

The Authority notes that while default risk is borne by the lender, it will pass on this expected cost to the borrower when the credit spread is determined. As such, the borrower also bears the consequences of its default risk. Similarly, a lender will take refinancing risk into account in the pricing of debt.

The Authority is of the view that both likelihood of default risk and refinancing risk is considered in the assigned credit rating by rating agencies. As such, the Authority's bond-yield approach is a valid approach to determine the cost of debt for regulated businesses with similar risk of a benchmark efficient firm – which is directly observed from the benchmark sample.

135 See for example, ATCO 2013, *Economic Regulation Authority's Draft Rate of Return Guidelines: response to discussion papers and stakeholder workshop*, www.erawa.com.au, 19 November, p. 5; DBNGP (WA) Transmission Pty Ltd 2013, *ERA Cost of Debt and Equity Workshop Papers: DBP Response,* www.erawa.com.au, 19 November, p. 15.

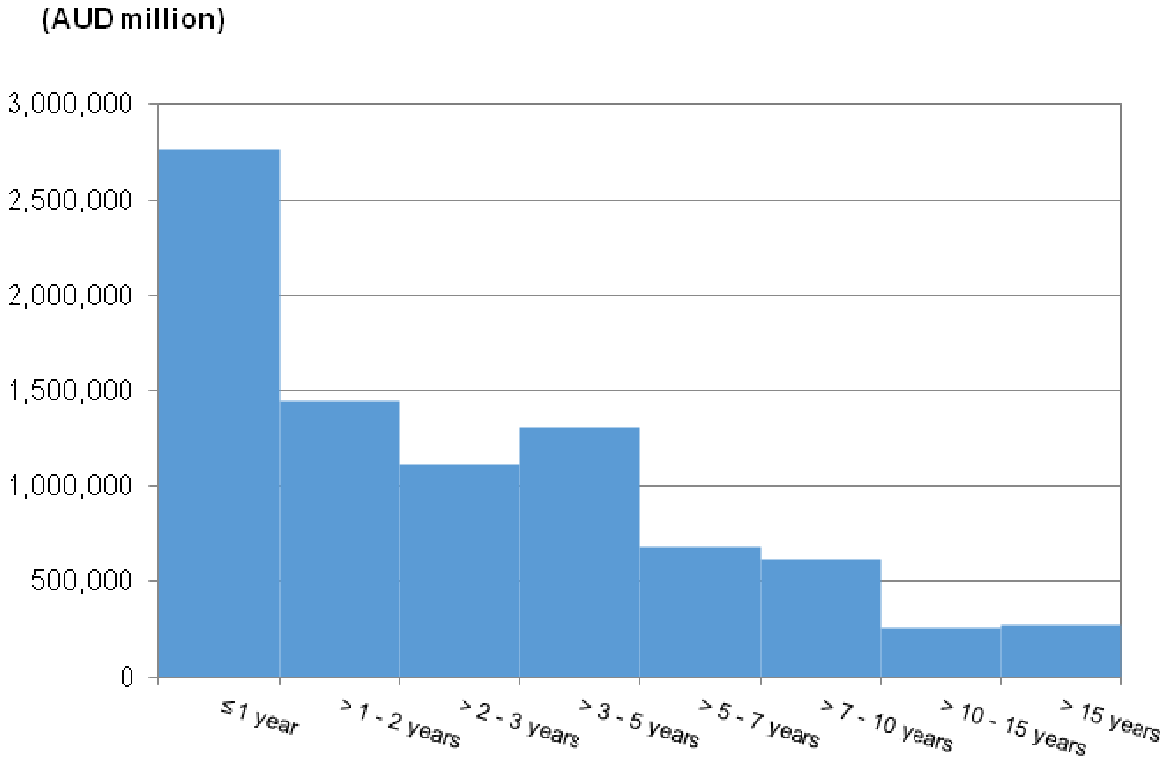
351. The Authority notes that this lack of replicability is predicated on the idea that the firm is unable to hedge its existing portfolio of staggered debt to reflect exactly the return on debt estimated through the on-the-day approach. The implied view is that the regulated firm must issue all of its debt in the averaging period, just prior to the regulatory period.

352. However, the Authority considers that regulated firms may issue debt at any time, and may hedge the risk free rate by undertaking interest rate swaps, in order to convert to the rate that reflects the prevailing on-the-day rate adopted as the regulatory return on debt.[136]

353. The Authority has not been presented with concrete evidence of impediments to hedging the risk free rate, through the use of interest rate swaps.

354. First, the swaps market is extremely liquid. The Australian Financial Markets Association (AFMA) provides an indication as to the liquidity of the interest rate swap market in Australia by collecting data from market participants on the total amount of Interest Rate Swaps Outstanding.[137] Of interest is the amount of fixed for floating interest rate swaps available as this allows regulated entities to hedge their interest rate exposure. In particular, the Authority notes that the largest volume of interest rate swaps outstanding occurs for a maturity of less than 1 year, implying that firms are easily able to hedge on an annual basis (Figure 5).

Figure 5 Fixed for Floating AUD Interest Rate Swaps Outstanding as at 31 May 2012.



Source: AFMA, ERA analysis.

136 The Authority notes that use of interest rate swaps will hedge both the risk free rate and a component of the debt risk premium. See Appendix 5 and also Chairmont Consulting 2013, *Comparative Hedging Analysis*, www.erawa.com.au.

137 Australian Financial Markets Association 2013, Australia, accessed 23 July 2013, www.afma.com.au/data/afmr.html.

355. Second, the Authority notes that its consultant, Chairmont Consulting, advises that transacting $2 billion of swaps in 20 days, in normal circumstances, would not 'move the market' price of swaps.[138] This equates to an average of $100 million of swaps per day.

356. Third, Frontier Economics express the view that:[139]

> ...it does not seem to us that periodic resetting of allowed returns by a regulator should compel businesses to refinance all their debt all at once. The important question is whether the businesses are able to hedge interest rate risk and refinancing risk effectively. It is not obvious to us that large networks are necessarily disadvantaged in terms of their ability to manage these risks using instruments such as IRSs, but we remain open to considering evidence to the contrary.

357. The Authority considers that these points undermine DBP's contention that, in funding large tranches of debt, a regulated firm will only deal with a small number of banks, and that somehow this constrains the amount of swaps that can be written within a given time period.[140] DBP makes this assertion, but provides no evidence in support.

358. Similarly, the Authority has also noted Western Australia Treasury Corporation's (**WATC**) views.[141] In particular, WATC has suggested that Chairmont Consulting did not consider the impact of hedging notional amounts over $1bn over a 20 day period would move the swap rate and this should be considered a transaction cost over and above that of 'efficient financing'.[142]

359. The Authority notes that the practice of staggering debt may increase 'mismatch timing risk'. As noted above, mismatch timing risk, also known as interest rate risk, derives from having revenue based on an assumption of the cost of debt that differs from the cost of debt that the firm actually incurs.

360. There are limited instruments for any firm seeking to hedge the debt risk premium. The Authority therefore considers that the potential for mismatch timing risk in relation to the debt risk premium applies to both regulated and non-regulated firms alike.[143]

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138 Chairmont Consulting 2013, *Comparative Hedging Analysis*, www.erawa.com.au, p. 19.

139 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. 36.

140 DBNGP (WA) Transmission Pty Ltd 2013, *Submission to the ERA Benchmark Cost of Debt Secretariat Working Paper*, www.erawa.com.au, p. 19.

141 Western Australian Treasury Corporation (WATC) in its submission suggested that the estimate of the DRP and the cost should account for the size of the regulated business, and the volume of the debt that must be refinanced (see Western Australian Treasury Corporation 2013, *Rate of Return Guidelines Review*, www.erawa.com.au, p. 1). WATC argued that liquidity constraints will not allow large entities to refinance or restructure (swap) all their debt within a short time window of 20 trading days. As such, WATC argued that the regulated businesses are left with significant interest rate risk. WATC also suggested that this constraint potentially gives significant power to the financial counterparties to engage in opportunistic pricing.

142 Western Australian Treasury Corporation, *Response to the Secretariat's Working Paper "On the benchmark cost of debt: Efficiency considerations",* July 2013. p. 1.

143 In this context, the Authority does not accept DBP's contention that mismatch pricing risk does not exist, whether it be for the monopoly firm or the competitive firm (DBNGP (WA) Transmission Pty Ltd 2013, *Submission to the ERA Benchmark Cost of Debt Secretariat Working Paper*, www.erawa.com.au, p. 13.). DBP suggest that mismatch timing risk has no validity from a theoretical perspective for monopoly business, as the firm has pricing power, or for pure competition, as pricing is always at marginal cost.[143] There needs to be some degree of fixed cost. DBP consider that mismatch timing risk can only occur

361. Firms may choose not to hedge, but to use other instruments to manage their mismatch pricing risk. For example, many firms include options in their debt issuance, to allow them to call back debt when it is more expensive than the prevailing rate, and then reissue new debt at the lower prevailing rate. These call options assist firms to minimise their financing costs, and are available to regulated and unregulated firms alike. The use of such instruments is productively efficient and part of efficient financing practices.

362. With regard to the base rate, unregulated firms operating in effectively competitive markets also face potential mismatch timing risk associated with prevailing base interest rates moving away from the level that underlies their interest cost, and hence pricing, decisions. Unregulated firms may hedge this risk through the interest rate swaps market, for example by swapping fixed rates for floating rates.[144]

363. However, unregulated firms are unlikely to match even the base rate exactly. Unregulated firms in effectively competitive markets will tend to hedge the base rate only to the point that reduces the associated financial risks down to optimal levels, given there is a cost associated with doing so. In addition, instruments to manage risks are available other than hedges. Hence, firms may not fully hedge their portfolio.

364. It also may be the case that some base interest rate hedges may be less than perfect, particularly given the daily fluctuations in financial markets for debt. Furthermore, in line with WATC's point, large corporations in the economy may not be able to fully hedge large amounts of new debt issuance at the one time. In consequence, no firm is likely to be able to replicate the prevailing cost of debt on its portfolio exactly at any point in time. The result, at best, will be some managed level of mismatch timing risk relating to the base rate.

365. On this basis, the Authority is of the view that it is incorrect to consider that the cost of debt needs to be able to be exactly replicable at all times. To do so is unlikely to be practical. Efficient financing costs do not necessarily achieve this.[145]

366. The view that the trailing average approach is preferred on efficiency grounds is therefore misplaced. Stakeholders claim that, to the extent that the trailing average would match the firm's embedded cost of debt, its mismatch timing risk is reduced significantly.[146,147] This is correct. The corollary would be that, under the trailing average, regulated firms would be able to reduce their hedging and other debt management activities markedly.

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when a firm needs to invest in one period to produce in the next, but faces a competitor which can invest and produce in the next period. The Authority considers that these arguments are internally inconsistent.

144 The Authority notes that any increase volatility in mismatch timing risk will lead to increased volatility for cash flows to equity. This is because the differences been interest cost and revenue are borne by equity.

145 The Authority therefore rejects DBP's view that the Authority should ensure that the method underpinning the estimate of the return on debt be possible to 'replicate for an incumbent', else there is some level of 'optimal impossibility' (DBNGP (WA) Transmission Pty Ltd 2013, *ERA Cost of Debt and Equity Workshop Papers: DBP Response*, www.erawa.com.au, 19 November, p. 13 to p. 15).

146 ATCO 2013, *Economic Regulation Authority's Draft Rate of Return Guidelines: response to discussion papers and stakeholder workshop*, www.erawa.com.au, 19 November, p. 5.

147 The Authority notes DBP's contention that regulated firms may not exactly replicate a trailing average structure, but considers that this misses the point (DBNGP (WA) Transmission Pty Ltd 2013, *ERA Cost of Debt and Equity Workshop Papers: DBP Response*, www.erawa.com.au, 19 November, p. 16). The question is whether the firm could match the structure, and the implications of such an outcome. The Authority considers that a regulated firm could follow the structure implied by the trailing average approach if it wished to do so.

367. The regulated firm's debt risk premium, under a trailing average approach, would also likely reduce, as lenders would account for the lower risk of future mismatch timing risk and related risks, such as default risk.[148] However, to the extent that this opportunity is not available to other unregulated firms in the economy, such an approach would create a type of financial subsidy to the regulated firm. This creates an economic distortion and an associated reduction in economic efficiency.[149]

368. The Authority concludes that the on-the-day approach does not create a barrier to firms adopting staggered debt portfolios to manage re-financing risk. The Authority also considers that all firms with staggered debt portfolios face a resulting potential mismatch pricing risk, which may not be able to be eliminated completely as interest rates fluctuate. The Authority considers that, as far as possible, it should match the signal provided by prevailing rates. The regulated firms will then have the maximum incentive to adopt efficient financing practices, similar to other firms in the economy.

369. The Authority further concludes that it would not be in the long term interests of consumers to provide regulated firms with the financial advantages that would accrue from the trailing average approach. The resulting financing practices would not be consistent with efficient financing practices elsewhere in the economy. The resulting financing practices would provide an effective interest cost subsidy to the regulated firm.

370. In summary, the Authority considers that the prevailing on-the-day approach to the return on debt is preferred over portfolio trailing average approaches on efficiency grounds, in terms of:

- the superior prediction performance of the on-the-day approach, which will result in more efficient investment decisions, both by the regulated firm, and by upstream and downstream customers; and
- the potential distortions to the efficient financing costs of a benchmark efficient entity that a trailing average approach would provide.

371. The Authority concludes therefore that the on-the-day approach is more likely to deliver the allowed rate of return objective, and be in the long term interests of consumers.

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148 The Authority notes DBP's contention that demand risk means that the portfolio approach does not reduce the debt risk premium for the regulated firm under the portfolio approach (DBNGP (WA) Transmission Pty Ltd 2013, *ERA Cost of Debt and Equity Workshop Papers: DBP Response*, www.erawa.com.au, 19 November, pp. 16 - 17). However, the Authority considers that as demand is adjusted at every regulatory reset to allow for changes in forecast expectations, this risk is low. Furthermore, this is not an 'all other things equal' comparison, as the same demand risk applies with the prevailing on-the-day approach.

The quote relating to the work of Valta, suggesting that 'industry concentration is inversely related to the cost of debt; more certainty means a lower cost of debt', also misses the point. Here we are considering the regulation of monopoly, to achieve economically efficient outcomes that that are consistent with effectively competitive markets. It would be remiss to provide a subsidy that is not available to other firms in the economy, just because it is a monopoly.

149 To the extent that the trailing average approach may reduce hedging costs and debt risk premia for regulated firms, then once this was observed in the benchmark sample and passed through, this element of the subsidy to regulated firms would be reduced, to a degree.

6.2.1.6 A menu of options?

372. The Authority notes the views set out in some submissions that NGR 87 (10) requires that the regulator offer a menu of cost of debt options based on the three approaches – on-the-day or the two portfolio approaches – that may then be chosen by the regulated firm. For example, DBP submitted:[150]

> At the outset, we would like to point out that we are not necessarily in favour of a trailing average over an on-the-day approach. In fact, we believe that, provided regulators act to prevent gaming by switching from one system to another, the choice of which debt cost to use ought to lie with the regulated firm, and not with a regulator; we do not believe there is sufficient evidence to say that one is more efficient than the other.

373. ATCO Gas submitted:[151]

> ATCO Gas Australia considers that if the Rate of Return Guideline restricts the cost of debt to a single estimation mechanism, the regulator and the business would be in conflict from the outset despite the efficient practices of the business.

374. GGT submitted:[152]

> A trailing average portfolio approach is expressly permitted by rule 87 (10(b)...

375. The Authority does not agree with this view. The Authority considers that it is clear from the terms of NGR 87(10) that the regulator may decide on the approaches that meet the requirements of the NGL and NGR. In particular, NGR 87(10) states that:

> ...the methodology adopted to estimate the return on debt may, without limitation, be designed to result in the return on debt reflecting:
>
> (a) 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 when the AER's decision on the access arrangement for that access arrangement period is made;
>
> (b) 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
>
> (c) some combination of the returns referred to in subrules (a) and (b).

376. The Authority notes that these are 'and/or' conditions, without limitation, and that a single 'approach' is explicitly an option. As further support, the Authority notes that the Australian Energy Market Commission observed in its decision that the regulator *could* adopt one approach. The Authority is of the view that this ruling does not require that the regulator should adopt more than one approach to determine the cost of debt:[153]

> The regulator will need to set out its approach(es) to estimating the return on debt in its rate of return guidelines. The Commission expects that the development of the guidelines will provide a forum for service providers, consumers and other stakeholders to propose different approaches to the estimation of return on debt, and for the regulator to discuss the merits of different approaches before setting out its proposed approach in the guidelines. The Commission intends that the

150 DBNGP (WA) Transmission Pty Ltd 2013, *ERA Draft Rate of Return Guidelines: DBP Response*, www.erawa.com.au, 7 October, p. 28.

151 ATCO 2013, *Economic Regulation Authority's Draft Rate of Return Guidelines: response to discussion papers and stakeholder workshop*, www.erawa.com.au, 19 November, p. 7.

152 Goldfields Gas Transmission 2013, *Further submission on rate of return guidelines*, www.erawa.com.au, 19 November, p. 10.

153 Australian Energy Market Commission 2012, *Rule Determination*, www.aemc.gov.au, p. 90.

regulator could adopt more than one approach to estimating the return on debt having regard to different risk characteristics of benchmark efficient service providers. Service providers will have an opportunity at the time of their determination or access arrangement to propose an alternative approach to that proposed by the regulator in the guidelines, but the service provider will need to explain why its proposed approach is better than the approach proposed by the regulator in the guidelines.

377. The Authority has considered the alternatives to the on-the-day approaches in the sections above, and concluded that they would be less effective in delivering the allowed rate of return objective. On this basis, the Authority proposes to estimate the return on debt through the on-the-day approach.

6.2.1.7 Issues in comparing the relevant models

378. In its submission, DBP considered that as the form of a possible trailing average approach has not been set out by the Authority, it cannot be compared to the status quo on-the-day approach.[154] DBP considered that it is not possible to undertake a robust comparison without specifying the period of the trailing average, the weighting on different years, how the approach might work, or the transition mechanism. DBP submitted that general principles are insufficient to make the relevant assessment.

379. The Authority does not agree with this claim by DBP. The Authority considers that the assessment conducted by the Authority demonstrates that any trailing average approach – whether pure or hybrid – will perform less well in providing incentives for economic efficiency in comparison to the on-the-day approach. The Authority is of the view that economic efficiency is a critical issue for consideration in the context of ensuring that the long term benefits of consumers are met.

6.2.1.8 A single reset at review or annual updating?

380. As noted above, the Authority considers that regulated firms face mismatch timing risk on an efficient staggered debt portfolio. However, mismatch timing risk may be greater for regulated firms than for non-regulated firms due to the artificial constraint imposed by the Authority under its current approach in setting the cost of debt once every five years, at the start of each access arrangement period.

381. The Authority notes that this outcome is inconsistent with its intent to be 'supportive of specific regulatory aims', and thereby 'seek to achieve rates of return that would be consistent with the efficient outcomes of effectively competitive markets'.

382. The Authority considers that the mismatch timing risk for the regulated firm could be made closer to that faced by unregulated firms if it updated the on-the-day cost of debt for each regulatory year.

383. Such an approach would:

- be consistent with NGR 87 (9)(b);
- facilitate management by the regulated firm of its staggered portfolio of floating rate debt, including through interest rate swaps, in a manner that aligned more closely to the efficient financing practices of all other firms in the economy;

[154] DBNGP (WA) Transmission Pty Ltd 2013, *Submission to the ERA Benchmark Cost of Debt Secretariat Working Paper*, www.erawa.com.au, p. 10.

- more closely aligned the mismatch timing risk of the regulated firm with that faced by the non-regulated competitive firm; and
- as a consequence, enhance dynamic, allocative and productive efficiency by providing incentives for the firm to incorporate the prevailing cost of debt in its investment decisions.

384. To the extent that the mismatch timing risk of the regulated firm would then be aligned with that faced by the unregulated firm in an effectively competitive market, then the outcome would be consistent with efficient financing costs, and with the requirement for efficiency more generally.

Alternatives for annual updating

385. The Authority engaged Chairmont Consulting to, among other things, evaluate approaches to setting the return on debt through the on-the-day approach. Chairmont Consulting concluded that annually updating the return on debt is preferred to other options that were considered.[155]

386. The Authority has therefore considered two annual update options proposed by Chairmont Consulting:[156]

- a full annual update of the base rate and the debt risk premium components ('option B' in Chairmont's evaluation); and
- a partial annual update the debt risk premium, with the base rate set once every five years at the start of the regulatory period ('option C' in Chairmont's evaluation).

387. These options may be contrasted with the Authority's previous approach, of resetting the components of the return on debt only at the start of the regulatory period, and then maintaining that return on debt for the duration of the regulatory period ('option A' in Chairmont's evaluation).

388. The Authority considers that the *efficiency* aspects of the allowed rate of return objective, and the objectives of the NGL more broadly, would be best met by adopting option B, for a full annual update of the risk free rate and the debt risk premium.

389. By closely replicating the prevailing opportunity cost of the debt associated with the portfolio of the benchmark efficient entity, the full annual update would:

- align the incentives relating to efficient financing and debt risk management practices with those of firms elsewhere in the economy;
- reduce regulatory barriers to debt issuance at any point in time, as the mismatch between the regulated rate on debt and the prevailing rates would be minimised;
- the 40 day averaging period used for the purposes of updating the annual rate, would allow firms the opportunity each year to reset their debt portfolio, with less chance of mismatch on any new issuances;

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155 Chairmont Consulting 2013, *Cost of Debt Comparative Analysis*, www.erawa.com.au, 27 November, p. 4.

156 Chairmont Consulting 2013, *Cost of Debt Comparative Analysis*, www.erawa.com.au, 27 November, p. 4.

- lead to similar efficient financing costs as other firms elsewhere in the economy, thereby achieving the efficiency objectives of the NGL and the NGR, as well as the allowed rate of return objective.

Issues relating to annual volatility

390. The Authority recognises that full annual updating will lead to greater volatility in annual costs during the regulatory period and therefore in reference tariffs, as compared to a five yearly reset for the return on debt. The Authority has estimated that an annual +1 per cent move in the return on debt has the potential to move the required network tariff revenue in any year, and hence the network tariffs, by as much as +3 per cent in any year in nominal terms.

391. The Authority notes that analysis by Chairmont Consulting suggests that annual volatility could be significant (Figure 6).

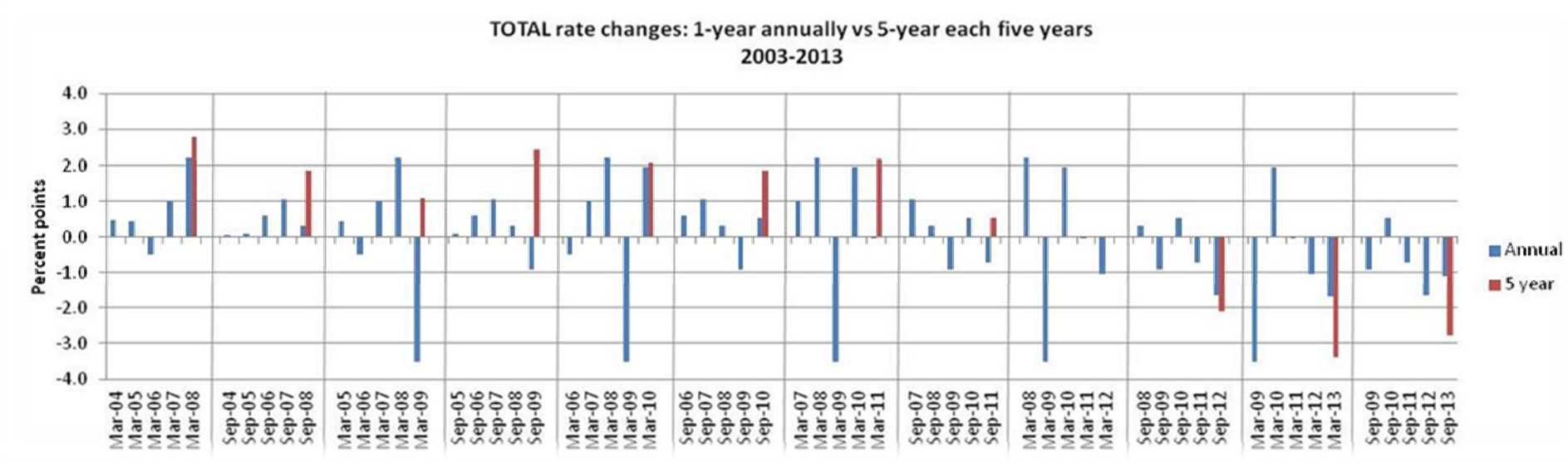
392. Nevertheless, with annual updating, the Authority considers that there may be options for large wholesale and retail customers to deal with the ensuing fluctuations that result in their gas network prices through hedges in the financial markets, as part of the their standard treasury operations. Alternatively, larger wholesale consumers could negotiate a smoother tariff path with the network service provider, in the event that the service provider could more cost effectively hedge the fluctuations.

393. Smaller retail consumers also need not necessarily face volatile pricing. A gas retailer might offer two types of tariffs:

- one in which prices were smoothed, which would be facilitated by the retailer hedging the network price fluctuations through its treasury operations, or negotiating with the network service provider; or
- one in which prices would fluctuate, but with a lower average cost, for example reflecting lower hedging costs.

394. By signalling the underlying driver – changes in tariffs arising from changes in the cost of debt – negotiations for an appropriate allocation of costs, and potential market based solutions, could be facilitated. In this case, the trade-off between volatility and lower prices would be made clear, informing solutions for customers that best meet their preferences.

Figure 6 **Total rate changes: 1-year annually versus 5-year resets**



Source: Chairmont Consulting 2013, *Cost of Debt Comparative Analysis*, www.erawa.com.au, 27 November, p. 29.

395. For these reasons, the Authority considers that the benefits of annual updating could potentially be retained, with limited or no detriment for customers. If anything, by signalling smaller change increments more frequently, customers would be better informed, and able to make better decisions. This outcome would be consistent with the economic efficiency considerations set out above.

396. However, gas retailers have expressed concern at the resulting potential for network tariff volatility arising from annual updates, and a preference for stable tariffs. On this basis, gas retailers have expressed support for retaining the current approach of updating the cost of debt once every five years.[157] This preference has bearing on the consideration of the Authority with regard to the long term interests of consumers.

397. Therefore, the Authority has determined that it will continue to set the risk free rate once, at the start of the regulatory period. This will substantially dampen any changes arising from fluctuations in the cost of debt, at least within the regulatory period.

398. This change to a 'partial update' approach will have minimal impact on efficient financing costs, as the regulated firm should be largely indifferent to the term of the (base) risk free rate.

399. In most circumstances, the CGS risk-free rate yield curve, which represents the relationship between the observed yields and terms to maturity, is upward sloping. With an upward-sloping yield curve, the risk-free rates of return derived from observed yields on the 1-year CGS bonds will be lower than those obtained from the yields on 5-year term CGS bonds.

400. However, the slope of the yield curve is most influenced by expectations about future interest rates. This implies that, *abstracting from term and liquidity premia*, the *expected* present value of different term instruments should be the same, with the corollary that the choice of the term of the base rate will have little effect on the regulated return:[158,159]

> Interest rate risk is removed when changes in interest rates have an equal impact on cost and revenue. This observation is important to the case of a regulated cost of capital pricing regime, where interest rate changes fully flow through to revenues. The risk neutral approach to managing interest rate risk is to match the interest rate impact on costs to that of the revenue side. The implication of this paradigm is that the operator faces no interest rate risk whether it is given a base rate with a resetting period of 1 year, 5 years or anything in between, under one condition. That condition is; the required swaps must be equally available to the operator regardless of the term. For the swaps to be equally available:
>
> - Swap market participants are willing to provide credit approval to the operator for swaps of any maturity up to a least 5 years; and
> - Liquidity of swaps trading in the different terms is equivalent.

401. On this basis, the Authority considers that setting the risk free rate once, at the start of the regulatory period, will have little impact on the practices of the regulated firm. The advantage will be that the return on debt will be significantly less volatile over the

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157 Wesfarmers Chemicals, Energy and Fertilisers 2013, Submission to the ERA Consultation Paper 'Guidelines for the Rate of Return for Gas Transmission and Distribution Networks', www.erawa.com.au, 19 November; Alinta Energy 2013, *Rate of Return Guidelines Review*, www.erawa.com.au, 19 November.

158 Chairmont Consulting 2013, *Cost of Debt Comparative Analysis*, www.erawa.com.au, November 28, p. 10.

159 Evidence suggests that term premia may be positive or negative at times, fluctuating in a typical range of -1 to +1 per cent (see for example Reserve Bank of Australia 2009, *A Term Structure Decomposition of the Australian Yield Curve*, Research Discussion Paper, www.rba.gov.au, p. 23).

regulatory period, meeting the expressed preferences of gas retailers. The downside would be that network cost changes are not signalled as frequently for transmission pipeline and network customers, and that the investment signals for regulated firms are not as efficient. However, the Authority considers that long term interests of consumers should take precedence in this case.

402. The Authority will still require that the debt risk premium be updated annually, as it considers that this is an important efficiency consideration, given the inability of firms to hedge this component of the return on debt.

403. Changes in the debt risk premium are generally small, so retaining this partial update is not expected to contribute significant volatility under normal circumstances. In circumstances where the debt risk premium does change markedly, then the Authority considers that the efficiency considerations outweigh the concerns of customers, such that annual updating of the debt risk premium should be retained.

404. Under the 'partial update' approach for the return on debt:

- the risk free rate will be based on the observed yield of a 5-year term Commonwealth Government Security, averaged over a 40 day period just prior to start of the regulatory period:
  - the 5-year term would be consistent with the present value principle, as the regulatory period on this component will be five years;
  - the resulting estimate of the risk-free rate will contribute to the revenue path in each respective regulatory year;
- the debt risk premium will be derived from the yield to maturity of an annually observed sample of bonds issued by comparator firms with similar credit ratings as the regulated entity:
  - the estimate of the debt risk premium will be derived from a 'bond yield' weighted sample of relevant bonds of comparator firms observed in the period just prior to the respective regulatory year;
  - the debt risk premium will be updated annually;
- the Authority will implement the annual update by setting tariffs, for regulatory years two to five, by including an automatic cash flow adjustment to the revenue path in each relevant year (see the next section for a description of the annual update automatic adjustment mechanism).

405. As changes in the risk-free rate drive volatility in interest rates most of the time, such a partial update can be expected to lead to more stable estimates of the return on debt during the regulatory period.

406. Nonetheless, the Authority considers that the efficiency properties of a full annual update are important. Given this, the Authority would consider a full update proposal, if the service provider was able to demonstrate the widespread support of customer groups. As part of demonstrating customers' support for such a full update approach, the Authority expects that the service provider would explore with customer groups a range of alternative, market-based means to manage volatility.

407. In the event service providers are able to demonstrate support for the full annual update approach, then:

- the risk-free rate would be based on the observed yield of a 1-year term Commonwealth Government Security, averaged over a 40 day period just prior to start of the regulatory year:
  - the 1-year term would be consistent with the present value principle, as the regulatory period on this component would now be one year;
- the debt risk premium would continue to be updated annually;
- the resulting estimate would contribute to the revenue path, and to annual update automatic formula in each respective regulatory year;
- the Authority would implement the annual update by setting tariffs, for regulatory years two to five, by including an automatic cash flow adjustment to the revenue path in each in each relevant year (see the next section for a description of the annual update automatic adjustment mechanism).

Implementation of annual updating

408. The Authority considers that it is preferable for changes arising from annual updates to be transmitted to reference tariffs in each regulatory year, as part of the annual tariff variation mechanism. As noted above, such an approach will facilitate efficient financing by the regulated entity, and also facilitate economically efficient outcomes in upstream and downstream markets.

409. The Authority also notes GGT's concerns with the proposed annual updating of the 'on-the-day' estimate of the rate of return on debt.[160] GGT suggests that this proposal conflicts with the requirements of NGR 87(9) and 87(10). However, the Authority considers that an 'automatic application of a formula' for addressing the resulting change in revenue would meet the requirements of NGR 87 (12). The Authority also considers that the requirements of NGR 87(8) and NGR 87(11) support the annual update approach.

410. The Authority will base its estimates of the return on debt on a risk premium over and above the risk-free rate, as well as an allowance for debt raising costs and hedging costs:

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

411. The Authority will annually update the return on debt, to reflect annual updates to the estimate of 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 be set once, at the start of the regulatory period, and apply unchanged for each subsequent regulatory year in the regulatory period.

412. The Authority will publish the resulting return on debt on its website just prior to the commencement of the regulatory year. Revenue and prices to apply in the relevant regulatory year will then be adjusted commensurate with the updated return on debt, as part of the annual tariff update, through an automatic update mechanism.

[160] Goldfields Gas Transmission 2013, *Submission responding to ERA Cost of Debt Working Paper*, www.erawa.com.au, p. 5.

413. The risk free rate will be based on the observed yield of a 5-year term CGS, averaged over a 40 day period just prior to the start of the regulatory period, which will apply for the duration of the regulatory period (see Chapter 7 – Risk free rate). The 5-year term reflects the present value principle that the term of debt should match the regulatory update period.

414. The debt risk premium will be derived from the yield to maturity of a weighted sample of bonds of comparator firms with similar credit ratings as the regulated entity, observed just prior to the regulatory year (see Chapter 8 – Credit rating and Chapter 9 – Debt risk premium). This annual update approach is in recognition that it is difficult for firms to manage risk related to changes in the debt risk premium, given the lack of hedging instruments.

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

416. The rate of return on debt estimated for the first regulatory year – based on the sum of the estimates of the risk-free rate, the debt risk premium and the allowances for debt raising and hedging costs for the first regulatory year – will be applied for the duration of the regulatory period, as a means to set the 'initial revenue path'. Therefore, this estimate of the rate of return on debt will apply to the first regulatory year, and will contribute to the revenue for the remaining years two to five of the regulatory period. As a result, this 'initial revenue path' would be the same as that under the Authority's previous approach, where the rate of return on debt was estimated once at the start of the regulatory period.

417. The Authority will implement the annual update by setting tariffs – for regulatory years two to five – by including an automatic cash flow adjustment to the 'initial revenue path' in each respective year. The adjustment would account for the difference in revenue arising from the difference in the rate of return on debt under the 'initial revenue path' and the annually updated rate of return on debt in each subsequent, respective regulatory year. The difference in the rate of return on debt will reflect the difference arising from the change in the debt risk premium.

418. The formula for calculating the annual adjustment to the revenue path for a change in the estimate of the debt risk premium or the nominal risk free rate will be as set out in equation 6 above.

419. Under this formula, all variables remain unchanged from those provided in the final access decision, except for the movements in DRP in years 2 to 5.

7 Risk free rate of return

420. The risk-free rate of return is a key input to the Authority's approach to estimating the return on equity and the return on debt.

421. 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.

422. 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 inflation rate was zero during an investment period. The National Gas Rules (**NGR**) require the Authority utilise a nominal vanilla rate of return in future regulatory decisions, so in this chapter, the term risk free rate refers to the nominal risk free rate.

7.1 Approach

423. The Authority considers that Commonwealth Government Security (**CGS**) bonds are the best proxy for risk-free assets in Australia. Observed yields from these CGS bonds – as reported daily by the Reserve Bank of Australia – will be used for the purpose of estimating a risk-free rate of return.

424. Linear interpolation of the observed yields of CGS bonds will be used to estimate the risk free rate, as it is not common to observe a CGS bond with remaining term to maturity that exactly matches that of the regulatory period.[161]

425. 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. 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.

426. An averaging period of 40 trading days – prior to the release of the regulatory decision – will be adopted for the purpose of determining the risk-free rate of return to be used in the estimate of the return on equity and the return on debt for the subsequent 5-year regulatory period.

7.2 Reasoning

427. There are three key issues to consider when developing an estimate of the risk-free rate of return for use in the determination of the regulated rate of return. These relate to (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. Each of these issues is considered in what follows.

[161] In the linear interpolation approach, two bonds are selected with terms to maturity that fall on either side of the term 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 term by assuming a linear increase in yields between the straddle dates on the two bonds observed.

7.2.1 The choice of the proxy for "risk-free" assets

428. Australian regulators have consistently adopted the observed yields to maturity of CGS as the best proxy for the nominal risk-free rate of return.

429. The Authority considers that bonds issued by the Commonwealth Government of Australia are the best proxy for the risk-free rate in Australia for the following reasons:

- *First*, CGSs are essentially free from default risk. The Australian Government has consistently received the highest possible credit rating from both Standard and Poor's and Moody's. Payments from these bonds are guaranteed by the Australian Government.
- *Second*, these bonds are the most liquid assets in Australia in terms of the volume at issuance, various terms to maturity, and narrow spreads between bid-ask yields.
- *Third*, the observed yields of these bonds are transparently recorded and reported by the Reserve Bank of Australia on a daily basis.

430. With respect to the choice of proxy, Wesfarmers Chemicals, Energy & Fertilisers submitted that the choice of the risk free asset should be a zero coupon asset. Wesfarmers suggested that coupons introduce reinvestment risk to an investor, as they have to reinvest these coupons at an uncertain future rate of return.[162]

431. The Authority notes that currently all CGS available are coupon paying bonds.[163] As a consequence, this form of reinvestment risk is unavoidable when investing in CGS and no zero coupon asset currently exists for the purposes of deriving the risk free rate of return. The Authority is of the view that, in deriving an estimate of a risk-free rate of return, the main issue is to determine the most appropriate proxy for the risk-free rate of return. Despite the risk issues relating to coupons, the Authority considers that CGS is, on balance, the best instrument to determine the risk free rate.

432. The Authority notes that in addition to CGS, there have also been proposals to use either:[164]

- yields on Commonwealth government guaranteed bank debt;
- yields on State government debt; or
- the bank bill swap rate (**BBSW**) has been proposed as an alternative proxy of the risk free rate.

433. In its previous regulatory decisions on Dampier Bunbury Pipeline's (**DBP**) proposed access arrangement revisions, the Authority discussed these proposals.[165] The Authority is of the view that there was insufficient evidence to depart from the use of CGSs as a proxy for the risk-free rate of return, and therefore for regulatory consistency there should only be one proxy for the nominal risk free rate.

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162 Wesfarmers Chemicals, Energy & Fertilisers, *Rate of Return Guidelines Review,* 28 Feb 2013.

163 Reserve Bank of Australia 2013, Australia, accessed 29 November 2013, www.rba.gov.au/statistics/by-subject.html

164 Australian Energy Regulator, May 2009, Final Decision, *Review of the weighted average cost of capital parameters for electricity transmission and distribution network service providers*, pp. 136-140.

165 Economic Regulation Authority, *Draft Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline*, 14 March 2011, p.183.

434. More recently, Chairmont Consulting in its November 2013 report suggested that the Authority should base its return on debt estimates on BBSW, as this is the measure commonly used by markets as the base rate for short term swaps.[166] The Authority notes that longer term Interest Rate Swap **(IRS**) rates are also reported based on observed market transactions.

435. As set out by Chairmont Consulting in its June 2013 report to the Authority, the difference between a CGS risk free rate and a swap rate of similar term is called the spread of swap (**SS**). However, it should not matter which rate is used for determining the overall return on debt. If debt risk premiums are estimated consistent with the chosen base – whether that base be the CGS risk free rate or BBSW – 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:[167]

$$Yield = R_f + SS + DRP_s \quad (7)$$

where

R_f is the CGS risk free rate;

SS is the spread of swaps to the CGS rate; and

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

436. Chairmont Consulting noted that the SS can vary. Typically the SS is not large, in the range of 40 to 60 basis points, although sometimes the spread may be higher.[168] The Authority recognises that 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 SS.

437. The Authority has considered a move to using swap rates for the risk free rate when estimating the return on debt. Such an approach would align with typical hedging practices. However, the Authority has concerns that available IRS market data on swap rates for longer maturities – such as beyond 6 months – are less reliable than short term BBSW.

438. The Authority notes that using observed market transactions of swap rates will result in estimates of the risk free rate that are biased upward. This is a consequence of the possible counter-party credit risk present in IRS,[169] and the implicit premium paid by those hedging when entering into a swap. This approach also relies on the assumption that longer maturity swap markets are sufficiently liquid.

439. Therefore, the Authority considers that it is more appropriate to retain the use of CGS as the proxy for the risk free rate, as the longer dated rates may be more robustly estimated from CGS data. The Authority notes that such an approach would ensure that firms have 'reasonable opportunity' to recover their cost of debt. The Authority notes that firms base their hedging on the swap rates and that the risk-free rate is

[166] Chairmont Consulting 2013, *Cost of Debt Comparative Analysis*, www.erawa.com.au, November 28, p. 12.
[167] Chairmont Consulting 2013, *Comparative Hedging Analysis*, www.erawa.com.au, June 12, p. 14.
[168] Chairmont Consulting 2013, *Comparative Hedging Analysis*, www.erawa.com.au, June 12, p. 17.
[169] Hull J.C (2009), *Options, Futures and other Derivatives,* Seventh Edition, Pearson Prentice Hall, p. 169.

generally lower than the relevant swap rate. Previous advice to the Authority indicated that a total cost of debt can be decomposed into a risk-free rate (or a swap rate) and a debt risk premium. On this basis, the Authority is of the view that using a risk-free rate as a base rate will allow regulated businesses to hedge a small part of the Authority's estimate of the DRP, together with the risk-free rate.[170]

440. The Authority therefore will retain the use of the CGS risk free rate for the purpose of this rate of return guideline. This decision is consistent with previous Australian regulatory decisions. The use of the CGS risk free rate is considered the approach which best meets the allowed rate of return objective. It is fit for purpose, particularly as it is robust, transparent and replicable.

7.2.2 The term of the risk free rate

441. In response to the Authority's Draft Guidelines, submissions from ATCO Gas, Goldfield Gas Transmission (**GGT**), and Energy Networks Association argued that the term of the risk-free rate should be 10 years, given the long lives of regulated assets.

442. Some Australian regulators use CGSs with a 10-year term to maturity whereas others use CGSs with a 5-year term to maturity. The Australian Energy Regulator (**AER**), for example, has adopted a 10-year term for a nominal risk-free rate of return.[171] The Authority and other regulators – including the Queensland Competition Authority (**QCA**) and the Independent Pricing and Regulatory Tribunal (**IPART**) – have adopted a 5-year term for the risk free rate.

443. Current Australian regulatory practice in relation to the term of the risk-free rate of return are summarised in Table 3.

[170] This arises because the debt risk premium estimated by the Authority, against a CGS base, will be larger than the debt risk premium over and above the swap rate. Then, to the extent that firms use the swaps market to hedge movements in the base, some of the Authority's estimate of the debt risk premium will also be hedged. The additional amount hedged will be the spread of swaps.

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

Table 3 Terms of a risk-free rate of return in the Australian regulatory decisions

Regulator	Year	Industry	Term of the risk-free rate of return (Years)
ACCC[172]	2011	Fixed Line Services (Telecommunications)	10
AER[173]	2012	Gas Distribution Network	10
ERA[174]	2012	Electricity Distribution/Transmission	5
ERA[175]	2011	Gas Transmission	5
IPART[176]	2012	Water, sewerage, stormwater drainage and other services	5
QCA[177]	2012	Water, sewerage, stormwater drainage and other services	5
ESCOSA[178]	2012	Water, sewerage, stormwater drainage and other services	10

Source: Compiled by the Economic Regulation Authority

444. The Authority is of the view that the 'present value' principle requires that the term of a risk-free rate of return should be equal to the length of a regulatory control period, to ensure that regulated businesses are not over- or under-compensated (see Appendix 2 – The present value principle). The Authority considers that it is appropriate to continue using a 5-year term for the risk-free rate for the return on equity and the return on debt, using the yield on a 5-year CGS as a proxy, to ensure that the present value principle is met.

7.2.3 The averaging period

445. 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.[179] The Authority has to date utilised a 20 trading days period.

172 Australian Competition and Consumer Commission, *Inquiry to make final access determinations for declared fixed line services — Final report*, July 2011, p. 61.

173 Australian Energy Regulator, *Access Arrangement final decision Envestra Ltd 2013-17 Part 1,* March 2013, p. 29.

174 Economic Regulation Authority (Western Australia), *Final decision on proposed revisions to the access arrangement for Western Power*, 2012.

175 Economic Regulation Authority, *Final Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline*, 31 October 2011, p.158.

176 Independent Pricing and Regulatory Tribunal, *Review of prices for Sydney Water Corporation's water, sewerage, stormwater drainage and other services, From 1 July 2012 to 30 June 2016*, p. 183.

177 Queensland Competition Authority, *Final report, Sunwater irrigation price review 2012–17, Volume 1, May 2012*, p. 485.

178 Essential services commission of South Australia, *Advice on a regulatory rate of return for SA Water—Final advice*, February 2012, p. 9.

179 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 Authority adopts the simple moving average in its calculations.

446. The Major Energy Users Inc (**MEU**) submitted that the averaging period used in calculating the risk free rate of return should be fixed with a longer term than 20 days.[180] MEU suggested that a 12-month averaging period delivers a less volatile risk free rate, whilst delivering an outcome similar to one month averaging.

447. Chairmont Consulting also suggested that the Authority could consider a longer averaging period, so as to extend the window available for regulated firms to undertake hedging activities.[181]

448. WATC have emphasised in submissions to the Authority that it would struggle to hedge its portfolio in the averaging period, as the size of its transactions would 'move the market'.[182] The Authority has considered WATC's arguments in this context in detail at Section 6.3.1.5 in Chapter 6 – Return on debt, concluding that it is incorrect to consider that the return on debt needs to be able to be exactly matched at all times by regulated firms. To do so is unlikely to be practical, and is not consistent with the efficient financing practices of firms in effectively competitive markets.

449. With regard to the averaging period, the Authority considers that there is a trade off between efficiency and short term volatility considerations. In particular dynamic and allocative efficiency is fundamental to both producers' and consumers' long run interests and is better achieved through a risk free rate that matches the current prevailing rate. However, that rate may be very volatile in the short term, which may be conducive to establishing a risk free rate which is not the best estimate of the prevailing risk free rate environment.

450. The Authority conducted its own analysis and concluded that an averaging period of up to 60 trading days, just prior to the release of the regulatory decision, is the best predictor of the forward looking estimate of the risk free rate for the subsequent regulatory period (see Appendix 5 – Diebold Mariano test).[183] The Authority considers that prediction performance is important for achieving the efficiency requirements of the National Gas Objective (see, for example, the discussion at Section 6.3.1.4 of Chapter 6 – Return on debt).

451. Based on the analysis set out in Appendix 5 – Diebold Mariano test, the Authority considers that an averaging period of 40 days would still provide a good estimate of the prevailing rate, while reducing the daily volume of transactions required to adjust larger debt portfolios, all other things equal. The Authority considers that allowing the service provider to nominate a 40 day period – agreed with the Authority – that falls close to the final decision for the access arrangement, or close to the submission of a tariff variation, would meet both the requirement for efficiency and acceptable volatility.

452. The Authority will therefore move to adopt a 40 business days averaging period for the purpose of estimating the CGS risk free rate.

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180 Major Energy Users Inc, *AER guideline on Rate of Return, Response to Issues Paper,* February 2013.

181 Chairmont Consulting 2013, *Cost of Debt Comparative Analysis*, www.erawa.com.au, November 28, p. 12.

182 Western Australian Treasury Corporation 2013, *Rate of Return Guidelines Review*, www.erawa.com.au, 7 October, p. 4.

183 Economic Regulation Authority, September 2012, *Final Decision on Proposed Revisions to the Access Arrangement for the Western Power Networ*k, pp. 659-666.

7.2.4 Other Considerations

7.2.4.1 A consistent risk-free rate of return should be used in the Sharpe-Lintner CAPM

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

$$r_e = r_f + MRP.\ \beta_i \quad (8)$$

454. GGT submitted that, with reference to the application of the Sharpe-Lintner CAPM, the term of risk-free rate of return is assumed to be different by regulators, with the following construct:

$$R_i = R_{f,current} + \beta_i (R_{m,historic} - R_{f,historic}) \quad (9)$$

where

R_i is the return to asset i;

$R_{f,current}$ is the current risk free rate;

$R_{f,historic}$ is the historic risk free rate;

$R_{m,historic}$ is the historic market return; and

β_i is equity beta for asset i.

455. GGT argued that the risk-free rate of return used in the Sharpe-Lintner CAPM, on the left and right in the above equation, must be the same to restore consistency between both risk-free rates.

456. The Authority does not agree with GGT's assertion that an inconsistency exists with respect to the MRP calculation. The Authority is of the view that the 5-year CGS risk free rate of return applied in the Sharp-Lintner CAPM on the left is the best available proxy for the forward looking estimate of the risk free rate, consistent with the regulatory period and the investment horizon. However, there is no similar proxy for the forward looking MRP on the right. Current Australian regulatory practice is to estimate the forward looking MRP using various approaches. One of these approaches is based on the average of the historical annual observations of the MRP. The historic MRP is derived as the difference between the market return and the return on CGS bonds (or risk-free rate) in each observed historical year. This approach to estimating the MRP from historic observation is based on the assumption that past experience will provide an indication of future expectations. The approach has gained support for being transparent, extensively studied and well understood. Detailed discussions on this and various approaches to estimating the MRP can be found in Chapter 11 – Market risk premium.

457. Utilising the same risk free rate for both the risk free rate and MRP as GGT suggests implies a one-to-one negative relationship between the two, contrary to empirical evidence.[184] As a consequence, the Authority is of the view that the risk free rate and MRP are different quantities, each requiring different estimation methods. Therefore, the Authority considers that no inconsistency arises estimating the risk free rate using the currently observed risk free rate and a historic one for the purposes of estimating the historical realised return.

7.2.4.2 Analysts' risk-free rate of return forecasts

458. In its submission on behalf of DBP the Brattle Group suggested the use of a forecast risk-free rate as an alternative to the current risk free rate.[185]

459. The Authority notes that DBP and its consultants have not provided any evidence to substantiate their proposal in which analysts' forecast risk-free rate should be used in deriving a risk-free rate of return for the rate of return guidelines. In addition, DBP's consultant, the Brattle Group, also submitted that forecast risk-free rates of return are not available in Australia. The Authority is of the view that using a forecast risk-free rate of return is not appropriate for the purpose of this rate of return guidelines.

7.2.4.3 Use of survey evidence to inform the term of the risk free rate

460. In its report prepared for the Energy Networks Association, Incenta Economic Consultants (**Incenta**) was of the view that finance theory does not provide an unambiguous guide to the term of the risk-free rate, and is somewhat clouded by the shortcomings of the Sharpe Lintner Capital Asset Pricing Model. Incenta argued that a key issue to consider relating to the term of the risk-free rate of return is how investors actually value assets and the investment horizon they apply in doing so.[186]

461. In order to test how investors perceive term when valuing assets, Incenta undertook a series of structured interviews with 14 market practitioners including two independent valuation experts and 12 investment bank/broker investment analysts to obtain their views on the relevance of term when advising their investor clients. Incenta found that there was complete unanimity among the interviewees about the application of a 10 year risk free rate to estimate the cost of equity for regulated energy businesses.

462. In addition, Incenta also submitted that none of those interviewed stated that they would use a different risk-free rate (to 10 years) to estimate the cost of equity for non-regulated infrastructure (such as a toll road).[187] Based on the outcomes of these interviews, Incenta recommended using a 10-year risk-free rate for estimating the cost of equity, and that this 10-year rate also be applied consistently to estimate the market risk premium. Incenta considered that its recommendation is not based on theory. Rather, its recommendation was based on achieving consistency with the practice of valuation professionals – for whom the use of a 10-year term for the risk-free rate is

184 As discussed in chapter 11, any relationship between the risk free rate and MRP has mixed empirical evidence.

185 The Brattle Group, *Estimating the Cost of Debt, Prepared for Dampier Bunbury Pipeline,* 4 March 2013.

186 Incenta Economic Consultants, June 2013, *Term of the risk free rate for the cost of equity*, A report prepared for Energy Networks Association, p. 5.

187 Incenta Economic Consultants, June 2013, *Term of the risk free rate for the cost of equity*, A report prepared for Energy Networks Association, pp. 7-8.

widespread – and with observations of how investors actually value regulated infrastructure assets.[188]

> ...since the market applies a 10 year risk free rate and a risk premium and prices assets in this way, it drives valuation, and regulators should not be out-of-step with the market, or they will risk under-investment

463. The Authority considers that evidence presented by ENA and Incenta relating to market practitioners' views is based on a rejection of the present value principle.

464. First, the Authority notes in this context that Incenta states that market practitioners view the residual value of asset as being risky.[189] However, the Authority considers that the fact that the regulatory asset base is not re-valued periodically undermines this view, implying a very low risk for the full return of the value of the regulatory asset base. This provides strong support for the present value principle as it is interpreted by the Authority.[190]

465. Second, the Authority considers that equity analysts are generally trying to estimate the value of the company, which involves estimating the present value of the stream of future cashflows, *to perpetuity*. In that case it would be reasonable to utilise the longest possible term risk free rate to contribute to the discount rate to be applied to those cashflows. However, that is not the regulatory task, which involves determining rate of return for a five year period, based on an understanding that the full value of regulatory asset base will be returned over its effective life. Consistent with the present value principle, the regulatory task requires a term for the rate of return which matches the regulatory period.

466. The Authority therefore is of the view that the term of the rate of return be, as far as possible, consistent with the term of the regulatory period (for more detail, see Appendix 2 – Present value principle).

7.2.5 Methodology used to estimate the risk free rate

467. The Authority notes that the yields of CGSs are reported daily by the Reserve Bank of Australia (**RBA**), and that these reported yields will form the basis for estimating the

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188 Incenta Economic Consultants, June 2013, *Term of the risk free rate for the cost of equity*, A report prepared for Energy Networks Association, p. 9.

189 Incenta Economic Consultants, June 2013, *Term of the risk free rate for the cost of equity*, A report prepared for Energy Networks Association, p. 7.

190 The Authority notes that the present value principle has been articulated by Professor Davis as follows (Davis K. 2012, *The Debt Maturity Issue in Access Pricing*, www.australiancentre.com.au, p. 3):

> Because cash flows are reset each five years for the subsequent five years taking into account both risk free interest rates and credit spreads prevailing at that time, it is only when the cost of five year debt is used by the regulator that these two conditions are met. The intuition behind this argument (which is developed formally in the next section) can be explained by noting the similarity (albeit with an important difference discussed in the next paragraph) between determination of allowable cash flows on an access asset and cash flows on a floating rate bond.
>
> ...Focusing solely on the debt financed component, the principal difference with the floating rate note is that cash flows are reset at regular dates by the regulator in line with movements in both risk free interest rates and the credit spread facing the asset owner-borrower.4 Then, by issuing debt of the same maturity as the reset period with the same coupon as applied by the access regulator, the asset owner will have financed and perfectly hedged the current period cash flows. Moreover, at the next reset date, the asset owner will be able to reissue one period debt at par with the same coupon rate as that reset for the debt financed component of the asset by the regulator. Thus, if the regulator resets asset cash flows in line with the one period cost of borrowing (using the one period risk free rate and one period credit spread) the asset owner is able to meet debt financing costs and be perfectly hedged by a succession of one period borrowings.

risk-free rate of return. This risk-free rate can be observed with reasonable certainty. However, it is not always the case that the remaining term to maturity of an existing CGS will matching the required term of the risk-free rate. When this occurs, the Authority will observe the yield of two CGSs 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

468. The benchmark credit rating is a key input for estimating the Debt Risk Premium (**DRP**). The credit rating is defined as the forward-looking opinion provided by a ratings agency of an entity's credit risk. Credit ratings provide a broad classification of a firm's probability of defaulting on its debt obligations. As a consequence, credit ratings represent the risk present in holding a debt instrument.

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

8.1 Approach

470. The Authority considers that a credit rating based on a benchmark sample of Australian utilities subject to similar risk as the benchmark efficient entity is appropriate and relevant for the purpose of determining the benchmark efficient entity's credit risk.

471. The Authority is of the view that the list of Australian rated utilities is an appropriate starting point in which the benchmark sample can be formed. The list is reported by Standard & Poor's in its industry report card. Companies included in the benchmark sample to determine the credit rating for the benchmark efficient entity should satisfy two conditions. *First*, the company must be a network service provider in the gas and/or electricity industry in Australia. *Second*, its credit rating must be issued by an international rating agency such as Standard and Poor's or Moody's and publicly available.

472. The Authority's analysis indicated that gas businesses in Australia generally have lower credit ratings in comparison with electricity businesses in Australia. The Authority's analysis also shows that the credit rating for Australian gas businesses is within the BBB band. As a consequence, for the purpose of these guidelines, the benchmark credit rating is assumed to encompass the BBB-/BBB/BBB+ credit band.

8.2 Reasoning

473. Current Australian regulatory decisions in relation to the benchmark credit rating are presented in Table 4 below.

Table 4 Benchmark credit rating in the Australian regulatory decisions

Regulator	Year	Industry	Credit Rating
ACCC[191]	2011	Fixed Line Services (Telecommunications)	A
AER[192]	2012	Gas Distribution Network	BBB+
ERA[193]	2012	Electricity Distribution/Transmission	BBB/BBB+/A-
ERA[194]	2011	Gas Transmission	BBB/BBB+
IPART[195]	2012	Water, sewerage, stormwater drainage and other services	BBB/BBB+
QCA[196]	2012	Water, sewerage, stormwater drainage and other services	BBB+
ESCOSA[197]	2012	Water, sewerage, stormwater drainage and other services	BBB

Source: Compiled by the Economic Regulation Authority

474. The Authority adopted a credit rating of BBB/BBB+ in all three regulatory decisions for gas businesses in Western Australia. In its most recent decision in relation to Western Power, the Authority adopted a credit rating of BBB/BBB+/ A- based on an updated sample of Australian energy businesses.[198]

8.2.1 Methodology used to estimate credit rating and issues

475. The Authority notes that various approaches for determining a benchmark credit rating were previously examined by the AER in its 2009 weighted average cost of capital (**WACC**) Review. These techniques included: (i) ordinary least squares (**OLS**) regression techniques (as proposed by Associate Professor Lally); (ii) sample means; (iii) probit and logit regression models; (iv) sample medians; and (v) best comparators approach.

476. Lally (2006)[199] proposed applying OLS analysis in order to determine the appropriate credit rating for the benchmark efficient entity. This approach involves examining the

191 Australian Competition and Consumer Commission, *Inquiry to make final access determinations for declared fixed line services — Final report*, July 2011, p. 67.

192 Australian Energy Regulator, *Access Arrangement Information for the ACT, Queanbeyan and Palerang gas distribution network*, 1 July 2010 – 30 June 2015 p. 41.

193 Economic Regulation Authority (Western Australia), *Final decision on proposed revisions to the access arrangement for Western Power*, 2012.

194 Economic Regulation Authority, *Final Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline*, 31 October 2011, p. 158.

195 Independent Pricing and Regulatory Tribunal, *Review of prices for Sydney Water Corporation's water, sewerage, stormwater drainage and other services, From 1 July 2012 to 30 June 2016*, p. 197.

196 Queensland Competition Authority, *Final report, Sunwater irrigation price review 2012–17, Volume 1, May 2012*, p. 498.

197 Essential services commission of South Australia, *Advice on a regulatory rate of return for SA Water—Final advice*, February 2012, p. 49.

198 Economic Regulation Authority (Western Australia), *Final decision on proposed revisions to the access arrangement for Western Power*, 2012.

199 Lally, *The Appropriate Credit Rating for Australian Electricity Transmission Businesses,* Paper in support of AER Submission, March 2006.

relationship between the credit rating (the dependant variable) and variables relative to the credit rating, such as financial cash flows and qualitative variables. Lally assigned numbers to credit ratings in order to perform this regression. The benefit of this approach is that it allows a credit rating to be calculated given a set of financial data. For example, the benchmark efficient assumption of 60 per cent gearing could be an input into this model.

477. However, the drawback of the OLS approach is that it assumes that credit ratings are equidistant, that is, the difference in credit worthiness between ratings is the same. It is unlikely that the increment between two adjacent ratings on the credit rating scale such as an A- credit rating is one equal increment above that of a BBB+ credit rating. In addition, the OLS approach is sensitive to 'outliers' or extreme values in the sample.[200] Furthermore, credit ratings are by definition discrete variables, whereas OLS is based on the assumption of continuous variables. Accordingly, in its 2009 WACC Review, the Australian Energy Regulator (**AER**) put limited weight on the credit ratings derived using OLS regression techniques and sample averages.[201] The Authority agrees with the AER that the OLS regression model is inappropriate for estimating credit ratings, and as such will not be used for the purposes of these rate of return guidelines.

478. Logit analysis has been suggested as a more appropriate method for estimating the credit rating of a benchmark efficient entity as an alternative to OLS analysis.[202] Logit analysis uses dependent variables that can only take on discrete values.[203] The discrete variables do however have a specific ordering. Logit analysis assigns a probability of the dependent variable occurring, based on values of the independent variables. In the context of credit rating analysis, logit analysis assigns probabilities to each possible credit rating, reflecting the likelihood a firm has the given credit rating. Logit analysis estimates these probabilities via the values of a company's financial data. The credit rating of a benchmark efficient firm would be assigned by choosing the credit rating that has the highest probability.[204]

479. The Logit method has the advantage of being directly applicable to estimating the benchmark firm credit rating, as credit ratings are by definition discrete variables that have a specific ordering. This method however requires a large sample of observations in order to be reliable. Given the lack of observations for regulated entities, the AER considered this approach to be unreliable.[205] The AER noted it would revisit this approach in the future if more data became available. The Authority agrees with the AER that logit analysis requires a large data set which is not available at the moment. As a consequence, logit analysis will not be used for the purposes of estimating credit rating by the Authority.

480. The simple average value of credit ratings involves assigning numbers to credit ratings of comparable businesses, and then taking the simple average. The value obtained in this approach is then taken as the benchmark efficient credit rating. The AER notes

200 The Allen Consulting Group, *Credit rating for the 'benchmark efficient network service provider', Commentary on the AER's Explanatory Statement,* Report to Grid Australia, Energy Network Association and Australian Pipeline Association, January 2009,

201 Australian Energy Regulator, *Electricity transmission and distribution network service providers, Review of the weighted average cost of capital (WACC) parameters,* May 2009, p. 357.

202 Ibid.

203 Cramer, J.S (2003), *Logit Models from Economics and Other Fields,* Cambridge University Press, p. 1.

204 Australian Energy Regulator, *Electricity transmission and distribution network service providers, Review of the weighted average cost of capital (WACC) parameters,* May 2009, p. 357.

205 Ibid.

that this approach implies that the distance between credit ratings are uniformly distributed, implying the difference in creditworthiness between each rating is the same.[206] In addition, the presence of a single outlier observation can bias the outcome. The Authority therefore considers that the average credit rating value should not be used to estimate the benchmark efficient credit rating.

481. The "best comparator" approach was suggested by the Allen Consulting Group (**ACG**) in 2006[207] in response to the large number of variables that affect credit ratings and the lack of credit rated Australian firms. This method involves observing the most relevant financial indicators for a sample of firms that have been subject to recent regulatory decisions.[208] These ratios are then projected into the future regulatory period, and compared to the same financial indicators of relevant listed Australian firms. The credit rating for the benchmark efficient firm is then estimated from the credit rating of the most comparable listed Australian firms.

482. ACG used ElectraNet, GasNet, United Energy, Envestra and DUET for the comparable listed Australian firms, but placed less weight on United Energy due to its broadband service. Using this method, ACG concluded that ElectraNet is the best listed comparator, and chose a credit rating of BBB+ as the representative credit rating of the benchmark efficient entity.

483. The AER noted that while no method is perfect, the best comparator approach uses businesses that have a higher level of gearing than that assumed for the benchmark efficient entity, which biases the estimated credit rating.

484. 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. This approach is relatively robust to the presence of outliers in the comparator business sample relative to the average sample approach. This approach does not require any strong assumptions required for the average value of the credit rating as above. In addition, this approach does not involve assuming equidistant intervals between credit ratings.

485. The median value approach was used by the Authority in its recent Western Power access decision.[209]

8.2.2 Construction of the benchmark sample

486. The benchmark efficient entity is defined as:

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

487. In order 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. The Authority considers that it is appropriate to select Australian

206 Australian Energy Regulator, *Explanatory Statement Electricity transmission and distribution network service providers, Review of the weighted average cost of capital (WACC) parameters,* December 2008.

207 ACG, *Credit rating for a benchmark electricity transmission business,* Report to Electricity Transmission Network Owners Forum, May 2006.

208 Australian Energy Regulator, *Electricity transmission and distribution network service providers, Review of the weighted average cost of capital (WACC) parameters,* May 2009, p. 358.

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

companies with similar risk for the benchmark sample which is used to determine a benchmark credit rating.

488. The Authority considers that the Standard & Poor's (**S&P**) list of Australian utilities is an appropriate starting point for a sample to determine a benchmark credit rating for the purpose of this rate of return guideline. The Authority has also conducted extensive research from other service providers such as Bloomberg and Moody's to identity additional companies for inclusion in the benchmark sample. The Authority's findings indicate that both Bloomberg and Moody's do not provide any additional firms in comparison with S&P's list of Australian utilities. As such, the Authority is of the view that S&P's list of Australian utilities is appropriate to be considered as the starting point for a benchmark sample.

489. In determining a benchmark credit rating for gas businesses in Western Australia, the Authority has considered a benchmark credit rating from the following samples of comparable businesses:

- A sample including both Australian gas and electricity companies (*Sample 1*);
- A sample including all privately-owned gas and electricity businesses (*Sample 2*); and
- A sample including all privately-owned gas and electricity businesses excluding businesses with support from their parent companies (*Sample 3*).

490. In this analysis, the Authority considers the median credit rating of the above samples for the period of 5 years from 2008 to 2012 using Standard and Poor's Industry Report Cards.[210]

491. The Authority is of the view that 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 credit wrapping (even though this practice is no longer common in Australia). Nevertheless, in circumstances where an entity credit rating is unavailable but its instrument credit rating is available, the Authority considers that it is appropriate to include the instruments' credit rating in the benchmark sample. This approach will help to ensure the benchmark sample includes sufficient data points for determining a benchmark credit rating.

492. The Authority considers that 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 Standard and Poor's or Moody's. The Authority notes that, for the period from 2008 to 2012, the following 22 companies have satisfied the above two conditions.

[210] S&P's Industry Report Cards include (i) Australian And New Zealand Network Utilities Maintain Stable Credit Quality, November 2012; (ii) Favourable Industry Trends And Weakening Demand Place Asia Pacific Utilities In Fine Balance For The Next Six Months, November 2012; (iii) Regulatory Cloud Still Hangs Over Stable Outlook For Australian And New Zealand Utilities, May 2012; (iv) Australian Utilities Are On A Firm Footing, But Confronting Regulatory Reviews, November 2011; (v) For Australian Utilities, The Spotlight Turns To Asset Sales And Regulatory Outcomes, As Refinance Risks Moderate, May 2011; (vi) Refinancing And Balance Sheet Management Remain Top Of The Agenda For Australian Utilities, May 2010; (vii) For Australian Utilities, The Challenge Remains To Manage Refinancing And Balance Sheets, May 2009; (viii) As Risks Heat Up, Can Australian Utilities Strengthen Their Balance Sheets?, October 2008; (ix) Australian Utilities' Credit Prospects Dimmed By Looming Shadow Of M&A, Climate, And Regulatory Risks, May 2008.

1. Alinta LGA Ltd/Jemena (AGL)/Singapore Power International Assets Australia
2. Alinta Network Holding Pty Ltd/WA Network Holdings Pty Ltd/ATCO Gas Australia LP
3. The CitiPower Trust
4. DBNGP Finance Co Pty Ltd
5. DBNGP Trust
6. Diversified Utility and Energy Trusts (DUET) Group
7. ElectraNet Pty Ltd
8. Energy Partnership (Gas) Pty Ltd
9. Envestra Ltd
10. Envestra Victoria Pty Ltd
11. Ergon Energy Corporation Ltd
12. Ergon Energy Queensland Pty Ltd
13. ETSA Utilities Finance Pty Ltd
14. Gas Net Australia (Operations) Pty Ltd/APT Pipelines Ltd
15. Powercor Australia, LLC
16. SP AusNet Group
17. SPI Australia Holdings (Partnership) LP
18. SPI Electricity & Gas Australia Holdings Pty Ltd
19. SPI Electricity Pty Ltd
20. SPI PowerNet Pty Ltd
21. United Energy Distribution Holdings Pty Ltd
22. United Energy Distribution Pty Ltd

493. Appendices 6 and 7 contain the relevant credit ratings for each of the above companies for the years 2008 to 2012.

8.2.3 Sample 1: All Australian gas and electricity companies

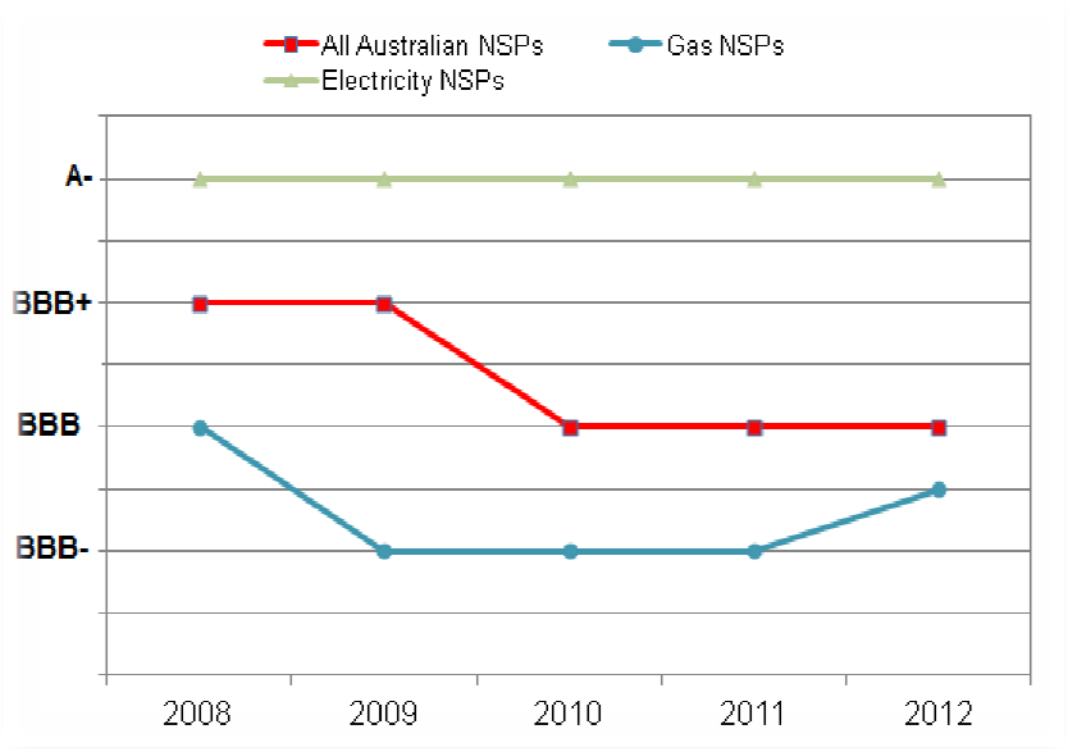
494. The Authority also notes that, for the above period from 2008 to 2012, some businesses were not rated for all years. The Authority has considered how the sample has evolved over the 5 year period from the AER's analysis in 2008.

495. A summary of this analysis on the available credit ratings for Australian gas and electricity businesses, known as *Sample 1*, is included in Figure 7. From this summary, the Authority notes the following:

- First, all 22 companies in the sample have credit ratings available in 2008 and 2009.
- Second, only 19 companies (out of 22 companies) have credit ratings available in 2010.
- Third, only 16 companies (out of 22 companies) have credit ratings available in 2011.
- Fourth, only 14 companies (out of 22 companies) have credit ratings available in 2012.

496. Figure 7 presents the median credit rating for *Sample 1* for the period of 5 years from 2008 to 2012. *Sample 1* is a full benchmark sample. The median credit rating for all Australian gas and electricity businesses across 5 years is presented by the red line. When gas and electricity businesses are considered in isolation, they are represented by the blue line and the green line respectively.

Figure 7 Median Credit Rating of Australian Gas and Electricity Network Service Providers, 2008 – 2012



Source: S&P and the ERA's analysis

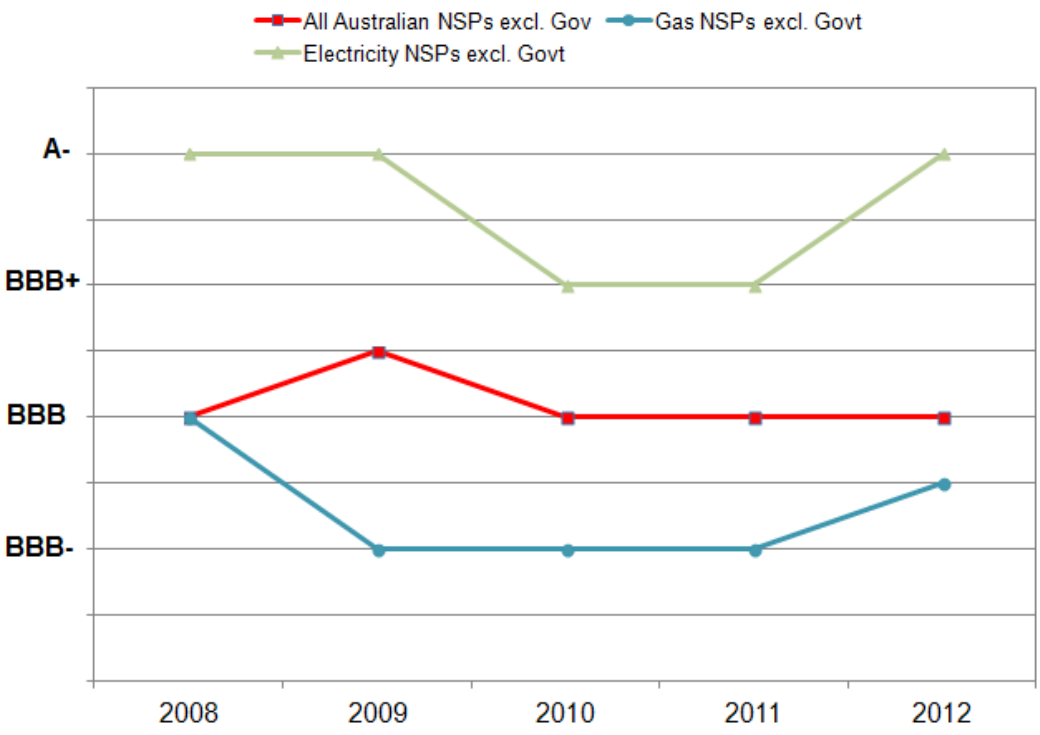
497. Figure 7 indicates the median credit rating for a full benchmark sample, *Sample 1*, including all Australian gas and electricity companies is BBB/BBB+.

8.2.4 *Sample 2: All Australian gas and electricity companies excluding government-owned businesses*

498. Sample 2 excludes all government-owned businesses from the full benchmark sample. A list of the companies included in Sample 2 is in Appendix 6. Figure 8 presents a median credit rating for all gas and electricity businesses over the last 5 years, from 2008 to 2012, with government owned businesses excluded from the sample. The Authority notes that there are 21 companies included in this analysis beginning in 2008, dropping to 13 in 2012.

499. When the government-owned businesses are excluded from the sample, the median credit rating for the Australian gas and electricity businesses across 5 years is represented by the red line. When gas and electricity businesses are considered in isolation, they are represented by the blue line and the green line respectively.

Figure 8 Australian Gas and Electricity NSPs Excluding Government-owned firms



Source: S&P and the ERA's analysis

500. Figure 8 indicates that the median credit rating for *Sample 2* is BBB.

8.2.5 *Sample 3: All Australian gas and electricity companies excluding government-owned or parent-owned businesses*

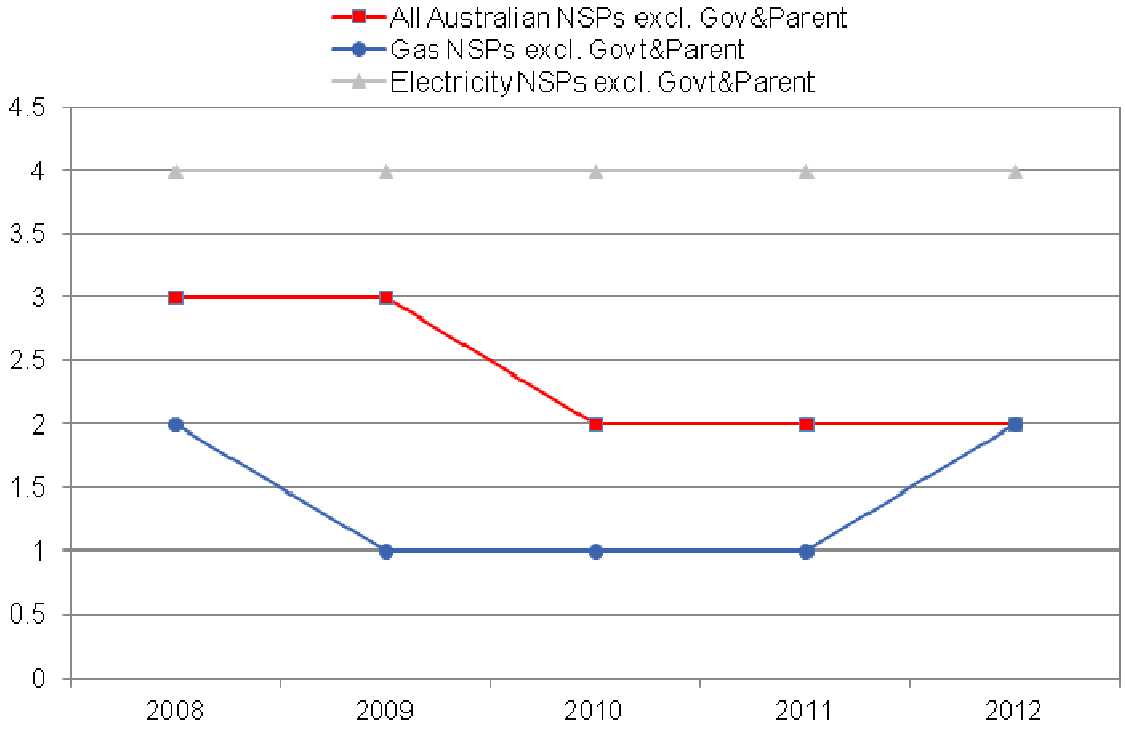
501. *Sample 3* excludes government-owned businesses or parent-owned businesses from the full benchmark sample. A list of the companies included in *Sample 3* is in Appendix 7.

502. Figure 9 presents a median credit rating for *Sample 3* over the last 5 years, from 2008 to 2012. The Authority notes that there are 19 companies from 2008 reducing to 11 companies in 2012 included in this analysis.

503. When the government-owned and parent-owned businesses are excluded from the sample, the median credit rating for the Australian gas and electricity businesses across 5 years is represented by the red line. When gas and electricity businesses are considered in isolation, they are represented by the blue line and the green line respectively.[211]

[211] Six of the 11 companies in the All Australian NSP sample are rated BBB or lower. Although Envestra is part owned by the APT Pipeline stapled trust it is still included in the sample as it was not a subsidiary.

Figure 9 Australian Gas & Electricity NSPs excluding Government-owned and Parents-owned Companies



Source: S&P and the ERA's analysis

504. Figure 9 indicates that the median credit rating for *Sample 3* is BBB/BBB+.

8.2.6 Results

505. The Authority considers that the credit rating for the efficient benchmark entity should be based on a sample of firms operating in the energy industry in Australia with similar risk.

506. In its 2009 WACC Review on the weighted average cost of capital parameters for electricity transmission and distribution network service providers, the AER observed that publicly listed credit ratings for government-owned enterprises and businesses with financially supportive parents would tend to be upwardly biased. The AER also noted that Standard and Poor's considers that gas networks generally face marginally greater risks than electricity networks.[212]

507. In considering the results set out above, the Authority has concluded that the median approach – in which a benchmark credit rating is derived from a sample of selected Australian businesses – is sensitive to the sample of companies used. The Authority notes that the removal and/or addition of one extra company into the sample may alter a benchmark credit rating. Therefore, the Authority considers that care must be taken when a benchmark credit rating is derived using the sample median.

508. The Authority therefore considers it appropriate to assign a range for the benchmark credit rating, rather than one particular credit rating. Using a range also allows for a larger benchmark sample of bonds to be included in the calculation of the bond yield

[212] Australian Energy Regulator, *Electricity transmission and distribution network service providers, Review of the weighted average cost of capital (WACC) parameters,* May 2009, p. 390.

approach (see Chapter 9 – Debt Risk Premium). The Australian Pipeline Industry Association (**APIA**) submitted that it supports the use of a wider range of credit ratings for the purposes of calculating the cost of debt allowance.[213] The Authority notes that it has utilised a range of credit ratings in previous WACC determinations.[214,215]

509. The Authority notes that for each of the 3 samples above, the median credit rating for Australian network service providers – including both electricity and gas – is in the range of BBB/BBB+. However, the Authority notes that for gas only networks, the appropriate range is BBB-/BBB. In consequence, for the purposes of these guidelines, the Authority considers that the BBB band, encompassing the BBB-, BBB and BBB+ credit rating notches, is the appropriate credit rating for the benchmark efficient entity.

8.2.7 Adjustments to the benchmark credit rating

510. In its submissions, the Major Energy Users Inc (**MEU**) submitted that there is no evidence supporting the Australian regulators' decision to adopt the benchmark credit rating of BBB+ concurrently with a gearing of 60 per cent in their previous regulatory decisions.[216] The MEU stated that market evidence shows a higher gearing (i.e. the debt component accounts for more than 60 per cent of the total asset) and a higher credit rating (better than BBB+ credit rating) combination is possible.[217] The MEU suggests a upwards revision to the credit rating to take this into account.

511. The Authority notes that the MEU does not provide any evidence to substantiate its view. The Authority considers that a benchmark credit rating derived from an appropriate sample of Australian businesses using a well accepted method is appropriate, and that no upwards revision is necessary.

512. Dampier to Bunbury Pipeline (**DBP**) submitted that credit ratings are imperfect indicators of the risk faced by a network service provider.[218] DBP believes that using credit ratings contradicts Rule 87 of the National Gas Rules (**NGR**), "a similar degree of risk as that which applies to the service provider in respect of the provision of reference services". DBP believes that the ERA is proceeding on the assumption that Rule 87 implies a need to identify the benchmark credit rating for estimating the cost of debt. DBP uses the report prepared by the Brattle Group to suggest that using the credit rating for the basis of estimating the cost of debt is insufficient, as firms will differ with respect to their coverage ratios, capital structures, cash flow variability, level of capital expenditures and business risk.

513. In response, the Authority is of the view that some cross-check is required to ensure that a median credit rating derived from a benchmark sample is appropriate. Some financial indicators such as the S&P's and Moody's credit metrics can be employed for this purpose. However, the Authority also notes that international rating agencies such

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213 The Australian Pipeline Industry Association Ltd, "*Response to Issues Paper, The Australian Energy Regulator's Development of Rate of Return Guidelines*", February 2013.

214 Economic Regulation Authority (Western Australia), *Final decision on proposed revisions to the access arrangement for Western Power*, 2012.

215 Economic Regulation Authority, *Final Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline*, 31 October 2011, p. 158.

216 Major Energy Users Inc. *Australian Energy Regulator, Better Regulation, Rate of Return Guidelines Comments on the Issue Paper* February 2013.

217 Major Energy Users Inc. *Australian Energy Regulator, Better Regulation, Rate of Return Guidelines Comments on the Issue Paper* February 2013.

218 Dampier to Bunbury Natural Gas Pipeline (DBNGP), WA Transmission Pty Ltd, "Submission on the Rate of Return Guidelines Consultation Paper", 6 March 2013.

as S&P and Moody's have also placed significant attention on a qualitative assessment of a business when determining an appropriate credit rating. As such, complete analysis of a benchmark credit rating may not be available from the credit metrics.

514. DBP submitted that electricity transmission entities are unlikely to be comparable to a gas transmission entity. DBP also emphasise that they disagree with using the credit rating as the key parameter in estimating the debt risk premium.

515. The Authority disagrees with DBP's view that a company's specific risk profile should be considered when determining a benchmark credit rating for regulated gas businesses in Australia. The Authority considers that a regulated rate of return and its input parameters are to be determined based on an efficient benchmark entity for the long-term benefits of consumers. In addition, any regulated rate of return only compensates the service provider for the systematic risk present in providing a reference service, not firm specific risk. As a consequence, the Authority disagrees with DBP that there should be an adjustment to account for firm specific risk.

9 Debt risk premium

516. The focus of this chapter is on the estimate of the debt risk premium (**DRP**). The DRP is the margin above the risk free rate of return, required to compensate holders of debt securities for the risk in providing debt finance. The debt risk premium compensates holders of debt securities for the possibility of default by the issuer.

9.1 Approach

517. The Authority is of the view that it is appropriate to use the bond-yield approach together with the joint-weighting mechanism to estimate the debt risk premium. The debt risk premium derived from the bond-yield approach will be based on the observed yields of relevant Australian corporate bonds, taken from Bloomberg, that qualify for inclusion in the benchmark sample.

518. The Authority will use the Bloomberg data service exclusively in order to construct the benchmark sample. Under the bond-yield approach, the following criteria apply in order to select bonds to be included in the benchmark sample.[219]

- credit rating of each bond must match that of the benchmark efficient entity, as rated by Standard & Poor's;
- the remaining time to maturity must be two years or longer;
- the bonds must be issued in Australia by Australian entities and denominated in Australian dollars;
- fixed bonds and floating bonds are eligible for inclusion;
- both Bullet bonds and bonds with Callable/ Putable redemptions are eligible for inclusion; and
- there are at least 10 yield observations over the required 40 day averaging period.

519. The debt risk premium is derived based on the observed yields obtained from the bonds in the benchmark sample. The debt risk premium for each bond is calculated by subtracting the relevant risk free rate that has the same maturity as that of the bond.

520. A weighted average debt risk premium is then calculated by weighting each estimated debt risk premium for each bond in the benchmark sample by its "joint-weight". The joint-weight for each bond is calculated by multiplying the bond's term to maturity by its amount at issuance, then dividing by the sum of all bonds in the sample's terms to maturity times their amount at issuance. The debt risk premium for the benchmark efficient entity is then calculated as the weighted average debt risk premium of each bond in the benchmark sample by using its joint weight.

[219] Economic Regulation Authority, *Discussion Paper – Measuring the Debt Risk Premium: A Bond-Yield Approach*, December 2010 p. 11.

9.2 Reasoning

9.2.1 Theoretical considerations

521. The DRP provides compensation to lenders for the additional risk associated with providing debt capital, over and above the risk-free rate. As such, the extent of the compensation, or 'credit spread', is closely related to the risk of the business. When issuing debt in the form of bonds, a credit rating can be assigned 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.

522. The DRP 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,[220] and is quoted by financial services such as Bloomberg.

523. The Authority notes that 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.[221] Therefore, the Authority considers that observing the yield of corporate bonds for the purposes of estimating the DRP is conservative. The Authority 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.

524. It is noted by the Authority that in its determination for Sun Water, Queensland Competition Authority (**QCA**) utilised a cost of capital where the cost of debt estimate exceeded the cost of equity estimate.[222] QCA noted that this arises as a consequence of the DRP being based on the promised yield, rather than the actual expected rate of return, with the true expected return including a discount for the expected default losses of bonds.

525. A benchmark sample of corporate bonds is expected to capture the characteristics of the benchmark firm because they have the same credit rating assigned by an international rating agency such as Standard & Poor's (**S&P**). Therefore, the benchmark sample of corporate bonds is seen to possess 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, the Authority considers that any method used to estimate the DRP must first rely on a sample of corporate bonds with a similar degree of risk.

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220 By setting the price of the bond equal to the promised cash flows of the bond, and solving for the discount rate.

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

222 Queensland Competition Authority, *Final report, Sunwater irrigation price review 2012–17, Volume 1, May 2012*, p. 497.

526. The Authority notes that 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 5 presents the S&P risk profile to determine the credit rating for a particular business.

Table 5 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: Standard & Poor's

527. S&P states a more comprehensive list of categories on which it bases its assessment of financial risk which includes accounting; financial governance and policies/risk tolerance; cash flow adequacy; capital structure/asset protection; and liquidity/short-term factors. Furthermore, its assessment also incorporates business risk including country risk; industry risk; competitive position; and profitability/peer group comparisons.

528. The Authority notes that assigning a credit rating to a debt security of a business is an independent assessment by an independent rating agency. This process considers both qualitative and quantitative statements reflecting the likely risk of holding a debt security. The Authority is therefore of the view that bonds with the same credit rating have a similar probability of default and therefore similar level of risk. As a result, the Authority considers that 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.

529. In its submission, the Brattle Group argued that the credit rating should not be considered in isolation. It submitted that specific financial ratios and risk factors should be taken into account when determining the cost of debt for a particular regulated business and adjustments made where appropriate.[223] The Authority disagrees with the Brattle Group's submission that the regulator should explicitly perform an adjustment so that the business and financial risk of the benchmark efficient firm is better matched with that of a regulated business as such an approach is arbitrary. The Authority considers that the risk of the benchmark efficient entity is adequately captured by its credit rating, as its purpose is to estimate the risk present in holding a bond in aggregate. As a consequence, the Authority rejects the Brattle Group's suggestion for an adjustment to be made. The Authority notes that the Brattle Group did not submit any mechanism for how this adjustment should be performed.

[223] The Brattle Group, "Estimating the Cost of Debt", 4 March 2013.

9.2.2 Methods adopted by regulators for estimating the debt risk premium

530. The generally accepted approach to estimating the return on debt involves estimating a DRP, which is added to the estimate of the risk free rate. Key components in estimating the return on debt include:

- the credit rating of the benchmark service provider;
- the resulting DRP of the benchmark service provider; and
- debt raising costs.

531. Australian economic regulators have consistently adopted this method for determining the cost of debt. However, an alternative approach – adopted by overseas regulators such as Ofgem and the New Zealand Commerce Commission (**NZCC**) – is to estimate the cost of debt directly from a sample of corporate bonds (without separately identifying the risk-free rate or DRP).

532. Australian regulatory practices in relation to the estimate of the DRP are presented in Table 6 below. Each of these methodologies is discussed in detail below.

533. In its inquiry into the access arrangements for fixed line services, the Australian Competition and Consumer Commission (**ACCC**)[224] used a single Telstra bond with a maturity of approximately 10 years to estimate the DRP. The ACCC considered this bond to be representative of the cost of debt for providers of fixed line services. The ACCC estimated the DRP by taking the 20 day average of the Telstra bond maturing on 15 July 2020[225] for the period from the 3rd to 30th June 2011. The estimated DRP is the difference between this average of the observed yield and the Bloomberg estimate of the 10 year CGS fair value curve (**FVC**).[226]

534. The Australian Energy Regulator (**AER**)[227] and ESCOSA[228] have both utilised the Bloomberg FVC for estimating the DRP in their regulatory decisions. The AER determined the DRP by defining the benchmark bond as a ten-year corporate bond with a BBB+ credit rating. The DRP is then measured by extrapolating the Bloomberg 7-year BBB fair value curve. The AER extrapolated the Bloomberg 7-year BBB FVC to a 10-year maturity using 'paired bond' analysis. This involves estimating the DRP from the Bloomberg 7-year BBB FVC, then adding a premium estimated from the difference between the 10-year AAA FVC and the 7-Year AAA FVC:

10-year BBB FVC = 7-year BBB FVC + (10-year AAA FVC – 7-year AAA FVC)

535. ESCOSA also used the Bloomberg 7-year FVC as a starting point to estimate the DRP. However, ESCOSA added an additional 20bp in order to extrapolate the estimate from a 7-year term to a 10-year term. This was based on an estimate of the difference in yields between the DRP for bonds with a maturity greater than 7 years and the Bloomberg 7-year BBB FVC.

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224 Australian Competition and Consumer Commission, *Inquiry to make final access determinations for declared fixed line services — Final report*, July 2011, p. 69.

225 Bloomberg Ticker: EI291758 Corp.

226 Bloomberg ticker: C12710Y Index.

227 Australian Energy Regulator, *Access Arrangement final decision Envestra Ltd 2013-17 Part 1,* March 2013, p. 30.

228 Essential services commission of South Australia, *Advice on a regulatory rate of return for SA Water—Final advice*, February 2012, p. 9.

536. The Independent Pricing and Regulatory Tribunal (**IPART**) utilised an inter-quartile range approach to estimating the DRP by considering a sample of securities that serve as proxies for the cost of debt for Sydney's Water Corporation.[229] The inter-quartile range approach defines the upper bound of the DRP as being in the top 25 per cent of DRPs in the sample, and the lower bound as being in the bottom 25 per cent of DRPs in the sample. The midpoint of this range is then used as the DRP estimate. The sample used by IPART in its review of prices for Sydney Water consisted of the Bloomberg 7-year BBB FVC, 13 Australian-issued bonds and 12 bonds issued by Australian companies denominated in USD.

537. The Authority notes that overseas regulators such as NZCC have also adopted a similar approach to the bond-yield approach.[230] In NZCC's method, the DRP is calculated as the spread between corporate bonds and New Zealand (**NZ**) government bonds. The bid yields to maturity for NZ corporate bonds, issued by an electricity or gas distribution business, denominated in NZ dollars, publicly traded, and with a remaining maturity of five years, are used. With regard to the NZ government bonds, bid yields are contemporaneously interpolated for the remaining term to maturity of 5 years.

538. In its determination for Price Monitoring of SEQ Water and Wastewater Distribution and Retail Activities 2013-2015 in January 2013, the Queensland Competition Authority (**QCA**) estimated the DRP as the sum of the debt margin estimated from Bloomberg's FVC (2.29 percent); a credit default swap allowance (1.18 per cent); an interest rate swap allowance (0.135 per cent); and an annual debt refinancing allowance (0.125 per cent).[231] This DRP was estimated by PwC.

539. In the UK, 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. The Alberta Utilities Commission determines the cost of equity independently of the cost of debt. The DRP plays an indirect role through qualitative adjustments made to the return on equity with respect to returns available on high grade corporate bonds.[232]

229 Independent Pricing and Regulatory Tribunal, *Review of prices for Sydney Water Corporation's water, sewerage, stormwater drainage and other services, From 1 July 2012 to 30 June 2016*, p. 206.

230 Commerce Commission New Zealand 2012, *Cost of Capital Determination for Electricity Distribution Businesses to Apply to a Customised Price-Quality Path Proposal*, 2012 NZCC 25, September.

231 Queensland Competition Authority, *Price Monitoring of SEQ Water and Wastewater Distribution and Retail Activities 2013 – 15,* January 2013..

232 Alberta Utilities Commission 2011, *2011 Generic Cost of Capital, Decision 2011-474*, December, p. 24.

Table 6 Estimating the Debt Risk Premium in the Australian regulatory decisions

Regulator	Year	Industry	Cost of Debt Methodology
ACCC[233]	2011	Fixed Line Services (Telecommunications)	Observed 20 day average of DRP for a single Telstra bond maturing July 2020
AER[234]	2012	Gas Distribution Network	Extrapolation via Bloomberg's fair value curves
ERA[235]	2012	Electricity Distribution/Transmission	Bond -yield Approach
ERA[236]	2011	Gas Transmission	Bond-yield Approach
IPART[237]	2012	Water, sewerage, stormwater drainage and other services	Bloomberg's FVC and sample of securities – Inter-quartile range approach.
QCA[238]	2012	Water, sewerage, stormwater drainage and other services	Bloomberg's FVC + Credit default swap allowance + Interest rate swap allowance + Debt refinancing allowance.
ESCOSA[239]	2012	Water, sewerage, stormwater drainage and other services	Extrapolation via Bloomberg's FVC.

Source: Compiled by the Economic Regulation Authority

9.2.3 Bloomberg's Fair Value Curve

540. The Authority has previously adopted the Bloomberg's Fair Value Curve **(FVC)** in order to estimate the DRP for regulated entities. The Bloomberg FVC provides an estimate of the yield curve for Australian corporate debt based on a given credit rating band.

541. Submissions questioned why the Authority was not considering Bloomberg's FVC as the primary source for estimating the DRP.[240] The Authority also received a

233 Australian Competition and Consumer Commission, *Inquiry to make final access determinations for declared fixed line services — Final report*, July 2011, p. 69.

234 Australian Energy Regulator, *Access Arrangement final decision Envestra Ltd 2013-17 Part 1,* March 2013, p. 30.

235 Economic Regulation Authority (Western Australia), *Final decision on proposed revisions to the access arrangement for Western Power*, 2012.

236 Economic Regulation Authority, *Final Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline*, 31 October 2011, p. 158.

237 Independent Pricing and Regulatory Tribunal, *Review of prices for Sydney Water Corporation's water, sewerage, stormwater drainage and other services, From 1 July 2012 to 30 June 2016*, p. 206.

238 Queensland Competition Authority, *Final report, Sunwater irrigation price review 2012–17, Volume 1, May 2012*, p. 497.

239 Essential services commission of South Australia, *Advice on a regulatory rate of return for SA Water—Final advice*, February 2012, p. 9.

240 Goldfields Gas Transmission Pty Ltd, "*Submission to Economic Regulation Authority Consultation Paper: Guidelines for the Rate of Return for Gas Transmission and Distribution Networks."* 28 February 2013 p. 19.
Western Australian Treasury Corporation, "Rate of Return Guidelines Review", 15 March 2013.

submission from Competition Economists Group (**CEG**) on behalf of Energy Networks Association (**ENA**) advocating the use of the Bloomberg FVC.[241] CEG provided an opinion regarding the use of the Bloomberg FVC, stating that using an independent expert opinion on estimating the DRP has significant advantages. In particular, as it is built for commercial purposes, "there is no obvious incentive for it to bias its estimates up or down". CEG notes that a significant disadvantage of utilising the Bloomberg FVCs is that the methodology underpinning them is opaque and non-replicable. In addition, CEG observes that the FVCs provided by Bloomberg do not include an estimate for 10 year maturity and therefore extrapolation methods are required if the benchmark term of debt assumption is 10 years. To estimate the robustness of the Bloomberg FVC, CEG fits Nielson-Siegel yield curves to a sample of bonds and then compare it to the Bloomberg FVC. CEG estimated the yields on floating rate notes provided by UBS using the trading margins reported by UBS and adding the swap rates as reported by Bloomberg. CEG constructed 32 different sub-samples based on the following choices used to construct each sample:

- Rated BBB+ or BBB to A-;
- Excluding bonds with options or using all bonds;
- Bonds denominated in AUD only or all currencies;
- Country of domicile for the issuer (Australia or all countries); and
- Data source (Bloomberg or Bloomberg and UBS).

542. In applying the Nielson-Siegel curve analysis to each sample of bonds, CEG noted that the results are consistent with the results of extrapolating the Bloomberg's FVC to a 10 year maturity.[242] As a consequence, CEG concluded that using the Bloomberg FVC is the most appropriate method for estimating the DRP in the context of utility regulation.

543. The Authority notes that as the cost of debt will be updated on an annual basis, the term to maturity for the cost of debt is now one year. As a consequence, extrapolation to ten years as suggested by CEG is unnecessary. The Authority disagrees with CEG's submission regarding the use of the Bloomberg FVC, with analysis indicating that the Bloomberg FVC produces higher estimates than those observed in the corporate bond market. In addition, CEG arrived at its conclusion by constructing 32 different samples, and used this wide range of DRP estimates to imply that this was consistent with the FVC. In addition, the Authority cannot judge the appropriateness of the Bloomberg FVC without access to the methodology which is used to derive Bloomberg's FVC, as a consequence, the Authority cannot rely on it to estimate the DRP.

544. The Authority notes that its reasoning for a departure from the use of Bloomberg's FVC was discussed at length in its Discussion Paper[243] and the Final Decision on WAGN's proposed Access Arrangement.[244] The Authority considered that its major concern was the lack of liquidity in the Australian corporate bond markets and that

241 Competition Economists Group 2013, *Estimating the debt risk premium,* June 2013.

242 The extrapolation of the Bloomberg FVC is the method used by the AER and adds the difference between the DRP of the 10 year AAA BFVC and the 7 year AAA BFVC to the DRP of the 7 year BBB BFVC.

243 Economic Regulation Authority, *Discussion Paper – Measuring the Debt Risk Premium: A Bond-Yield Approach,* December 2010.

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

Independent Pricing and Regulatory Tribunal, *Estimating the debt margin for the weighted average cost of capital, Analysis and Policy Development* – Discussion Paper May 2009, p. 20.

Bloomberg's estimates of the FVC have been substantially different from those observed in the Australian corporate bond markets, particularly for Bloomberg's FVC estimates with a longer term such as 10 years. The Authority noted that lack of liquidity was the reason for CBASpectrum ceasing publication of its fair value curves, in addition to the shortened duration of the Bloomberg FVC estimates. As a consequence, the Authority considered that the Bloomberg FVC did not adequately reflect the prevailing market conditions for debt. The Authority also considered that the difference could potentially be a result of the Bloomberg methodology to extrapolate from the observed yields of shorter term-to-maturity bonds into the longer term FVC. In addition, the method used by Bloomberg is not disclosed to the public and therefore the Authority could not determine the drivers of the difference or replicate the estimates using Bloomberg's approach. As a consequence, the Authority is of the view that the Bloomberg estimates of the FVC do not reflect the cost of debt for an efficient benchmark entity.

545. The Authority therefore does not consider the Bloomberg FVCs are 'implemented in accordance with best practice', as they are not supported by 'robust, transparent and replicable' datasets and as a consequence will not be used for estimating the DRP for the purposes of these guidelines.

9.2.4 The Authority's current method: the Bond-yield approach

546. Since 2010, the Authority has adopted the Bond-yield approach to estimate the DRP in its regulatory decisions.[245] 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 DRP is estimated for each bond from its observed yields and then weighted using a joint-weighting approach. The Authority developed the bond-yield approach after it considered that the Bloomberg FVC did not adequately reflect the cost of debt of an efficient benchmark entity.

547. The Authority notes that the use of the bond-yield approach has been appealed by various regulated entities in the past.[246,247] In addition, in its recent decisions on the Application by WA Gas Networks Pty Ltd and on the Application by DBNGP (WA) Transmission Pty Ltd (No 3) [2012] ACompT 14, released on the 26th July 2012, the ACT concluded that the Authority's bond-yield approach is a valid approach to estimate the DRP for regulated businesses:[248]

> ... The Tribunal emphasises here that in its bond yield approach the ERA departed from the usual regulatory practice of estimating the DRP from FVC curves [sic]. The Tribunal accepts that the ERA's approach is a valid one.

and: [249,250]

> ...the issue which is presently the subject of contention is whether the ERA selected a correct input for the DRP for the purposes of the modelling under rule 87(2). There

245 Economic Regulation Authority, *Final Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline*, 31 October 2011, p. 158.

246 Australian Competition Tribunal, *Application by WA Gas Networks Pty Ltd (No3) [2012].*

247 Australian Competition Tribunal, 2012, *Application by DBNGP (WA) Transmission Pty Ltd (No 3) [2012] ACompT 14*, 26th July 2012.

248 Australian Competition Tribunal, 2012, *Application by WA Gas Networks Pty Ltd (No 3) [2012] ACompT 12*, 8th June 2012, paragraph 179, p. 43.

249 Australian Competition Tribunal, 2012, *Application by DBNGP (WA) Transmission Pty Ltd (No 3) [2012] ACompT 14*, 26th July 2012, paragraph 306.

250 The limited respect the tribunal referred to was the original weighting mechanism employed by the Authority in the bond yield approach. This was amended by the Authority and is discussed in 9.2.4.2.

> were quite different proposals nominated by DBP on the one hand, and utilised by the ERA on the other, about which was the correct or preferable approach. The Tribunal has found that the approach of the ERA was a proper one. Among the concerns of DBP for urging its proposition to the ERA was the desirability of satisfying rule 87(1) and the national gas objective. It submitted that the ERA's approach would not achieve that outcome, both generally and because some of the inputs (including the DRP) were not satisfactory. The Tribunal has found that the ERA's approach is capable of achieving that outcome, but that in a limited respect it did not do so. The limited respect is the value of the DRP used by the ERA.

and:[251]

> ...the Tribunal is of the opinion that DBP failed to show error on the part of the ERA in deciding to base its determination of the DRP on its bond-yield approach, an approach recently endorsed by the Tribunal in the WAGN decision.

548. The Authority has addressed issues arising from the implementation of the bond-yield approach below. Overall, the Authority is of the view that the bond-yield approach and its joint-weighting mechanism are likely to best meet the allowed rate of return objective and requirements.

9.2.4.1 The benchmark sample

549. The key component of the bond-yield approach is to develop a benchmark sample of corporate bonds which hold a similar level of risk as that of the benchmark efficient entity. From this benchmark sample, a DRP is derived by observing the difference between the observed yield of the bonds and the relevant risk free rate. The Authority uses the Bloomberg data service exclusively in order to construct the benchmark sample. The following characteristics are required to select bonds to be included in the benchmark sample.[252]

- credit rating of each bond must match that of the benchmark efficient entity, as rated by Standard & Poor's;
- time to maturity of 2 years or longer;
- bonds issued in Australia by Australian entities and denominated in Australian dollars;
- inclusion of both fixed bonds[253] and floating bonds,[254]
- inclusion of both bullet and callable/ putable redemptions;[255] and
- includes at least 10 yield observations over the required averaging period.

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251 Australian Competition Tribunal, 2012, *Application by DBNGP (WA) Transmission Pty Ltd (No 3) [2012] ACompT 14*, 26th July 2012, paragraph 309.

252 Economic Regulation Authority, *Discussion Paper – Measuring the Debt Risk Premium: A Bond-Yield Approach*, December 2010 p. 11.

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

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

255 A callable (putable) 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 (putable) bond therefore has a higher (lower) yield relative to a standard bond, since there is a possibility that the bond will be redeemed by the issuer (bondholder) if market interest rates fall (rise).

550. The Authority developed the above criteria for deriving the benchmark sample based on considerations of market relevance and sample size. As outlined in its Discussion Paper in 2010, the Authority considers that these criteria are necessary given the small size of the Australian corporate bond market.[256] In addition, the Authority considers that the above criteria, which are used to construct a benchmark sample, allows for an estimate of the DRP that is commensurate with the risks faced by the benchmark efficient entity.

551. Western Australian Treasury Corporation (**WATC**) submitted that it was concerned with the input data quality of the benchmark sample. WATC considered that some of the data used in previous regulatory decisions had low Bloomberg valuation scores.[257] The Authority is aware of the potential weaknesses of observed yields for some bonds reported by Bloomberg. However, as discussed at length in its Discussion Paper released in December 2010[258] and its final decision on the adoption of the bond-yield approach in estimating the DRP in WAGN's proposed Access Arrangement,[259] the Authority is of the view that there is a trade-off between the relevance of the market data and the number of observations in the benchmark sample. The Authority notes that using Bloomberg's high valuation scores on observed yields will reduce the size of the benchmark sample to only a few bonds. As a consequence, the Authority is of the view that its current approach is appropriate.

552. Energy Networks Association **(ENA)** submitted a report prepared by PricewaterhouseCoopers **(PwC)** outlining the possible impact on the estimate of the DRP for regulated businesses when the Authority's bond-yield approach is adopted. ENA utilised only Bloomberg data, which does not contain pricing data on floating rate notes. It is noted that UBS does report data for the floating rate notes.[260]

553. WATC also submitted that a larger sample of bonds was available through the UBS database than that available from the Bloomberg terminal. The Authority considers that it is appropriate to use Bloomberg's reported data on Australian corporate bonds with their relevant observed yields data given Bloomberg's reputation as a world leading service provider of financial data. Using various sources of data for the same purpose may create an unnecessary duplication. As a consequence, the Authority considers that it is appropriate to rely on Bloomberg as the only source of data regarding the Australian corporate debt market.

554. In relation to the selection criteria used to determine the benchmark sample, WATC proposed the following bonds should be excluded from the sample:

- bonds with issuance less than $100 million;
- bonds with implicit government guarantees;
- bonds with rating dependent step-up clauses;
- bonds attached to public private partnership infrastructure;
- floating rate notes;

256 Economic Regulation Authority, *Discussion Paper – Measuring the Debt Risk Premium: A Bond-Yield Approach*, December 2010 p. 10.

257 Western Australian Treasury Corporation, "Rate of Return Guidelines Review", 15 March 2013.

258 Economic Regulation Authority, *Discussion Paper – Measuring the Debt Risk Premium: A Bond-Yield Approach,* December 2010.

259 Economic Regulation Authority, December 2010, *Final Decision on Proposed Revisions to the Western Australian Gas Network.*

260 Energy Networks Association 2013, *Potential impact of the ERA's DRP methodology,* June 2013.

- convertible bonds;
- bonds issues in offshore markets; and
- bonds with imbedded options.

555. As previously discussed, the Authority considers that it is appropriate to recognise a trade-off between the relevance of the data and the number of observations. The Authority is of the view that the objective is to estimate a DRP that is representative of a 'normal' or "benchmark" rate of return on debt that an investor would earn on an asset of similar risk.

556. The Authority considers that determining the benchmark sample based on criteria that are too restrictive will result in a small sample of bonds. This very small sample will lead to a decrease in statistical reliability and an increase in the risk of bias toward the individual characteristics of particular bonds in the sample. In response to WATC's proposed selection criteria, Table 7 below demonstrates the change in the estimate of the DRP when bonds are excluded based on WATC's proposal in comparison with the initial benchmark sample developed in the Authority's bond-yield approach. This analysis was conducted in June 2013.

557. The Authority notes that the estimate of the DRP slightly increases with a maximum magnitude of as low as 6 basis points in comparison with the original benchmark sample. The Authority also notes that the standard deviation for these estimates also increases representing an increased inefficiency of the estimates based on the sample as a consequence of too many restrictions. As a consequence, the Authority considers WATC's criteria to be inappropriate for determining the required DRP of the benchmark efficient entity.

Table 7 The Authority's Bond-yield Approach (Sample 1) and WATC's Proposed Criteria (Sample 2), June 2013

Sample	Number of Bonds in Sample 1	Number of Bonds in Sample 2 After Criteria Applied	Mean of the Debt Risk Premium	Standard Error (SE) (bp)	SE as a per cent of Mean
Initial Sample	**25**		**2.050**	**0.058**	**2.82%**
Excluding Bonds with:					
Face Value < $100m	25	23	2.045	0.063	3.06%
Implicit Government Guarantee	25	18	2.113	0.065	3.08%
Rating Dependent Step Up Clauses	25	17	2.101	0.066	3.15%
PPP Infrastructure Issuer	0	0	-	-	-
Embedded Options	0	0	-	-	-
Convertible Feature	0	0	-	-	-
Issue in Offshore Market	0	0	-	-	-
Floating Rate	0	0	-	-	-
All of the above Criteria	25	15	2.101	0.075	3.56%

Source: The Economic Regulation Authority's analysis

558. CEG critiqued the Authority's bond-yield approach by suggesting that the approach does not control for the composition of credit ratings within the sample and will be skewed towards the credit rating with the largest amount of bonds.[261] CEG also suggested that the Authority's selection criteria for bonds results in a significant

[261] Competition Economists Group 2013, *Debt strategies of utility businesses,* June 2013.

amount of relevant information lost. The Authority notes that the sample being skewed by credit rating is unavoidable, and can only be rectified by removing bonds from the sample. This is in contradiction to CEG's suggestion that the Authority's criteria result in a significant amount of relevant information being lost.

9.2.4.2 The joint-weighted averaging approach

559. The DRP is derived based on the observed yields obtained from the bonds in the benchmark sample. The DRP for each bond is calculated by subtracting the relevant risk free rate that has the same maturity and from the observed yield of the bond.[262] A weighted average DRP is then calculated by weighting each DRP in the benchmark sample by its *"joint-weight".* The joint-weighted approach was developed following consideration of the Australian Competition Tribunal **(**the **Tribunal)** ruling, which accepted the Authority's original use of a "term to maturity" weighted average for the DRP.[263,264] However, the Tribunal requested more detailed analysis of an "amount-issued" weighted average as the Tribunal considered that this characteristic of a bond would also have merit.[265] As a consequence, the Authority has utilised a multiplicative or joint-weighted mechanism to take into account both characteristics in its most recent regulatory decision with respect to the DRP.[266]

560. The joint-weighted mechanism takes into account two key characteristics of bonds in the benchmark sample: (i) the term to maturity (a bond with a longer term to maturity is given a higher weight in the sample); and (ii) the amount at issuance (a bond with a larger amount at issuance is given a higher weight in the sample).[267]

561. The joint-weighted average calculates a joint weighted average debt risk premium (**JW**) as follows:

$$JW = \sum_{i=1}^{n} w_i \overline{DRP_i} \qquad (10)$$

[262] As in Chapter 7 – Risk free rate, the risk free rate is calculated via linear interpolation of the two CGS with maturity closest to that of the desired maturity.

[263] A term to maturity weighted average assigns a higher weight to bonds with longer maturities.

[264] Australian Competition Tribunal, 2012, *Application by WA Gas Networks Pty Ltd (No 3) [2012] ACompT 12*, 8th June 2012.

[265] Similarly, an amount issued weighted average assigns a higher weight to bonds with larger issue amounts.

[266] Economic Regulation Authority (Western Australia), *Final decision on proposed revisions to the access arrangement for Western Power*, 2012.

[267] Australian Competition Tribunal, *Application by WA Gas Networks Pty Ltd (No3) [2012].*

where:

n is the number of bonds in the sample;

w_i is the weight assigned to bond i in the sample and defined as:

$$w_i = \frac{(Maturity_i).(IssueAmount_i)}{\sum_{j=1}^{n}(Maturity_j).(IssueAmount_j)};$$

$Maturity_i$ is the term to maturity of bond i;

$IssueAmount_i$ is the size of the bond, in dollar terms at its issuance date; and

$\overline{DRP_i}$ is the average debt risk premium observed over the averaging period (see Section 9.2.4.3) for bond i.

562. ENA submitted a report prepared PwC suggesting no econometric cross-check is available under the Authority's bond-yield approach, unlike that underpinning the Bloomberg FVC.[268] The Authority considers that ENA's criticism that no econometric cross-check is available for the joint-weighted approach is flawed. Given that the bond-yield approach is based on a benchmark sample of bonds, with a similar level of risk to that of the benchmark efficient entity, it follows that the derived DRP will be a function of bonds in that sample. As a consequence, no econometric cross check is necessary as the joint-weighted approach is constrained to have a sensible outcome reflecting the prevailing market conditions for funds.

563. The Authority received a submission from Dampier to Bunbury Pipeline (**DBP**) arguing that there is no basis for the joint-weighting mechanism.[269] CEG also suggested that the ERA's bond-yield approach weighting is inappropriate as it does not make use of all bond yield information that is available;[270] The Authority is of the view that the joint-weighting mechanism was developed using a robust process, supported by the Tribunal's recommendations. As such, the Authority considers that the joint-weighting mechanism is 'fit for purpose' for estimating the DRP in this rate of return guidelines.

9.2.4.3 Averaging period for the debt risk premium

564. The Authority is of the view that a 40 business day period prior to a regulatory determination is appropriate to be used in order to estimate the required risk free rate of return. This view is based on a discussion in Chapter ABC – A Risk-free rate of return. The rationale for doing so is to allow regulated entities sufficient time to refinance their debt portfolio, without compromising the Authority's desire for predictive efficiency. For internal consistency, the Authority will also adopt a 40 day averaging period in order to estimate the DRP for each bond in the benchmark sample.

565. Given the lack of pricing data regarding the Australian corporate bond market, the Authority has previously employed a criteria that removes bonds that contain less than

268 Energy Networks Association 2013, *Potential impact of the ERA's DRP methodology,* June 2013.

269 Dampier to Bunbury Pipeline, *Guidelines for the Rate of Return for Gas Transmission and Distribution Networks,* March 2013.

270 Competition Economists Group 2013, *Debt strategies of utility businesses,* June 2013.

50 per cent of observations over the averaging period.[271] Requiring bonds to have 100 per cent observed yields during the sample period would significantly reduce the number of bonds in the benchmark sample. Given the Authority's adoption of a 40 day averaging period, the Authority requires each bond to have at least 10 days of pricing data in this 40 day averaging period in order to be included in the benchmark sample. WATC criticised the Authority's current practice of doing this, suggesting that this reduces the quality of the resulting estimate.[272] As outlined above, the Authority is of the view that this is necessary given the lack of financial data available in Australia, with this approach maximising the number of bonds available in the benchmark sample.

9.2.4.4 Term to maturity debt risk premium

566. Energy Networks Association (**ENA**) submitted a report prepared by PricewaterhouseCoopers (**PwC**) outlining what it believed would be the impact of the Australian Energy Regulator (**AER**) adopting the ERA's bond-yield approach.[273] PWC performed analysis suggesting that the joint-weighting approach results in, on average, a DRP with an average term of 5.2 years. PwC suggested that this is inappropriate if the benchmark term assumption is 10 years.

567. CEG has expressed concern that the methodologies utilised by the ERA to estimate the DRP cannot be relied upon as an alternative to the Bloomberg FVC.[274] In particular, CEG stated that the methodology assumes a benchmark term of debt of 5 years, while CEG considers that the appropriate term is 10 years. Furthermore, CEG suggested that the maturity of the benchmark DRP is a function of the underlying sample of bonds; as a consequence, it is not consistent with any particular maturity.

568. The Authority considers that the criticism by CEG and ENA regarding the average DRP that arises from application of the joint-weighted approach is irrelevant for the purposes of the guidelines. As discussed in Chapter 6 – Return on debt, the Authority has elected to utilise an annual update for the cost of debt. Therefore, the Authority considers that the joint-weighted approach produces a conservative estimate of the DRP, as longer maturity bonds are given a higher weight.

569. In addition, Section 9.2.5 below discusses fitting a yield curve to the DRP in recent regulatory decisions by the Authority. This curve fitting technique allows for a calculation of the DRP conditional on the relevant assumed maturity. ESQUANT Consulting, on behalf of Gas Multinet estimate their own yield curves by using the Nelson-Siegel methodology (Table 8 to Table 11 below). Assuming these results are correct, ESQUANT Consulting has shown that there is no statistically reliable relationship between the observed DRP and term to maturity for the benchmark sample. This implies that the most appropriate model of the term structure of the DRP for each of the samples is that of a constant one across all maturities. Therefore, the Authority is of the view that the DRP estimated via the bond-yield approach is appropriate for these rate of return guidelines.

[271] Economic Regulation Authority (Western Australia), *Final decision on proposed revisions to the access arrangement for Western Power*, 2012.

[272] Western Australian Treasury Corporation, "Rate of Return Guidelines Review", 15 March 2013.

[273] Energy Networks Association 2013, *Potential impact of the ERA's DRP methodology,* June 2013.

[274] Competition Economists Group 2013, *Debt strategies of utility businesses,* June 2013.

9.2.5 Yield curve fitting

570. WATC noted that the Authority has stopped using the Bloomberg's FVC to estimate the DRP in favour of the bond-yield approach.[275] WATC also submitted that it is in favour of fitting a yield curve to bond yield data for a given credit category. WATC argued that this curve-fitting approach would allow an estimate of the DRP conditional on the maturity of a bond, that the bond yield approach does not facilitate. WATC noted there is a large literature on constructing a yield curve. WATC submitted that it preferred a methodology of fitting a risk-free yield curve using the "maximum smoothness" forward rate procedure. In this procedure, WATC submitted that the credit spread for each bond in the benchmark sample relative to the risk free are is calculated and then fitted into a yield curve using the maximum smoothness forward rate procedure. WATC noted this approach was recommended by Professor Erik Schlogl to IPART.[276] WATC also noted that if extrapolation of bond yields is required, (i.e. the bond with the longest term to maturity in the sample is shorter than the regulatory control period), then the regression model described by Queensland Treasury Corporation should be used.[277]

571. The Authority notes that Professor Erik Schlogl's advice to IPART was provided in order to ascertain if it is possible to extrapolate the DRP for longer term maturities than those currently observed for Australian corporate bonds.[278] This request was due to the 10-year term previously adopted by IPART in its WACC estimate being longer than the observed terms of relevant bonds in the Australian corporate debt market. It is noted that IPART has now adopted a 5-year term for estimates of the risk-free rate and the cost of debt.

572. The Authority will utilise a 1 year term for the cost of debt as a consequence of the implementation of an annual update. As a result, extrapolation using this methodology is unnecessary. In particular, the Authority notes that Professor Schlogl suggested applying the Krishnan, Ritchken and Thomson (2008) methodology to Australia.[279] Professor Schlogl suggested using international DRPs for comparable bonds to mitigate the lack of Australian corporate bonds. The Authority disagrees with the use of international data in constructing the bond sample for Australia within the domestic WACC framework. The Authority considers, however, that the application of the Nelson-Siegel yield curve may have merit. By utilising the sample of bonds adopted in the bond-yield approach in its previous regulatory decisions, a Nelson-Siegel yield curve can be fitted which would allow a DRP to be estimated conditional on the required maturity.

573. The Nelson-Siegel methodology assumes that the term structure of the DRP has the following parametric form:

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275 Western Australian Treasury Corporation, "Rate of Return Guidelines Review", 15 March 2013.

276 Schlogl, E 2009, "Estimation of the interest rate term structure of corporate debt", Appendix A in IPART 2009, "Estimating the debt margin for the weighted average cost of capital. Analysis and Policy Development- Discussion Paper", May 2009.

277 Queensland Treasury Corporation, "Debt Risk Premium Analysis," Appendix C in *Powerlink Queensland 2013-2017 Revised Revenue Proposal,* January 2012.

278 Independent Pricing and Regulatory Tribunal, *Estimating the debt margin for the weighted average cost of capital, Analysis and Policy Development* – Discussion Paper May 2009, p. 20.

279 Krishnan, C. N.V, Ritchken, P.H. and Thomson, J.B. (2010), 'Predicting Credit Spreads', *Journal of Financial Intermediation,* Vol 19, pp. 529-563.

$$y_t(\tau) = \beta_{0t} + \beta_{1t}\frac{1-\exp(-\lambda\tau)}{\lambda\tau} + \beta_{2t}\left(\frac{1-\exp(-\lambda\tau)}{\lambda\tau} - \exp(-\lambda\tau)\right) \quad (11)$$

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.

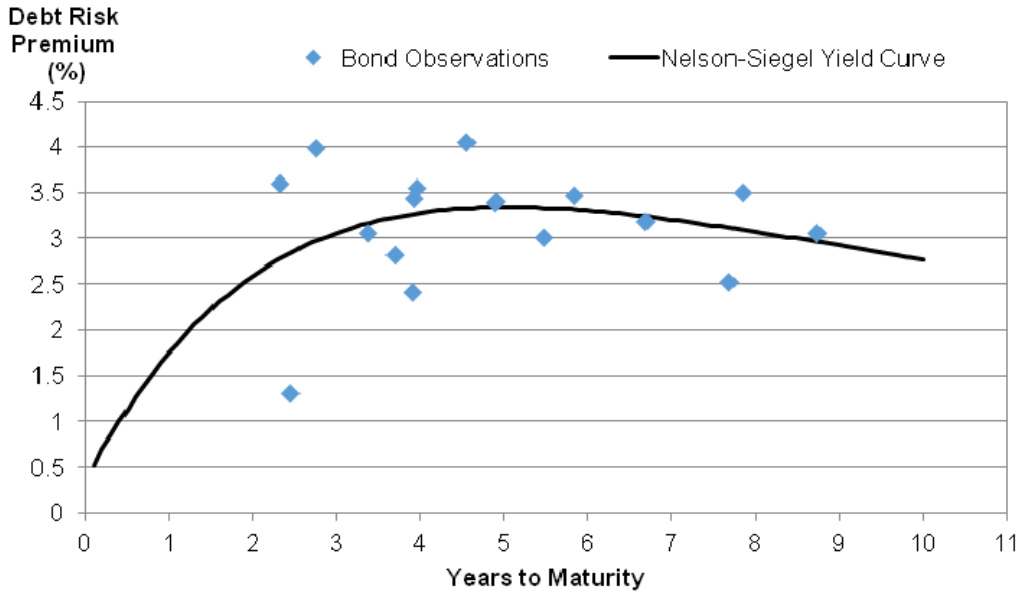
574. The Nelson-Siegel methodology uses observed data from the bond market to estimate the parameters $\beta_{0t}, \beta_{1t}, \beta_{2t}, \lambda$ by using the observed debt risk premium and maturities for bonds. With the estimated parameters $\beta_{0t}, \beta_{1t}, \beta_{2t}, \lambda$, a yield curve is produced by substituting these estimates into (1) and plotting the resulting *estimated* debt risk premium $\widehat{y_t(\tau)}$ by varying the maturity τ . $\widehat{y_t(\tau)}$ has the interpretation of being the *estimated* debt risk premium for a benchmark bond with a maturity of τ for a given credit rating.

575. The Authority has applied this methodology to the bonds underlying the bond-yield approach in recent regulatory decisions. The parameters $\beta_{0t}, \beta_{1t}, \beta_{2t}, \lambda$ were estimated using the R function *Nelson.Siegel* in the Yield Curve package.[280] Given the underlying bonds representing a given credit rating band (BBB/BBB+ in this case), this estimated curve has the interpretation of being the term structure of the DRP for a given credit rating.

576. The estimated DRPs from previous decisions using the joint-weighted mechanism and the Nelson-Siegel yield curve fitting are presented below (Figure 10, Figure 11 and Figure 12).

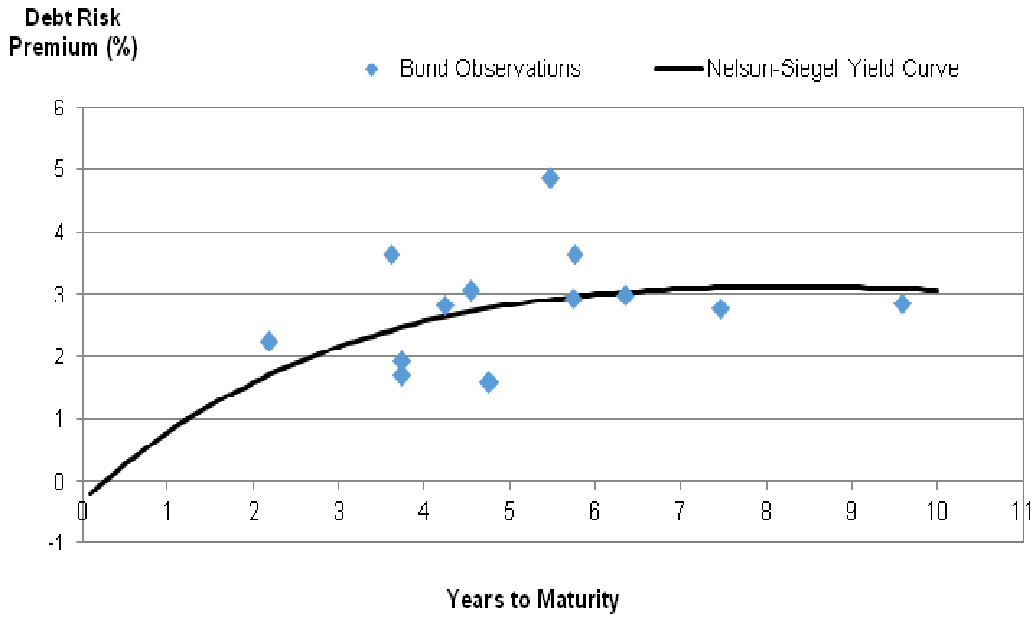
[280] Full documentation is available at : http://cran.r-project.org/web/packages/YieldCurve/YieldCurve.pdf.

Figure 10 Nelson-Siegel Yield Curve Fitting using Data from DBNGP Final Decision



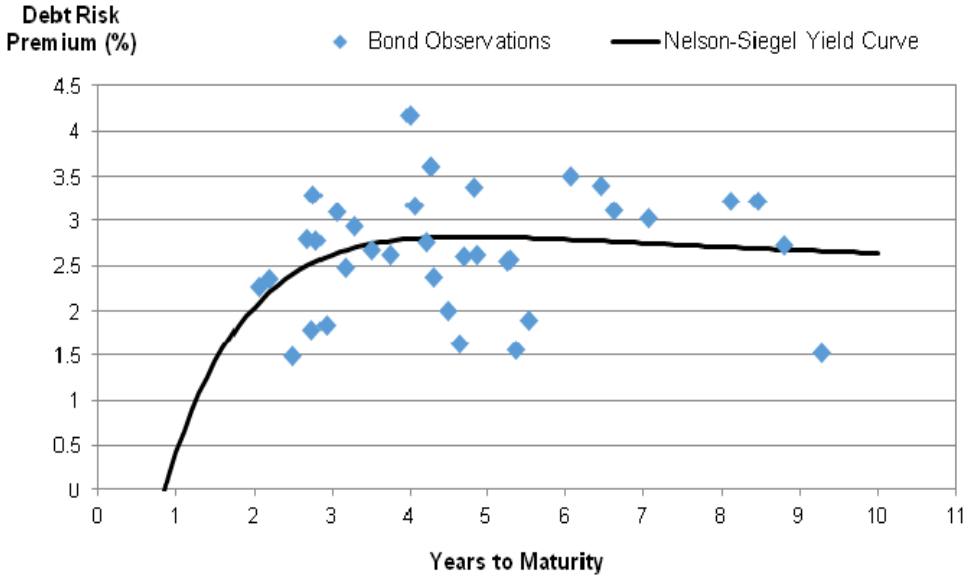
Source: Economic Regulation Authority's analysis

Figure 11 Nelson-Siegel Yield Curve Fitting using Data from WAGN Final Decision



Source: Economic Regulation Authority's analysis

Figure 12 Nelson-Siegel Yield Curve Fitting using Data from Western Power Final Decision



Source: Economic Regulation Authority's analysis

577. The corresponding parameters for the previous decisions using the joint-weighted mechanism and the Nelson-Siegel yield curve fitting are presented in Table 8 below. The estimated Nelson-Siegel DRP is conditional on a 5 year term to maturity, consistent with the regulatory control period in each determination.

Table 8 Estimates of the Debt Risk Premium from the Bond-yield Approach and the Nelson-Siegel Curve Fitting

Decision	Date	Joint-Weighted DRP[281]	Nelson-Siegel DRP	$\widehat{\beta}_{0t}$	$\widehat{\beta}_{1t}$	$\widehat{\beta}_{2t}$	$\hat{\lambda}$
DBP[282]	31/10/2011	3.196%	3.34%	0.0197	0.334	10.60	0.0285
WAGN[283]	20/12/2010	2.893%	2.83%	0.022	-0.347	10.913	0.2266
Western Power[284]	15/06/2012	2.708%	2.82%	2.343	-6.115	8.707	0.0725

Source: Economic Regulation Authority's analysis

578. Based on the results reported in Table 8, the Authority notes that the estimates of the DRP can be higher (as in the case for WAGN) and lower (as in the case for DBP and Western Power). The difference of the estimates under both approaches varies within the range of 6 and 14 basis points. However, the Authority is conscious of whether or not the difference (both under- and over-estimates) is significant enough to warrant such an extension of using the curve fitting techniques.

281 Note that the Joint-weighted approach was developed post 2012, this is a retrospective calculation for comparison purposes.

282 Economic Regulation Authority, October 2011, *Final Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline.*

283 Economic Regulation Authority, December 2010, *Final Decision on Proposed Revisions to the Western Australian Gas Network.*

284 Economic Regulation Authority, *Final Decision on Proposed Revisions to the access arrangement for Western Power, 2012.*

579. Using the estimates from the Authority's three most recent regulatory decisions as an example, the difference in the estimates under both approaches fall within a very small margin of less than 5 per cent in comparison with the estimate DRP. For example, for DBNGP's decision, the DRP is 3.196 per cent whereas the difference between the two approaches is 14 basis points (or 0.14 per cent). This difference falls within a margin of 4.3 per cent (taking 0.14 per cent divided by 3.196 per cent).

580. Curve fitting is a complex issue and there are various different techniques which can be used. The Authority considers that the small benefit from this complex technique is not sufficient to outweigh the costs and uncertainties involved in carrying out the exercise.

581. In its submission on behalf of Gas Multinet, ESQUANT Statistical Consulting provided criticism of the above ERA analysis regarding Nelson-Siegel Yield curves contained in the draft guidelines.[285] ESQUANT noted that the data sets used differ from those reported in the final decision documents for both the Western Australian Gas Networks (**WAGN**) and DBNGP. The Authority notes that it employed the data set described for "Scenario 2" from the WAGN final decision.[286] The data for DBNGP was taken from the DBNGP final decision.[287] The resulting small difference in results for DBNGP cannot be explained, differing by 7 basis points for the Nelson-Siegel DRP calculation. However, proceeding on the assumption that the ESQUANT dataset is correct, the Authority questions the conclusions drawn by ESQUANT from their own statistical analysis.

582. The result of ESQUANT's statistical analysis is shown below. ESQUANT provides an estimate of the standard error of the resulting DRP estimate for both the joint-weighted approach and the Nelson-Siegel yield curve approach by utilising the bootstrap method.[288] The Authority agrees with ESQUANT's assertion that this is the most appropriate measure of standard error across methodologies. Given that the joint-weighted approach and the Nelson-Siegel approach are distinct, only a bootstrap approach can calculate a standard error that is comparable across these methodologies. The bootstrap utilised for estimating the standard of the joint-weighted approach is the standard bootstrap approach as described by Efron and Tibshirani (1993).[289] For the Nelson-Siegel yield curve, the bootstrap is a residual based bootstrap as described in Venables and Ripley (2002).[290]

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285 ESQUANT Statistical Consulting 2013,*Review of ERA (WA) Yield Curve Analysis,* A report for United Energy and Multinet Gas June 2013.

286 Economic Regulation Authority, *Final decision on WA Gas Networks Pty Ltd proposed revised access arrangement for the Mid-West and South-West Gas Distribution Systems, February 2011, p. 92.*

287 Economic Regulation Authority, *Final decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline, p. 146.*

288 Bootstrapping refers to the statistical procedure of estimating the sampling distribution of an estimator by constructing new samples from the given set of observations. This procedure allows for the accuracy of a statistical estimate to be assessed without the need for parametric assumptions.

289 Efron, B and Tibshirani, R. (1993). *An Introduction to the Bootstrap.* Chapman & Hall: New York.

290 Venables, W.N and Ripley, B.D. (2002). *Modern Applied Statistics with S,* Fourth Edition. Springer: New York.

Table 9 Results Presented by ESQUANT's analysis of the Debt Risk Premium Calculation

		DRP (%)	SE (%)	Robust SE (%)
WA Gas Networks				
ERA Results	Joint-Weighted	2.893	-	-
	Nelson-Siegel	2.83	-	-
ESQUANT Results	Joint-Weighted	3.091	0.207	0.213
	Nelson-Siegel	2.857	0.254	0.245
DBNGP				
ERA Results	Joint-Weighted	3.196	-	-
	Nelson-Siegel	3.34	-	-
ESQUANT Results	Joint-Weighted	3.148	0.115	0.096
	Nelson-Siegel	3.277	1.360	.292
Western Power				
ERA Results	Joint-Weighted	2.708	-	-
	Nelson-Siegel	2.82	-	-
ESQUANT Results	Joint-Weighted	2.719	0.113	0.118
	Nelson-Siegel	2.819	0.141	0.152

Source: ESQUANT Statistical Consulting.

583. The Authority notes that using ESQUANT's own calculations the difference between the joint-weighted approach and the Nelson-Siegel approach is 0.234 per cent (for WA Gas Networks decision), -0.129 per cent (for DBNGP decision) and -0.1 per cent (for Western Power decision). The Authority considers that these results support the previous conclusion found in the draft rate of return guidelines. In particular, the Authority notes that for every estimate produced by ESQUANT, the Nelson-Siegel estimate falls within one standard error of the estimate using the joint-weighted approach. The Authority therefore considers that the joint-weighted approach does not diverge significantly from the Nelson-Siegel methodology. The Authority notes that ESQUANT claims that the joint-weighted approach underestimates the DRP. However, ESQUANT's own calculations show that the joint-weighted approach for WA GAS Networks produces a higher DRP than the Nelson-Siegel approach. The Authority also notes that the bootstrapped standard error for the joint-weighted approach is lower than that of the Nelson-Siegel approach for all of the data sets analysed by ESQUANT.

584. ESQUANT Consulting has estimated Nelson-Siegel yield curves for each data set, using both the DRP and cost of debt as *response variables*. ESQUANT used the Diebold and Li approach with the following parametric form:

$$y(\tau) = \beta_0 F_0 + \beta_1 F_1 + \beta_2 F_2 \quad (12)$$

where

$$F_0 = 1, F_1 = \frac{1 - e^{(-\lambda\tau)}}{\lambda\tau}, F_2 = \frac{1 - e^{(-\lambda\tau)}}{\lambda\tau} - e^{(-\lambda\tau)}$$

585. ESQUANT Consulting quoted the estimated coefficients, standard errors and p-values for these coefficients. In addition, ESQUANT Consulting also tested the hypothesis that all slope coefficients are not simultaneously zero by performing an F-test for each estimated model. A p-value greater than 0.05 indicates that at the 5 per cent significance level, the hypothesis of a Nelson-Siegel yield curve is rejected at the 5 per cent level. This implies that the most appropriate model for modelling the term structure of either the cost of debt or DRP is that of a constant one across all maturities. The results are as follows (Table 10).

Table 10 Estimated Nelson-Siegel Yield Curves of Debt Risk Premium by ESQUANT

		Estimate	Std. Error	t-value	Pr(>|t|)	F-value	Pr(>F)
WAGN	Lambda	-0.01	0.08	-0.16	0.87	0.53	0.6746
	Beta0	-11.73	175.18	-0.07	0.95		
	Beta1	12.84	172.03	0.07	0.94		
	Beta2	7.09	116.64	0.06	0.95		
DBP	Lambda	0.00	0.13	0.02	0.98	0.29	0.8333
	Beta0	-353.45	36166.94	-0.01	0.99		
	Beta1	354.64	36173.99	0.01	0.99		
	Beta2	403.45	38381.97	0.01	0.99		
WP	Lambda	-0.09	0.04	-2.62	0.01	2.10	0.1196
	Beta0	2.55	0.23	11.27	0.00		
	Beta1	0.01	0.02	0.31	0.76		
	Beta2	0.00	0.00	0.28	0.78		

Source: ESQUANT Statistical Consulting.

Table 11 Estimated Nelson-Siegel Yield Curves of Cost of Debt by ESQUANT

		Estimate	Std. Error	t-value	Pr(>|t|)	F-value	Pr(>F)
WAGN	Lambda	-0.01	0.07	-0.21	0.84	0.93	0.4654
	Beta0	-5.94	127.47	-0.05	0.96		
	Beta1	12.02	124.42	0.10	0.93		
	Beta2	6.14	79.35	0.08	0.94		
DBP	Lambda	0.00	0.13	0.01	0.99	0.78	0.5308
	Beta0	-907.42	146554.78	-0.01	0.99		
	Beta1	911.93	146561.59	0.01	0.99		
	Beta2	999.14	153066.81	0.01	0.99		
WP	Lambda	-0.08	0.02	-3.57	0.00	4.01	0.0157
	Beta0	4.78	0.32	14.95	0.00		
	Beta1	0.04	0.07	0.54	0.59		
	Beta2	0.01	0.01	0.47	0.64		

Source: ESQUANT Statistical Consulting.

586. The Authority notes that out of the 6 Nelson-Siegel Yield curves calculated, 1 is statistically significant at the 5% significance level. This implies that for 5 out of the 6 data sets the best statistical model is that of a constant DRP or cost of debt. This detail has been omitted from ESQUANT report. Therefore, the Authority is of the view that the analysis conducted by ESQUANT actually produces evidence against the use of Nelson-Siegel yield curves for the purposes of estimating the DRP rather than advocating its use.

587. In order to judge if the joint-weighted approach systematically underestimates the DRP relative to the Nelson-Siegel approach, ESQUANT has produced a simulation exercise that compares the two methods. ESQUANT assumed that the Nelson-Siegel model for the cost of debt applied to the bonds underlying the Western Power decision is correct. ESQUANT simulated a new sample of bonds of size n =13,25 and 50 to 300 in steps of 50 using this assumed model. The maturities for each bond are simulated by drawing from a log-normal distribution with mean 1.463 (log-scale) and standard deviation on the log scale of 0.397. Yields are then calculated via the assumed Nelson-Siegel relationship, with a random normally distributed error term with mean 0 per cent and standard deviation of 0.628 per cent added to the yield. The amount issued is then calculated via the lognormal distribution with mean on the log scale of 5.237 and standard deviation on the log scale of 0.534. Using these generated samples, ESQUANT estimated the DRP using the joint-weighted, Nelson-Siegel and smoothing spline approaches[291]. The results are as follows:

[291] The smoothing spline approach is an alternative method for constructing yield curves, which involves estimating a smooth curve to a set of observations.

Table 12 Results from ESQUANT Simulation exercise

	Joint-Weighted Average		Nelson-Siegel		Smoothing Spline	
N	Median(%)	Robust SD(%)	Median(%)	Robust SD(%)	Median (%)	Robust SD (%)
13	2.678	0.341	2.799	0.288	2.723	0.292
25	2.645	0.287	2.736	0.192	2.747	0.221
50	2.638	0.183	2.754	0.15	2.745	0.188
100	2.615	0.135	2.727	0.084	2.718	0.149
150	2.636	0.113	2.736	0.055	2.719	0.11
200	2.614	0.09	2.714	0.053	2.711	0.101
250	2.645	0.089	2.717	0.051	2.721	0.085
300	2.62	0.078	2.706	0.039	2.741	0.101

Source: ESQUANT Statistical Consulting.

588. ESQUANT suggested the correct DRP based on the Western Power data set for a 5 year maturity is 2.717 per cent. ESQUANT used the evidence presented in Table 12 to suggest that the joint-weighted approach is systematically biased downwards. ESQUANT has undertaken a simulation exercise by assuming that the Nelson-Siegel model is the correct process by which the cost of debt is related to the maturity of each bond. It is therefore not a surprising result that the joint-weighted approach is "biased" with respect to the Nelson-Siegel approach, as the former was assumed to be the correct model in the simulation exercise. The Authority notes that ESQUANT has also highlighted problems with its estimated model through the report, yet has proceeded to draw conclusions from the simulation exercise. ESQUANT states that for Western Power, the curve is relatively flat up to about 5 years and then concave for longer maturities. This produces invalid conclusions when the fitted Nelson-Siegel yield curve is used to calculate the cost of debt for maturities greater than five years. For example, the estimated cost of debt using ESQUANT's Nelson-Siegel model for a 10 year maturity is negative, defying theoretical constraints.

589. ESQUANT then uses each of the above analyses to conclude the following:[292]

> Our analysis has shown that the joint-weighted averaging approach of the ERA (WA) is biased downwards and is not very precise. We have also found that eliminating short maturity bonds has deleterious effect on the properties of the Nelson-Siegel parameter estimates. However, as the sample size increases the Nelson-Siegel estimates have far greater precision than the joint-weighted average estimates, and they are unbiased for all sample sizes.
>
> If the available data is confined to the limited samples that the ERA (WA) has used in its recent decisions, then the Nelson-Siegel method, as applied to observations of the DRP, will produce results that are not statistically different from a constant DRP for all maturities. Improved models can be obtained by using Yield and not DRP as the response variable.

590. The Authority considers that the results produced by ESQUANT indicate that the lack of bond data produces statistically insignificant yield curves for 5 out of 6 data sets. This lack of data implies the necessity of the bond yield approach to be adopted in the Australian bond market. ESQUANT then utilised the above simulation exercise to

[292] ESQUANT Statistical Consulting 2013,*Review of ERA (WA) Yield Curve Analysis,* A report for United Energy and Multinet Gas June 2013.

suggest that the joint-weighted approach will be biased downwards against the pre-assumed Nelson-Siegel method. In addition, ESQUANT's own calculations indicate that the joint-weighted approach has lower standard errors than the Nelson-Siegel estimates, implying less precision when using the Nelson-Siegel approach. As a consequence, the Authority has rejected the advice contained in ESQUANT's report.

591. The Authority is of the view that the joint-weighted approach is conservative in that it gives higher weight to bonds with longer maturities, which theoretically, under typical conditions are expected to have higher yields. The Authority notes that the failure of Nelson-Siegel yield curves to correctly model the DRP is due to the small sample of relevant Australian corporate bond data. The Authority therefore considers that the bond-yield approach is the most appropriate method to estimate the DRP for regulated entities.

10 Return on equity

592. National Gas Rule (**NGR**) 87(7) states that regulators, in estimating the return on equity, must have regard to the prevailing conditions in the market for equity funds. At the same time, under NGR 87(5), regard must be had for relevant estimation methods, financial models, market data and other evidence. Overarching these requirements, under NGR 87(3), the regulator is required to achieve the allowed rate of return objective.

593. There are no readily observable proxies for the expected return on equity. Estimating a forward-looking return on equity – sufficient to provide regulated firms with reasonable opportunity to recoup their prevailing equity financing costs – requires the use of models. Generally, these models seek to explain the required return on equity through a relationship with some 'portfolio' of risk factors, or else in terms of the present value of the expected stream of future cash flows.

594. In this chapter, the Authority assesses the range of estimation methods for the return on equity, in terms of the requirements of the National Gas Law (**NGL**) and National Gas Rules. The chapter then sets out the approach which the Authority will use for estimating the return on equity.[293] The chapter also identifies the points at which the Authority considers it may need to draw on its judgment to ensure that the allowed rate of return objective is achieved.

10.1 Approach

10.1.1 Models of the return on equity

595. The model used by Australian regulators for quantifying the return on equity and associated risk to date has been the Sharpe Lintner Capital Asset Pricing Model (**CAPM**). The previous NGR specifically referred to this variant of the model as being an example of a 'well accepted' financial model.[294]

596. 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.

597. 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 (DGM – both single-stage and multi-stage);

[293] NGR 87(14) requires that the rate of return guidelines set out the methodologies which the ERA proposes to use in estimating the allowed rate of return, as well as the estimation methods, financial models, market data and other evidence that the ERA proposes to take into account.

[294] 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).

- the Residual Income Model;
- Market Risk Premium approaches; and
- the Build-up Method.

598. 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;
- brokers' reports and the Dividend Yield approach.

599. The Authority has reviewed these asset pricing approaches in terms of their ability to contribute to the achievement of the allowed rate of return objective. The conclusion from that assessment leads the Authority to consider that only the Sharpe Lintner CAPM model is relevant for informing the Authority's estimation of the prevailing return on equity for the regulated firm, at the current time.

600. However, the Authority proposes to give weight to relevant outputs from the DGM when estimating the market risk premium (**MRP**) for input to the Sharpe Lintner CAPM. In particular, estimates from the DGM will be used to inform the range of the MRP, which will be then used as input to the Sharpe Lintner CAPM.

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

10.1.2 A five step approach to estimating the return on equity

602. The Authority will determine a single point estimate for the return on equity.

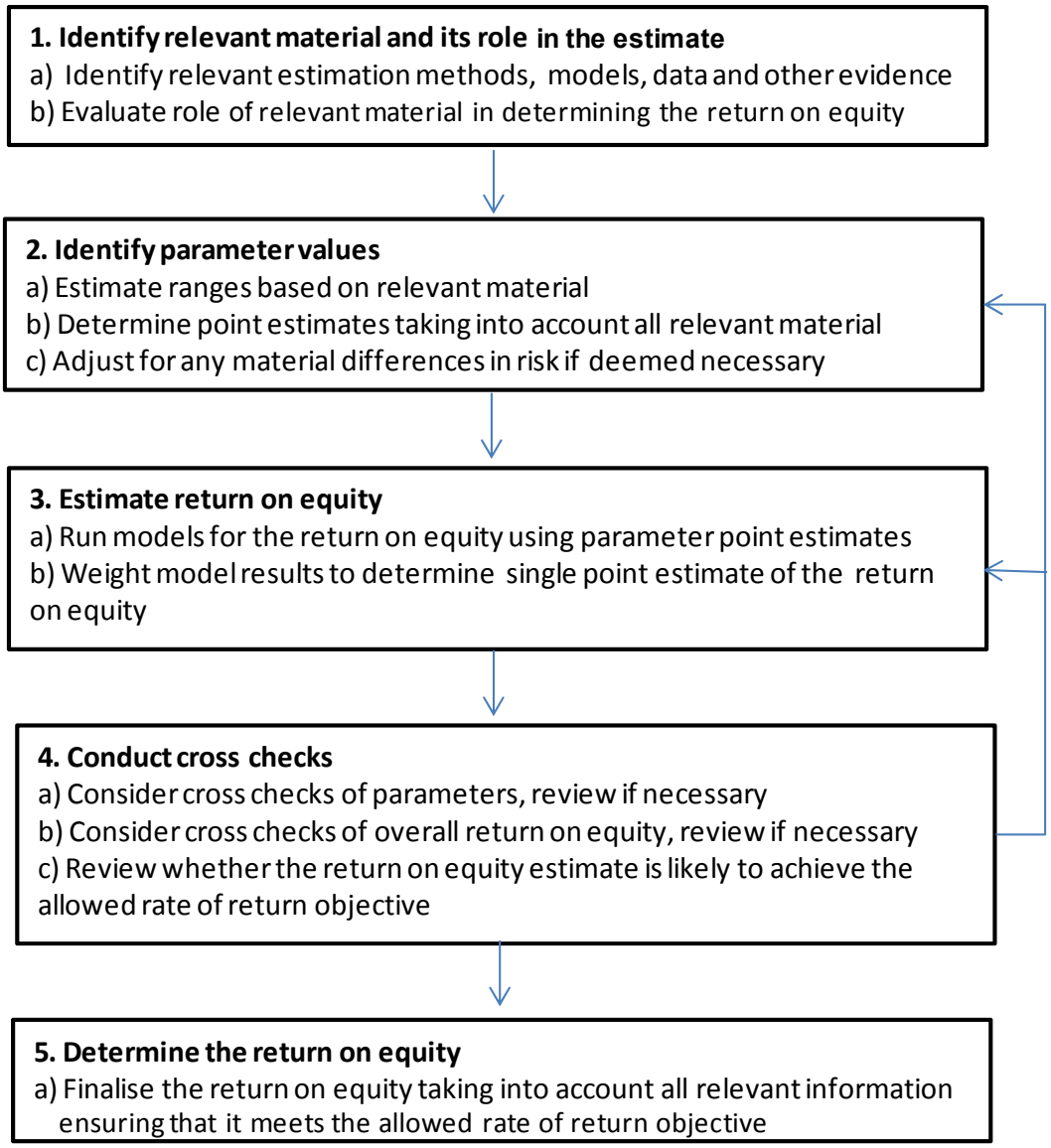
603. Where there are multiple relevant estimation methods, financial models, market data and other evidence informing the return on equity, then the Authority will combine these to form a range. The Authority recognises that it may be appropriate in some circumstances to adopt a formal weighting approach for each estimation method or model, for the purpose of determining the range.

604. Where the return on equity is derived as a range, then the Authority will utilise other relevant information, and its judgment, to determine a single point estimate for the return on equity.

605. Similarly, parameter estimates contributing to the relevant estimation methods or models may initially be estimated as a range, or derived directly as a point estimate. Where parameter estimates are derived as a range, the Authority will then utilise other relevant information and its judgment to determine a single point estimate for input to relevant estimation methods and models.

606. The Authority will adopt a five step approach for estimating the return on equity. The five steps are summarised in Figure 13. This approach will allow the Authority to have regard to a wide range of material, taking account of relevant models for the return on equity, as well as a range of other relevant information. The Authority will give weight to each piece of information according to its merits at the time of each determination. This will enable it to provide a transparent and clear decision that meets the allowed rate of return objective.

Figure 13 Proposed approach to estimating the return on equity[295]



10.2 Reasoning

607. The Authority needs to have regard to relevant estimation methods, financial models, market data and other evidence (NGR 87(5)(a)). The question then arises as to which of the possible alternative financial models meet this requirement, while also meeting the broader requirements of the NGL and the NGR.

295 The Authority considers that the term:

- 'approach' refers to the overall framework or method for estimating the return on equity, which combines the relevant estimation methods, financial models, market data and other evidence;
- 'estimation material' refers to any of the relevant estimation methods, financial models, market data and other evidence that contribute the 'approach';
- 'estimation method' relates primarily to the estimation of the parameters of financial models, or to the technique employed within that model to deliver an output.

10.2.1 Theoretical considerations for determining the return on equity

608. The estimate of the rate of return on equity is required to be forward looking; investors make investments based on their expectations of the stream of net cash flows that those investments will generate over the future period. This leads to a number of considerations.

609. First, the equity investor is principally concerned with the risks relating to the expected future stream of net cash flows. If an investor could expect to achieve the same return elsewhere at lower risk, then it would be irrational to invest in the regulated asset, as the expected present value would be lower than for the alternative investment. The efficient rate of return should just compensate the investor for the additional risk of holding the asset, over and above the 'risk free' asset. This is the key insight of the Markowitz portfolio theory, as well as of the CAPM.[296]

610. However, not all risks will be compensated in the return on equity. Theory suggests that 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 with respect to the variance of the returns on the overall market for securities.

611. Non-systematic or 'idiosyncratic' risks for the return on equity may be diversified away. Where idiosyncratic risks influence the variance of the expected returns to the asset, then this may be exactly offset through holding other assets in the efficient market portfolio with corresponding offsetting risk and variance.

612. 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.

613. Where asymmetric systematic risks can be established, the Authority considers that there may be a case to provide explicit recompense for these identified risks in the cash flows (see Chapter 3 – The benchmark efficient entity and risk).

614. Second, estimates of the return on equity need to be based on the expected returns of securities with similar risks, as the actual risks of the underlying assets of any firm are rarely observable.[297] 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.

615. 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 3, the Authority interprets a 'similar' degree of risk as allowing for reasonable differences in the degree of risk among firms informing the benchmark, which recognises the significant uncertainties in the risks and the associated confidence intervals.

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296 Brealey R.A. and Myers S.C. 1996, *Principles of Corporate Finance*, McGraw Hill, p. 173.

297 McKenzie M. and Partington G. 2013, *Risk, Asset Pricing and the WACC*, Report to the AER, www.aer.gov.au, p. 6.

616. Third, there is a need to consider prevailing conditions for the return on equity.[298] McKenzie and Partington succinctly capture the rationale for the need to consider prevailing conditions:[299]

> In principle then, what we first need to do is to measure the risk of the investment. We then discount the expected future cash flows from the investment at the *current* equilibrium expected return in the capital market, for securities with the investment's level of risk. The word 'current' is important here. In any required return calculation we should be using current values because if capital markets are efficient current values contain the best information available on future values. In particular historic values for the rate of return on equity, or interest rates, are not relevant *except* to the extent that they help us estimate the *current* rates. Since current interest rates are readily observable, historic interest rates typically have no place in determining the required rate of return. If the current interest rates differ from historic rates then there will have been windfall gains or losses that are already reflected in the current value of equity.

617. The prevailing return on equity will fluctuate. As noted in the recent paper outlining the reasons for the 2013 Nobel Prize award for economics, a range of evidence suggests that 'the volatility and predictability of stock, bond and foreign exchange returns can only be consistent with arbitrage-free [that is, efficient] markets if the expected return, i.e., the discount factor, is highly variable over time'.[300,301]

618. The Authority will estimate the prevailing return on equity that compensates investors for holding securities with similar risk of return as the regulated asset. The prevailing return on equity will fluctuate over time. In what follows the Authority considers the tools that may be used to establish estimates for the prevailing rate of return on equity.

10.2.2 Models of the return on equity

619. The model used by Australian regulators for quantifying the return on equity and associated risk to date has been the Sharpe-Lintner Capital Asset Pricing Model (**CAPM**). The previous NGR specifically referred to this variant of the model as being an example of a 'well accepted' financial model.[302]

620. 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.

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

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298 NGR 87(7).

299 McKenzie M. and Partington G. 2013, *Risk, Asset Pricing and the WACC*, DRAFT Report to the AER, provided as part of workshop materials, p. 6.

300 The Royal Swedish Academy of Sciences 2013, *Understanding Asset Prices*, www.nobelprize.org, p. 20.

301 Elsewhere in these guidelines, we consider whether historic time series data of observed fluctuations in the return on equity exhibits 'stationarity', and hence whether its historic observations can be relied on to provide a guide to expected future returns (see Chapter 11 – Market risk premium).

302 •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).

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

622. 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;
    - brokers' reports and the Dividend Yield approach.

623. The Authority reviews these approaches at Appendix 8 – Evaluation of models for the return on equity. The conclusion from that assessment leads the Authority to consider that only the Sharpe-Lintner CAPM model is relevant for informing the Authority's estimation of the prevailing return on equity for the regulated firm, at the current time.

624. The Authority also proposes to give weight to relevant outputs from the DGM when estimating the market risk premium (**MRP**) for input to the Sharpe-Lintner CAPM. In particular, estimates from the DGM will be used to inform the range of the MRP, which will be then used as input to the Sharpe Lintner CAPM.

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

626. The Authority does not expect it likely that there would be significant new developments over the course of the life of these Guidelines; the Authority expects to be able to rely on these Guidelines in making its decisions over the next three years. However, the Authority recognises that further development of models or empirical support may arise at some future point, that might make them relevant. In this event, the Authority would review its position.

10.2.3 A five step approach to estimating the return on equity

627. The Authority will adopt a five step approach for estimating the return on equity.[303] The five steps are summarised in Figure 13 above. This approach will allow the Authority to have regard to a wide range of material, taking account of relevant models for the return on equity, as well as a range of other relevant information. The Authority will have regard to each piece of information according to its merits at the time of each determination. This will enable it to provide a transparent and clear decision that meets the allowed rate of return objective.

[303] In what follows:
- 'approach' refers to the overall framework or method for estimating the return on equity, which combines the relevant estimation methods, financial models, market data and other evidence;
- 'estimation material' refers to any of the relevant estimation methods, financial models, market data and other evidence that contribute the 'approach';
- an 'estimation method' is considered to primarily relate to the estimation of the parameters of financial models, or to the technique employed within that model to deliver an output.

628. The approach is largely consistent with that proposed by stakeholders.[304] The exception is that the approach does not follow the Energy Networks Association's proposal to first estimate the return on equity for the average firm, before then estimating the return on equity for a benchmark efficient entity.[305]

629. The following provides the detail of each step in the estimation approach.

10.2.3.1 Step 1: identify relevant material and its role

630. The first step would be to identify the relevant material to be used to inform the estimate of the return on equity.

631. The relevance of estimation methods, financial models, market data and other evidence would be assessed based on the degree to which that material would contribute to the achievement of the allowed rate of return objective, and to the requirements of the NGL and the NGR more generally. Where the Authority exercised its judgment with regard to that assessment, it would articulate its reasoning based around the framework provided by the criteria.

632. At the same time, the role of that relevant material – in terms of its ability to contribute to the allowed rate of return objective – would be evaluated.

Models for the return on equity

633. As noted above, Appendix 8 – Evaluation of models for the return on equity concludes that only the Sharpe-Lintner CAPM model is relevant for informing the Authority's estimate of the return on equity at the current time.

634. All other models of the return on equity were judged to be not relevant at the current time.

635. Therefore, the Authority proposes to give full weight to the Sharpe-Lintner CAPM when estimating the return on equity.

Other relevant material

636. A range of other relevant material would be used to inform the modelling estimates, and to inform the overall return which is judged to best meet the allowed rate of return objective. Appendix 29 – Other relevant material provides a summary assessment.

10.2.3.2 Step 2: estimate parameter point estimates

637. The point estimates of the parameters to be used in the relevant return on equity models would be developed by drawing on the range of relevant material. Where these estimated parameters are subject to uncertainty or to multiple estimation approaches, the estimates would be first configured as ranges.

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304 See for example Australian Pipeline Industry Association 2013, *Rate of Return Review*, Attachment, www.erawa.com.au, 13 March, p. 26; and Energy Networks Association 2013, *Draft Rate of Return Guidelines – Meeting the requirements of the National Gas Rules*, Attachment A, www.erawa.com.au, 7 October, p. 47.

305 This initial step is omitted as it is considered to create additional work, with little additional insight. Further, the Authority considers that – under its transparent approach – it would be possible to back calculate this step should it be desired (for example, by substituting for the equity beta in the case of the Sharpe-Lintner CAPM).

638. Where there are multiple ranges for any particular parameter, these would be combined into a single range using judgement, giving an overall upper and lower bound for the parameter range.

639. Once parameter ranges are identified, the point estimates for parameters for use in the relevant models would be determined from within the identified range. The Authority would use its judgment to develop the point estimate, informed by any relevant forward looking indicators (see Appendix 33 – Other relevant material).

Parameter ranges

640. The Authority will draw on the range of relevant material to determine the point estimates of the parameters to be used in the relevant return on equity models. As the Sharpe-Lintner CAPM is judged to be the only relevant model at the current time, the following evaluations relate only to that model.

641. The parameters in the Sharpe-Lintner CAPM model are the risk free rate, the equity beta and the market risk premium (**MRP**). The risk free rate is observed as single point estimate from the Commonwealth Government Security (**CGS**) proxy. The equity beta and the MRP are subject to estimation uncertainty and multiple estimation approaches and are first derived as a range:

- The Authority has considered relevant material for the equity beta in Chapter 12 - Equity beta. The conclusion is that the equity beta is estimated to fall within the range of 0.5 – 0.70. This range is derived by combining information from:
  - empirical studies conducted by the Authority in 2011 and 2013;
  - observed equity betas for Australian listed utilities reported by Bloomberg and S&P; and
  - Henry's advice to the AER in 2009.
- The Authority has considered relevant material for the MRP in Chapter 11 – Market Risk Premium. The MRP is estimated to fall within the range of 5.0 – 7.5. This range is derived by combining information from:
  - historical time series data; and
  - the Dividend Growth Model.

Parameter point estimates

642. The next step will be to draw on relevant information to determine the point estimates for use in the modelling framework. As the Sharpe-Lintner CAPM is judged to be the only relevant model at the current time, the following evaluations relate only to that model.

Risk free rate

643. A point estimate will be determined for the risk free rate based on the average of the 5-year CGS observed yields over a 40 day period just prior to the regulatory determination (refer to Chapter 5 - Risk free rate). The Authority considers that a 5-year term for the risk free rate is consistent with the present value condition (see Appendix 2 – The present value principle).

Equity beta

644. The point estimate of the equity beta within the estimated range would be determined. Absent other influencing factors, an estimate of 0.6 for the equity beta could be adopted. This would be consistent with the mid-point of the estimated range, as well as analyses undertaken in previous decisions.

645. The Authority notes that this estimate of the equity beta is for the benchmark efficient entity. In the event that the Authority considered that there were material and substantiated risk differences between the benchmark efficient entity and those faced by the service provider in delivering the reference services, then the Authority may consider a further adjustment to the equity beta (see Chapter 3 – The benchmark efficient entity and risk).

Market risk premium

646. A point estimate of the MRP will be selected from within the identified range.

647. The Authority is of the view that the MRP may vary in response to changes in the risk-free rate. However, the Authority considers that there is no evidence to support a consistent relationship between the two (see Chapter 11 – Market risk premium).

648. In order to determine the point estimate of the market risk premium within a range, the Authority is of the view that relevant information relating to investors' perceptions of risk in the financial market should be used, in combination with the Authority's judgement with regard to prevailing conditions.

649. The Authority's starting point is around the mid-point of the identified range. Accordingly, the starting point would be between 6.0 and 6.5 per cent**.**

10.2.3.3 Step 3: Estimate the return on equity

650. The third step involves applying each relevant model to determine a related point estimate for the return on equity. The point estimates of the parameters relevant to each model, determined under Step 2, would be used as inputs.

651. The resulting range of point estimates would be weighted according to the Authority's judgment of their performance at the time, and a combined single point estimate of the return on equity would be produced. This weighting step is not necessary at the current time, as the Sharpe-Lintner CAPM is judged to be the only relevant model for estimating the return on equity.

10.2.3.4 Step 4: Consider other relevant material

652. Checks informed by other relevant material would be conducted to determine the reasonableness of the overall return on equity, and its ability to achieve the allowed rate of return objective. Appendix 29 – Other relevant material provides more detail on the additional relevant material that will be considered by the Authority.

653. Checks would include (see Appendix 30 – An indicative worked example):

- comparison of the risk free rate with the historic return on debt;
- comparison of the implied return on equity with the historic return on equity.

10.2.3.5 Step 5: Determine return on equity

654. Taking account of all relevant information and analysis, the Authority will make its final determination on the return on equity, ensuring that the return on equity meets the allowed rate of return objective and the requirements of the NGL and NGR.

11 Market Risk Premium

655. The market risk premium (**MRP**) is the required return, over and above the risk free rate of return, on a fully diversified portfolio of assets. The MRP, a key component of the estimate of the required rate of return on equity, compensates an investor for the systematic risk of investing in the "market" portfolio. Total risk for any business includes systematic risk and non-systematic risk. Systematic risk cannot be diversified away by investors because this type of risk affects all firms in the market.

656. The required rate of return on equity for future regulatory periods is a forward-looking concept. It is the expected return that is of importance when pricing capital in order to efficiently attract investment. While estimates of the cost of debt can be obtained by observing debt instruments, the financial markets do not provide a directly observable proxy for the cost of equity for either individual firms or the market as a whole.

657. In Chapter 10, the Authority sets out the framework which it will use for combining relevant material when determining the return on equity.[306] Chapter 10 also identifies those points at which the Authority considers it may need to apply its judgment to ensure that the allowed rate of return objective is achieved.

658. The National Gas Rule (**NGR**) 87(5) states that regulators must have regard to relevant estimation methods, financial models, market data and other evidence when determining the return on equity. The Authority concludes in Chapter 10 that the Sharpe-Lintner Capital Asset Pricing Model (**CAPM**) is the only model which is relevant for informing the Authority's estimate of the return on equity at the current time. The MRP is a key input to the Sharpe-Lintner CAPM.

659. This chapter considers issues related to the estimate of the market risk premium. In particular, it establishes the range for the forward looking estimate of the MRP. The method for determining the point estimate of the resulting range of the MRP – for use in the Sharpe-Lintner CAPM – is set out in Chapter 10.

11.1 Approach

660. The Authority considers that any estimate of the MRP is conditional on the relationship that exists between the MRP and the risk free rate. The Authority notes three possible theoretical relationships that can exist: (i) a negative relationship (ii) no relationship and (iii) a positive relationship.

661. The Authority has considered its own empirical analysis, in addition to the advice of academics, and concluded that it is not clear which of the above theoretical relationships exist between the MRP and the risk free rate.

662. The Authority's theoretical and empirical analysis of the MRP also has concluded:

- Historical averages of market risk premium are relevant for informing the future MRP.
- The return on equity is likely to be more stable than the MRP – therefore there is evidence to consider varying the MRP across regulatory decisions.

[306] NGR 87(14) requires that the rate of return guidelines set out the methodologies which the ERA proposes to use in estimating the allowed rate of return, as well as the estimation methods, financial models, market data and other evidence that the ERA proposes to take into account.

- There does not appear to be a consistent relationship between the risk-free rate and the MRP – statistical analysis does not provide assistance in considering how any variation in the MRP should be made.
- There does not appear to be a flight to quality during times of crisis in Australia – therefore this does not necessarily indicate that a substantial fall in the risk free rate is associated with an increase in the MRP.
- An adjustment to the MRP as a result of the risk free rate being at a low level is not necessary.
- The dividend growth model (**DGM**) provides information that can be used to inform the MRP.

663. The Authority notes that the historical risk premium approach implicitly assumes no relationship between the MRP and risk free rate, whilst the Dividend Growth Model implicitly assumes a negative relationship. Taking into account the conflicting evidence regarding the relationship between the MRP and risk free rate, the Authority considers that both historical averages and the DGM can be used to estimate a range for the MRP.

664. Once a range is established, other forward looking information outlined in Appendix 29 – Other relevant material will be used to inform the selection of a point estimate within the range.

665. Given the range of relevant estimates available at this point in time, the Authority is of the view that a range of 5.0 per cent to 7.5 per cent for the MRP is appropriate for the rate of return guidelines.

11.2 Reasoning

11.2.1 Theoretical Considerations

666. Modern portfolio theory (**MPT**) seeks to determine how a rational investor will allocate capital between various securities. By combining stocks in a portfolio, MPT proposes that investors can achieve higher levels of return, for a given level of risk, than they can by holding individual stocks. In this context, MPT assumes that an optimal portfolio exists, called the *market portfolio*, which maximises the expected return per unit of risk. Investors then determine the proportion of capital they allocate between a risk-free asset and the optimal market portfolio, which is risky, through their preference for risk. A detailed derivation of MPT can be found in Appendix 9 – Modern Portfolio Theory.

667. Following from Appendix 9, it can be shown that the return of an asset can be expressed in terms of the risk free rate of return, beta of the security and the expected market return. This representation is known as the Sharpe-Lintner CAPM and is expressed as follows:

$$E[R_i] = R_f + \beta_i(E[R_m] - R_f) \quad (13)$$

where

$E[R_i]$ is the expected return of security i;

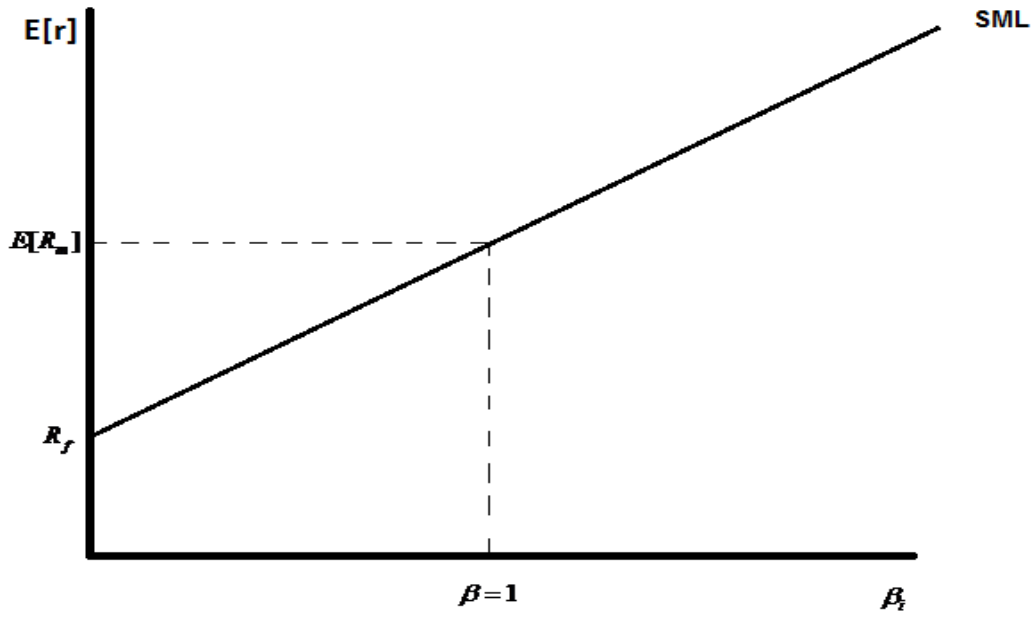
R_f is the risk free rate of return;

β_i is a measure of the systematic risk present in security i; and

$E[R_m]$ is the expected market return.

668. The difference between the expected return for security *i* and a risk-free rate of return, $E[R_m] - R_f$, is referred to as the MRP. The MRP represents the premium investors earn over and above the risk-free rate of return for bearing systematic risk. This situation can be represented graphically showing the relationship between a security's expected return $E[R_i]$ and a security's β (Figure 14). As a result, the intercept represents the risk-free rate of return, whilst the slope is the market risk premium. This relationship is known as the Security Market Line **(SML)**, and demonstrates the expected risk and return combinations possible for differing levels of systematic risk (β).

Figure 14 Security Market Line



669. The relationship between the MRP and the risk free rate of return is important for informing any regulatory decision regarding the MRP. Utilising the above framework, three different theoretical relationships between the MRP and risk free rate can be derived.

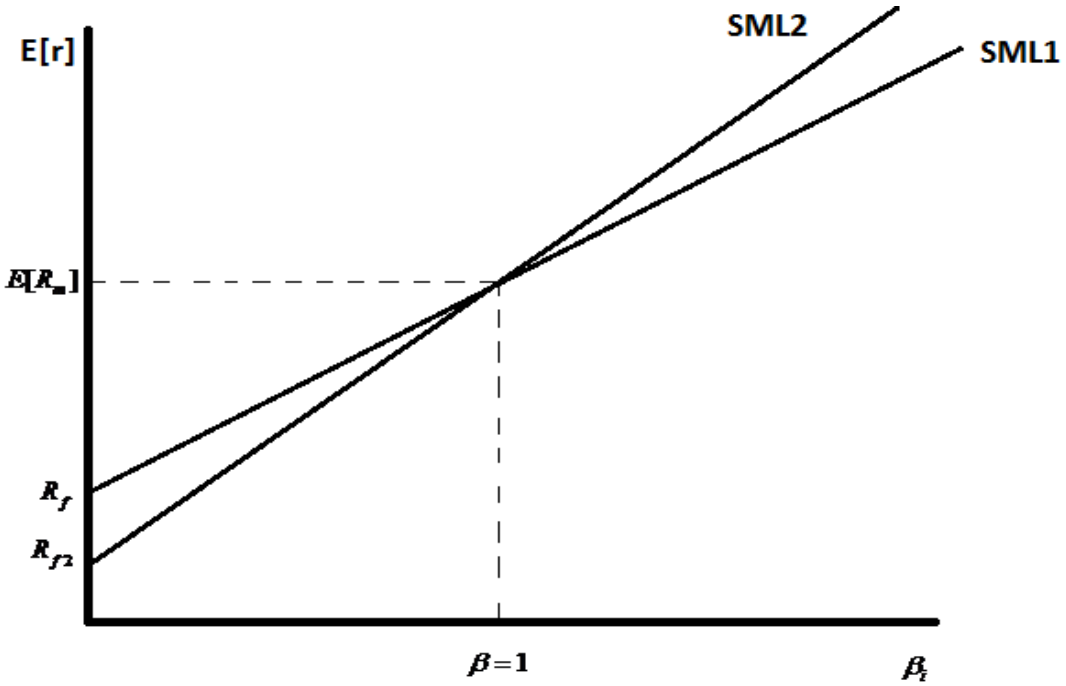
11.2.1.1 Modern portfolio theory – Dynamic scenarios

670. The Authority has considered three different dynamic scenarios to be applied to the static model set out above, stemming from a reduction in the risk-free rate of return:

- a reduction of a risk-free rate is associated with an increase in the MRP, *Scenario 1- Inverse Relationship;*
- a reduction of a risk-free rate is not associated with any change in the MRP, *Scenario 2 – No Relationship;* and
- a reduction of a risk-free rate is associated with a decrease in the MRP, *Scenario 3 – Positive Relationship.*

671. An inverse relationship between the risk-free rate and the MRP occurs when a change in the risk free rate of return results in an opposite change in the MRP. For example, a reduction in the risk free rate results in an increase in the expected MRP. This scenario depicts an MRP that is conditional on the risk free rate of return. Figure 15 shows that, when the risk-free rate of return decreases from R_f to R_{f2}, then the slope of the SML increases, which is representative of an increase in the MRP. Figure 16 depicts a negative relationship between the risk free rate and MRP, resulting in the same expected return for the market portfolio. *First*, it is assumed that the risk-free rate of return and the MRP are perfectly negative correlated. That is, any reduction in the risk-free rate will be offset by a one-for-one increase in the MRP, leaving the estimated return on equity unchanged.

Figure 15 An inverse relationship between the risk-free rate and the MRP

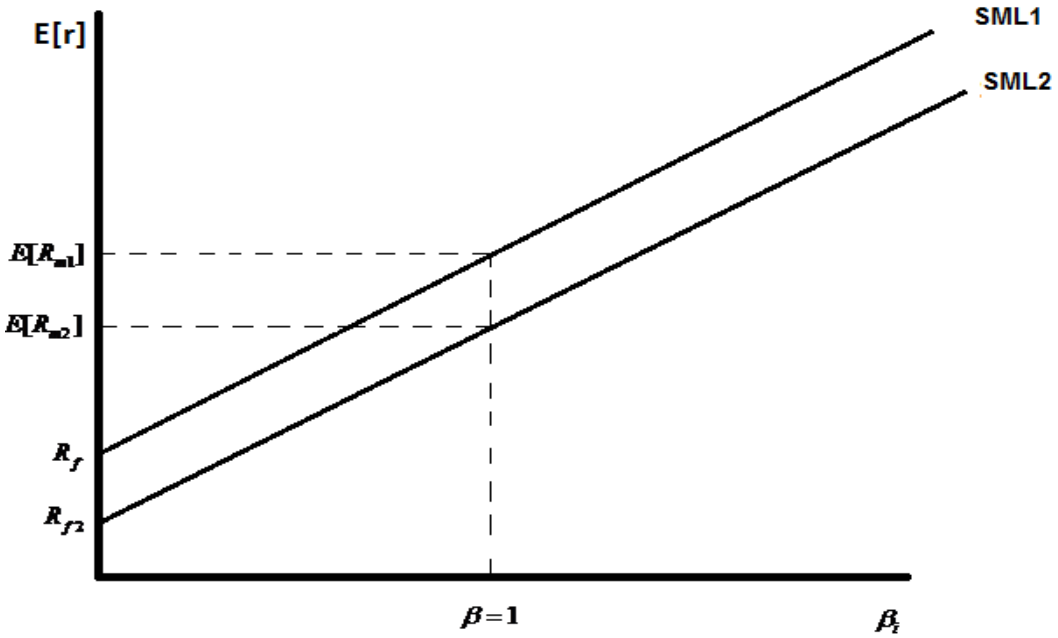


Source: Economic Regulation Authority's analysis

672. An alternative scenario occurs when a reduction in the risk-free rate of return leaves the MRP unchanged. In this scenario, the MRP is independent of any change to the risk free rate of return. As shown in Figure 16 below, a reduction in the risk-free rate of return from R_f to R_{f2} results in a parallel shift downwards of the SML, from the SML_1 to SML_2. In this scenario, the slope of the SML remains unchanged, which represents an unchanged MRP. This scenario between the MRP and risk-free rate corresponds

to a return on equity that has a direct one-to one relationship with the risk free rate. That is, any change to the risk free rate corresponds to the same change in the return on equity. The Authority is of the view that, theoretically, *Scenario 2* is also a possible relationship between the risk-free rate of return and the MRP. This implies that any reduction of the risk-free rate, together with a constant MRP, will reduce the estimated return on equity by the same magnitude. This reflects the practice adopted by the Australian regulators over the last decade.

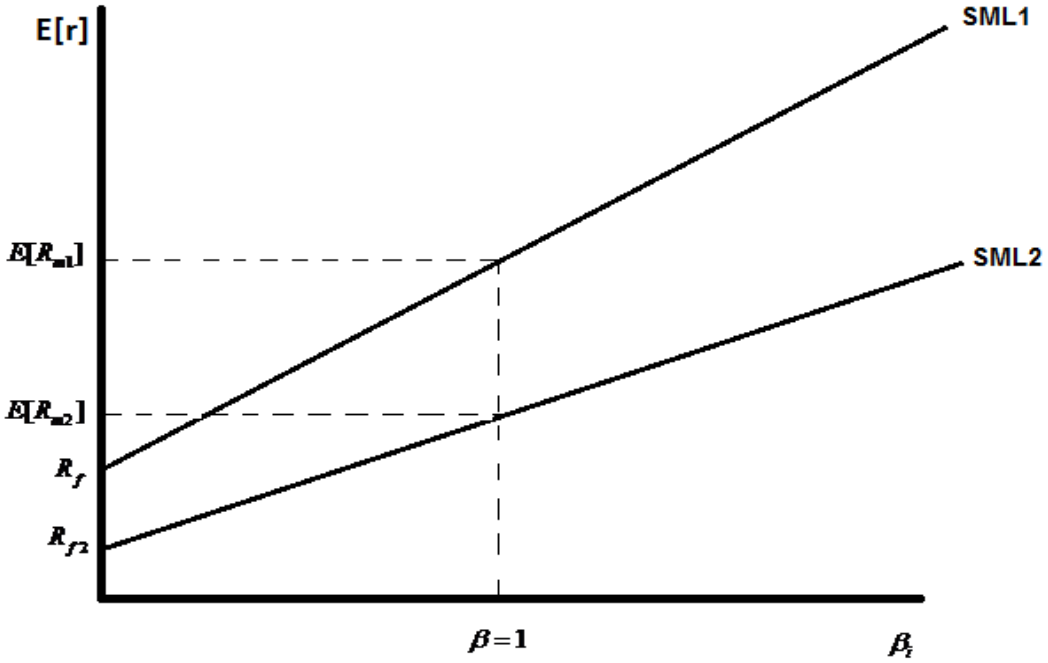
Figure 16 A reduction of the risk-free rate is associated with an unchanged MRP



Source: Economic Regulation Authority's analysis

673. Scenario 3 depicts the reverse relationship described in Scenario 1, where the MRP is conditional on the risk free rate; however, this relationship occurs in the opposite direction. For example, a reduction in the risk free rate also results in a reduction in the expected MRP. This situation is depicted below, with a reduction in the risk free rate shifting the intercept and reducing the slope of the SML (Figure 17).

Figure 17 A positive relationship between the risk-free rate and the MRP



Source: Economic Regulation Authority's analysis

674. Each of the scenarios above is relevant for the estimation of the expected MRP as any methodology will implicitly assume a relationship exists between the MRP and risk free rate of return. However, since theoretical considerations cannot provide the Authority with firm conclusions in relation to the relationship between the risk-free rate and the MRP in the Australian financial market, the Authority considers that empirical evidence, together with data observed from the market, will help inform a view on the relationship between the two parameters.

11.2.2 Evidence regarding the relationship between MRP and risk free rate

675. The Authority has conducted various empirical analyses, using different datasets and methodologies to inform its understanding of the relationship between the MRP and risk free rate in Australia. This analysis can be found in Appendix 10 – Flight to quality in the Australian financial market: empirical evidence, Appendix 11 – Co-integration between Commonwealth Government bond yields and the cash rate, Appendix 12 – Co-Integration between the equity risk premium and the risk-free rate of return, Appendix 13 – The equity risk premium and the risk-free rate: Granger Causality test, Appendix 16 – Is the return on equity stable?. The Authority has also considered advice from academics on this relationship in Appendix 14 – Relationship between the risk free rate, market risk premium and the return on equity: academic evidence. The Authority notes that its own analysis and the advice of academics provide conflicting evidence regarding the relationship between the MRP and risk free rate in Australia.

11.2.2.1 Evidence of an inverse relationship between the MRP and risk free rate

676. To inform its understanding of the behaviour of the MRP, the Authority conducted an empirical study to examine the behaviour of return on equity, the risk-free rate, and the

MRP using the longest possible dataset of 128 years from 1883 to 2010. The Authority has previously conducted studies using Bloomberg data, in an attempt to ascertain whether these series have a tendency to be anchored to a long-run mean and a consistent level of volatility. This analysis was to determine if the risk free rate, MRP or return on equity series were stationary and whether some combination of the series was co-integrated. The analysis was to also determine if the findings about the behaviour of the return on equity and the risk-free rate in Australia is comparable to the conclusions of academic studies based on data from overseas markets. A summary of the results and conclusions of this analysis can be found in Appendix 16 – Is the return on equity stable?

677. The findings of the analysis suggest that there is no statistically reliable relationship between the risk-free rate of return and the return on equity within the Australian context. In addition, this analysis also presents further empirical evidence to support the view that the risk-free rate is non-stationary, whilst the return on equity is stationary. These findings imply that there is no co-integrating relationship between the risk-free rate and the return on equity. This result follows from the theoretical properties of time series, as a linear combination of a non-stationary series and a stationary series will produce a non-stationary time series. Using this theoretical property, the properties of the MRP can be established as the MRP is defined as the difference between the return on equity (a stationary series) and a risk-free rate (a non-stationary series). This result implies that the MRP is a non-stationary series, as a consequence of the MRP being a linear combination of the return on equity and risk free rate series.

678. Additionally, Engel-Granger two-step co-integration tests fail to provide any evidence to support a relationship between the risk-free rate and return on equity. The fact that the return on equity tested as stationary on the data in combination with this finding implies a negative relationship between the risk free rate and MRP. This analysis also indicates support for Scenario 1 in 11.2.1.1 that a negative relationship exists between the MRP and risk free rate.

679. The Authority's analysis found evidence the return on equity series was stationary and symmetrically distributed series in Australia. The implication of stationarity in the return on equity is that the historical mean and variance of the series provide meaningful information relating to future outcomes. However, the Authority notes that the return on equity still exhibits very high levels of volatility and is thus not considered 'relatively stable or constant'. Based on the above analysis, the Authority considers that the return on equity is likely to be more stable than the MRP. As a consequence, this analysis provides evidence for a negative relationship between the risk free rate and the MRP. The Authority notes that studies based on overseas data such as Siegel (1998); Smithers and Co (2003); and Wright (2012) present evidence to suggest that the return on equity is more stable than the market risk premium, which implies a negative relationship between the MRP and risk free rate.[307] A summary of Wright's arguments can be found in Appendix 14 – Relationship between the risk free rate, market risk premium and the return on equity: academic evidence.

680. The Authority received submissions from stakeholders implying a negative relationship that exists between the risk free rate and MRP. DUET Group (**DUET**) submitted that it was appropriate to consider evidence that suggests that equity returns are more constant than the MRP over time, implying a negative relationship between the MRP and risk free rate. DBP advised that recognition of a relationship between the MRP

[307] Smithers and Co (2003) *A Study into Certain Aspects of the Cost of Capital for Regulated Utilities in the UK*, February, p.v49; Siegel, J (1998) *Stocks for the Long Run*, McGraw-Hill Second Edition; and Wright S (2012) *Review of Risk Free Rate and Cost of Equity Estimates: A Comparison of UK Approaches with the AER*, University of London.

and risk free rate is critical to ensure that the results of the CAPM are reliable. Reference was made to Professor Wright's conclusion that the return on equity is more constant than the MRP over time.[308] Competition Economics Group (**CEG**) presented Cambridge Economic Policy Associates' (**CEPA**) advice on estimation of the risk free rate and MRP to support its view that low bond yields tend to be associated with high levels of the expected MRP. Further reference was made to studies that implied this relationship (such as Smithers and Co and Wright[309]) on the basis that the real cost of equity is stable.[310]

681. The Authority has also received submissions suggesting that an explicit adjustment upwards should be made to the MRP to reflect the current "low level" of the risk free rate. This is based on the assumption of a negative relationship existing between the risk free rate and MRP. DUET Group argued that the Authority should consider re-examining the MRP during periods of historically low interest rates to ensure downwardly biased rates of return are not produced.[311] Goldfields Gas Transmission (**GGT**) provided analysis to highlight that the regulatory approach of adopting a constant MRP at a time when Commonwealth Government Securities (**CGS**) yields are low post the financial crisis has resulted in a fall in compensation to investors at a time when attracting investment was becoming more difficult.[312] Dampier to Bunbury Pipeline (**DBP**) also highlighted that a mechanistic application of an historic MRP was resulting in historically low cost of equity following the Global Financial Crisis (GFC). They argued that a reduction in the return on equity provided in regulatory decisions is not sensible given debt margins increasing 'three or four-fold' at the same time. DBP considered that there is a need for a 'sense-check'.[313]

682. CEG applied the AMP Capital Investor's method to estimate the MRP on a rolling basis between 1993 and 2013. When plotted against CGS yields, the results showed a more than offsetting rise in MRP vis-à-vis the inflation indexed CGS yield, particularly in recent periods where the CGS yield has been low.[314] CEG then produced an analysis of CGS beta estimates (relative to market returns). The results presented that the CGS beta was negative in recent years. CEG argued that the implications of the negative beta were that the prevailing MRP would be higher than the long run average constant.[315]

683. The Authority considered that there were two possibilities in relation to the current level of the risk-free rate: (i) the current level of the risk-free rate is unusually low from an historical perspective; or (ii) that its history is irrelevant and its use is appropriate as it reflects prevailing market conditions. The Authority notes that the AER has received advice from Professors McKenzie and Partington on this issue. [316]

684. The Authority agrees with McKenzie and Partington that classifying current interest rates as being abnormally low is a relative statement. McKenzie and Partington

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308 DUET Group, *Public Submission on Draft Rate of Return Guidelines*, 23 September 2013, pp. 2-3.

309 CEPA, *Advice on estimation of the risk free rate and market risk premium*, March 2013, p. 25.

310 Ibid, p. 36.

311 DUET Group, *Public Submission on Draft Rate of Return Guidelines*, 23 September 2013, p. 3.

312 Competition Economics Group, *Estimating E(Rm) in the context of recent regulatory debate*, June 2013, pp. 8-9.

313 Dampier to Bunbury Natural Gas Pipeline, ERA Draft Rate of Return Guidelines: DBP Response, 23 September 2013, p. 21.

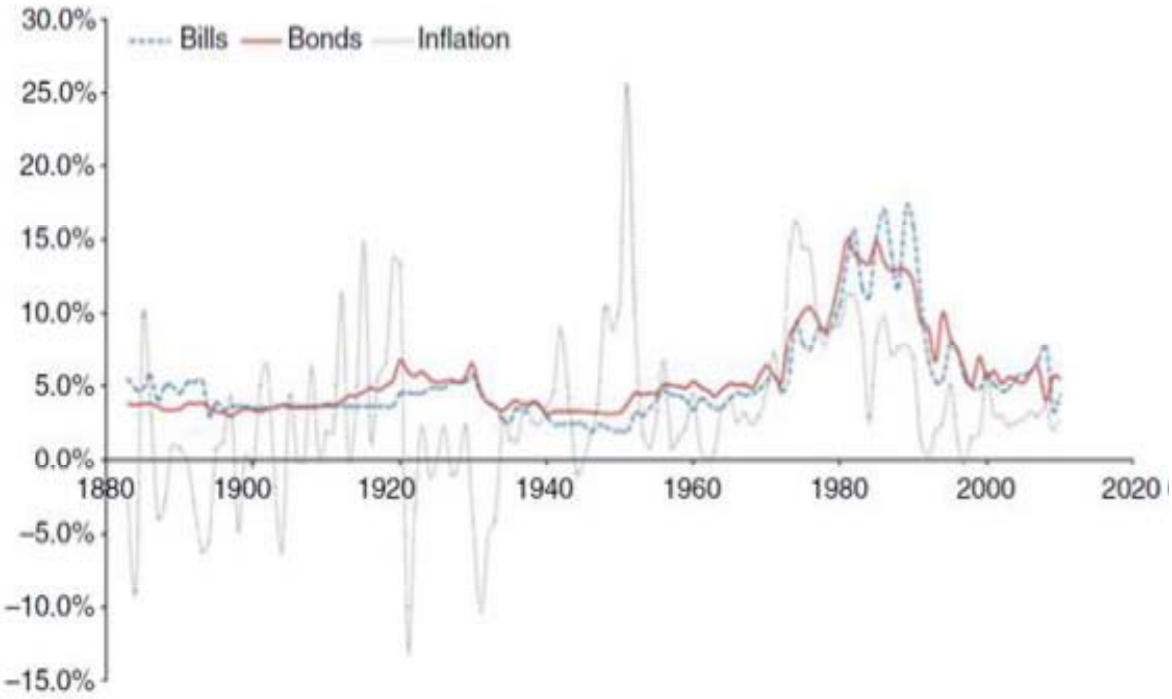
314 Ibid, pp.14-17.

315 Ibid, p. 28.

316 McKenzie and Partington, 2013, *Review of the AER's overall approach to the Risk free rate and Market Risk Premium,* A report to the AER, 28 February 2013, p. 8.

considered that a commonly used method is to assess the current interest rate against a long history of data. In their advice to the AER, McKenzie and Partington considered the history of yields in the USA, UK and Australia with the view that the lessons provided by the USA and UK are relevant for Australia as they have a greater length of historical data of interest rates. McKenzie and Partington concluded that it is the period of high interest rates in the seventies, eighties and nineties that are the best candidate for being abnormal, rather than the current "low" rates as presented in Figure 18 below.[317]

Figure 18 Bond yields, Bill yields and Inflation rates, 1880 - 2012



Source: Brailsford et al (2012)

685. In addition, after reviewing various studies on the long historical interest rates, in both nominal and real terms, in the US, the UK, and Australia, McKenzie and Partington were of the view that the more recent history of interest rates (in the seventies, eighties and nineties) is not truly representative of the long run in this market. They also argued that evidence exists which suggests that bond yields were stable (and possibly even falling) in the long run for the US, UK and Australian markets. They considered that the more recent history is anomalous and the high interest rates observed during this period are clearly not representative of the longer time series. As such, one conclusion that may be drawn is that the current level of interest rate is a return to the 'normal' long run interest rate regime. On the other hand, they also argued that there is a new normal and the most recent global financial crisis represents a true regime shift for global financial markets. However, they acknowledged that it is difficult to determine whether this is the case or not, and that only in the fullness of time will we be able to comment on this with any certainty.[318]

317 McKenzie and Partington, 2013, *Review of the AER's overall approach to the Risk free rate and Market Risk Premium,* A report to the AER, 28 February 2013, p.8.

318 McKenzie and Partington, 2013, *Review of the AER's overall approach to the Risk free rate and Market Risk Premium,* A report to the AER, 28 February 2013, pp.11-4.

686. In conclusion, the Authority is of the view that it is unclear that the current level of the risk free rate is at an historical low. The Authority remains unpersuaded that the current level of the risk-free rate is at a historical low. As a consequence, the Authority does not believe a revision to the MRP is necessary on the basis of reflecting the current level of the risk free rate.

11.2.2.2 Evidence against a relationship between the MRP and risk free rate

687. The above evidence produces support for an inverse relationship between the risk free rate and MRP, which is described in 11.2.1.1 as Scenario 1. However, the Authority has also performed alternative econometric tests (Dickey Fuller Generalised Least Squares tests) which provide contrary empirical evidence to the above. This is contained in Appendix 16 – Is the return on equity stable? This analysis produces evidence that the MRP is stationary (when a risk-free rate is proxied by observed returns on bills[319]) and that the MRP is marginally stationary (when a risk-free rate is proxied by observed returns on bonds). This analysis indicates support for Scenario 2 in 11.2.1.1 that is no relationship exists between the MRP and risk free rate. This is contrary to the above analysis in which the return on equity is stationary as this result implies the return on equity is non-stationary in Australia.

688. The Authority has performed econometric tests to examine the question of whether there has been a flight-to-quality in the Australian financial market. A flight-to-quality is said to occur when there has been a *significant* and *detectable* 'flight' of funds, from risky Australian assets (such as stocks) flow to relatively safe Australian assets such as government bonds, during times of heightened risk aversion. Detection of a flight-to-quality would present evidence of a relationship between the risk free rate and MRP. The Authority's analysis can be found in Appendix 10 – Flight to quality in the Australian financial market: empirical evidence.

689. The Authority investigated the assertion that a negative relationship exists between the Australian stock and government bond market on the basis of large scale liquidation of stocks (represented by a fall in the index price) simultaneously with large scale investment in the Commonwealth Government Securities (represented by a decrease in the CGS bond yields). Such a finding would provide evidence supporting a negative relationship between the expected Australian MRP and risk free rates (i.e. supporting the view that the Authority should increase the MRP when there is an event that causes a significant reduction in the risk free rate). However, the Authority's flight to quality study found no relationship between changes in the Australian stock prices and government bond yields during crisis periods. The Authority considers that this is evidence against a relationship between the MRP and risk free rate given that no relationship can be detected between stocks and Commonwealth Government Securities during crisis periods.

690. A number of submissions expressed concerns relating to the ERA's flight to quality analysis. DUET considered the ERA's flight to quality analysis indicates that the MRP is constant through the investment cycle. DBP argued that both the AER and the RBA provided evidence that is different with the ERA's conclusion.[320]

691. ATCO Gas Australia (**ATCO**) was of the view that flight to quality and Granger causality tests have very little relevance to estimating the cost of equity.[321] DBP

[319] Bills are a short term debt instrument of maturity up to 3 months.

[320] Ibid. p. 3.

[321] ATCO Gas Australia, *Draft Rate of Return Guidelines,* Public Submission, 25 September 2013, p. 23.

considered that the Granger causality tests undertaken by the ERA were irrelevant (Appendix 13 – The equity risk premium and the risk-free rate: Granger Causality test), on the basis that there had not been any argument about the direction of the relationship between the risk free rate and MRP. In addition, DBP stated that the ERA's flight to quality analysis answered the 'wrong' question with respect to testing for the 'decoupling' of stock and bond markets. DBP argued that even if evidence of "decoupling" was found, there would not be any requirement for a change in regulatory practice. This was because the tests were based on a very narrow time window. DBP was of the view that these narrow windows have no relevance to determinations taking place at other times.[322] CEG on behalf of the Energy Networks Association (**ENA**) outlined circumstances where the spot MRP (as opposed to the long run average) has increased. Examples given included periods of 'flight-to-quality' during which there is heightened anxiety and an increase in risk aversion and increased spreads on various risky assets over CGS. The 'flight-to-quality' was discussed in the context of international cash flows, not Australian cash flows.[323]

692. In response, the Authority draws attention to the initial question being investigated in its analysis, that is whether there is a significant and detectable 'flight' of funds from risky Australian assets (such as stocks) to relatively safe Australian assets such as government bonds during times of heightened risk aversion. In considering this theoretical hypothesis, the Authority considers that the direction of causality is from the Australian equity market to the Government bond market. This is contradicted by the evidence contained in Appendix 13-The equity risk premium and the risk-free rate: Granger Causality test. The Authority considers that the Granger causality tests therefore provide evidence against the flight-to-quality hypothesis formulated in that analysis, contrary to DBPs suggestion they are irrelevant. With respect to DBP's view on the narrow time windows, the Authority notes that event studies are designed to analyse situations when the movement of funds between stock and government bond markets is presumed to be the most significant. No supportive evidence of the negative relationship was found even in the periods where they are most likely to occur.

693. The Authority has received submissions from stakeholders suggesting an independent relationship exists between the MRP and risk free rate. DBP submitted that evidence has emerged showing that the risk free rate and the MRP are moving independently of one another. It highlighted that this change in the relationship had caused foreign regulators to change their approach in which the current risk free rate and current MRP are used.[324] DBP's view was that the ERA's co-integration based analysis was inconsistent with best practice. DBP stated that best practice takes both the MRP and volatility of market returns into account on the basis that the latter drives future increases in the former. It was DBP's view that the ERA's analysis does not take complicating factors into account.

694. The Authority is of the view the independent movement of the risk free rate and the MRP, as proposed by DBP, is consistent with the Authority's findings based on the empirical analyses outlined in this current section (however, conflicting evidence was previously presented in 11.2.2.2). The Authority's empirical analysis has also found that: (i) the MRP *can* be stationary depending on the statistical method used

322 Dampier to Bunbury Natural Gas Pipeline, ERA Draft Rate of Return Guidelines: DBP Response, 23 September 2013, p. 20.

323 Competition Economics Group, *Estimating E(Rm) in the context of recent regulatory debate*, June 2013, p.10.

324 Dampier to Bunbury Natural Gas Pipeline, ERA Draft Rate of Return Guidelines: DBP Response, 23 September 2013, pp. 19-20.

(Appendix 16); (ii) no conclusive relationship between the MRP and the risk-free rate exists (Appendix 16); and (iii) the cash rate (or monetary policy) is co-integrated with the risk free rate (Appendix 11- Co-integration between Commonwealth Government bond yields and the cash rate).

695. These three findings suggest that the risk free rate has a strong connection to monetary policy, as opposed to investors' views and investment decisions surrounding in the Australian stock market – implying no relationship between the two. However, the Authority notes that this evidence cannot be considered in isolation of the conflicting evidence previously presented in 11.2.2.1.

11.2.3 The Authority's considerations regarding the relationship between the risk free rate and MRP

696. In conclusion, the Authority's own empirical analysis does not support a clear relationship between the risk-free rate and the market risk premium within the Australian context. The contradictory evidence presented in 11.2.2.1 and 11.2.2.2 is consistent with the conclusions of an extensive literature review conducted by Professors McKenzie and Partington on both theoretical and empirical studies regarding this relationship. McKenzie and Partington found no conclusive evidence of any systematic relationship, concluding that this relationship could be negative; positive; or independent. Further details on McKenzie and Partington conclusions can be found in Appendix 14 – Relationship between the risk free rate, market risk premium and the return on equity: academic evidence

697. The Authority is therefore of the view that there is inconclusive evidence to suggest any qualitative relationship existing between the risk-free rate of return and the MRP. Given the conflicting evidence regarding the relationship between the risk free rate and MRP, it is necessary to use different methodologies, in addition to regulatory judgement in determining the appropriate value of the MRP. However, the implication of the analysis is that the MRP may fluctuate, depending on economic conditions. On this basis, the Authority considers that the forward looking MRP does vary. The Authority is of the view that the direction of that fluctuation – relative to the risk free rate and the return on equity – is not quantifiable. As a consequence, auxiliary information must be used to determine the appropriate point estimate within an estimated range of MRP values.

11.2.4 Estimating the market risk premium

698. The market risk premium cannot be directly observed, unlike other market based parameters such as the risk free rate and debt risk premium. As a consequence, estimation procedures for estimating the MRP are imprecise. In addition, the MRP is a forward-looking concept subject to high levels of uncertainty in the short term. The Authority considers that any estimated MRP must be a 5 year forward looking MRP, commensurate with the prevailing conditions expected in the regulatory control period. Australian regulatory practice has typically applied a long term average MRP of 6 per cent over the past decade. .

699. Table 13 demonstrates the recent history of estimates of the value of market risk premiums in Australia.

Table 13 The estimated value of the market risk premium in the Australian regulatory decisions

Regulator	Year	Industry	MRP (Per cent)
ACCC[325]	2011	Fixed Line Services (Telecommunications)	6.00%
AER[326]	2012	Gas Distribution Network	6.00%
ERA[327]	2012	Electricity Distribution/Transmission	6.00%
ERA[328]	2011	Gas Transmission	6.00%
IPART[329]	2012	Water, sewerage, stormwater drainage and other services	6.00%
QCA[330]	2012	Water, sewerage, stormwater drainage and other services	6.00%
ESCOSA[331]	2012	Water, sewerage, stormwater drainage and other services	6.00%

Source: Compiled by the Economic Regulation Authority

700. The Authority notes that any methodology used to estimate the MRP will have an implicit assumption regarding the relationship that exists between the MRP and risk free rate. The Authority notes that previous regulatory practice has implicitly assumed that no relationship exists between the risk free rate and MRP, and therefore a long term average MRP is the most appropriate method for a forward looking estimate of the MRP. However, given the inconclusive empirical and academic evidence regarding the nature of the relationship between the MRP and risk free rate, the Authority is now of the view that a reasonable range of estimates, using different methodologies is necessary in order to best estimate the most relevant forward looking MRP. This approach allows for a permissible range of MRP values to be estimated, taking into account the possible theoretical relationships that exists between the MRP and risk free rate. The Authority will then at a determination exercise its regulatory judgement, based on Auxiliary information outlined in Appendix 29 – Other relevant material, to inform the rate of return that best reflects the prevailing market conditions for funds.

701. The Authority notes that both the historical risk premium approach (described below in section 11.2.5) and the dividend growth model (described below in section 11.2.6)

[325] Australian Competition and Consumer Commission, *Inquiry to make final access determinations for declared fixed line services — Final report*, July 2011, p. 61.

[326] Australian Energy Regulator, *Access Arrangement final decision Envestra Ltd 2013-17 Part 1,* March 2013, p. 30.

[327] Economic Regulation Authority (Western Australia), *Final decision on proposed revisions to the access arrangement for Western Power*, 2012

[328] Economic Regulation Authority, *Final Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline*, 31 October 2011, p. 158.

[329] Independent Pricing and Regulatory Tribunal, *Review of prices for Sydney Water Corporation's water, sewerage, stormwater drainage and other services, From 1 July 2012 to 30 June 2016*, p. 183.

[330] Queensland Competition Authority, *Final report, Sunwater irrigation price review 2012–17, Volume 1, May 2012*, p. 485.

[331] Essential services commission of South Australia, *Advice on a regulatory rate of return for SA Water—Final advice*, February 2012, p. 9.

implicitly incorporate an assumption regarding the relationship that exists between the risk free rate and MRP. The dividend growth model 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 MRP.[332] As a consequence, the dividend growth model would be directly applicable if the MRP and risk free rate were perfectly negatively correlated through time. Given that 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. As a consequence, this approach would be appropriate if no relationship between the risk free rate and MRP through time existed.

11.2.5 Historical risk premium approach

702. The historical risk premium approach estimates the MRP by observing historical realised excess returns[333] of the market portfolio, and using this to inform the future expected MRP. This is based on the assumption that investors will determine their expected equity risk premium, in the future, informed by realised equity returns from the past. As noted previously, this approach implicitly assumes that no relationship exists between the MRP and risk free rate. It is also assumed expectations will be developed on long term observations and thus are relatively stable over time. Investors are not expected to change their long-term expectation of the MRP as frequently as daily changes in the financial markets.

703. The Authority received a number of submissions pointed to problems with using historical average of equity risk premium in estimating the forward looking MRP and, in particular, in the assumption that the MRP is invariant at 6 per cent. GGT stated that the use of past average of risk free rates in the calculation of the MRP is both incorrect and unnecessary. Instead, GGT considered that the MRP should be calculated by subtracting the current estimate of the risk free rate from the expected return on the market portfolio at a date close to the commencement of the access arrangement period. GGT referred to CEG's report for the ENA which highlighted that the expected MRP is not a direct input in the CAPM (i.e. it is constructed from other variables) and that the existence of an invariant MRP is not an assumption of the CAPM.[334] GGT was concerned that, by treating the MRP as a variable in its own right, and estimating it over long term historical averages, the Authority was essentially using a single factor model instead of the CAPM. In support of this, GGT highlighted CEG's evidence[335] against a stable MRP of 6 per cent. This analysis showed no relationship between the market return and the risk free rate. They also highlighted the Independent Pricing and Regulatory Tribunal's preference for using a weighted average of the long term risk free rate and short term risk free rate in the applications of the CAPM, which is a departure from the use of a stable MRP of 6 per cent.[336]

704. CEG's report made reference to the AER's past regulatory decisions requiring a material burden of proof in order to change from an expected MRP of 6 per cent. CEG was of the view that this effectively establishes a null hypothesis of an MRP of 6 per cent. GGT went on to outline that the level of certainty at which this hypothesis can be

[332] Lally M, *The Dividend Growth Model,* 4 March 2013, p. 3.

[333] Realised excess returns are the difference between the realised return of the market portfolio and the relevant risk free rate of return.

[334] Competition Economics Group, *Estimating E(Rm) in the context of recent regulatory debate*, June 2013, pp. 8-9.

[335] Provided for APA Group and the Victorian Gas Distributors in 2012.

[336] Goldfield Gas Transmission, *Submission on the Economic Regulation Authority's Draft Rate of Return Guidelines*, 19 September 2013, pp. 59-60.

rejected is undisclosed and unexplained.[337] CEG claimed that the AER ignored the literature and evidence implying a higher expected MRP than otherwise due to a lack of consensus. In particular, reference was made to McKenzie and Partington's findings that it is difficult to know whether there is a negative relationship between the risk free rate and the MRP and the use of this reasoning as justification for not rejecting the null hypothesis of an MRP of 6 per cent.[338]

705. CEG on behalf of the ENA advised that the result from adding a fixed MRP to an unstable underlying risk free rate should be cross checked against risk premiums on debt. CEG presented quotations from a Reserve Bank of Australia (**RBA**) letter[339] and interpreted these as saying debt and equity premiums are likely to be related. In support of this interpretation, additional reference was made to a statement in the letter that said:

> ...market risk premia are unlikely to be stable through time

and

> ...there has been a widening in the spreads between CGS yields and those on other Australian dollar-denominated debt securities. This widening indeed confirms the market's assessment of the risk-free nature of CGS and reflects a general increase in risk premia and other assets.

706. From a range of letters and reports from the International Monetary Fund, RBA and Australian Office of Financial Management, CEG formed the view that if increased demand for sovereign debt is not also leading to heightened demand for Australian listed equities it is wrong to assume that depressed CGS yields are also associated with depressed required equity returns, that is a constant spot MRP.[340] CEG proposed that there are some periods where there is heightened uncertainty and/or risk aversion in financial markets such that the risk free rate and MRP will move in the opposite direction. This is contrary to a cost of equity falling in tandem with the risk free rate when a fixed MRP is used.[341]

707. NERA Economic Consulting (**NERA**) suggested that the Australian Energy Regulator (**AER**) should, on average, set the MRP to match the unconditional mean MRP. Specifically, it advises that the MRP should be set above and below this unconditional mean based on market conditions. Accordingly, NERA suggested that an estimate of the unconditional mean is useful in the regulatory decision process. In order to inform this estimate, NERA surveyed academic literature, in addition to commercially available material from investment banks. NERA reported the following:[342]

- Dimson, Marsh and Staunton (2012) report the arithmetic mean of annual returns of Australian stocks from 1900 to 2012 of 13%.[343]
- Brailsford, Handley and Maheswaran (2012) report an annual return of Australian stocks from 1900 to 2012 of 12%.[344]

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337 Competition Economics Group, *Estimating E(Rm) in the context of recent regulatory debate*, June 2013, pp. 34-39.

338 Ibid, pp. 37-39.

339 Reserve Bank of Australia (2012) *Letter regarding the Commonwealth Government Securities Market*, Guy Debelle, Assistant Governor, Financial Markets, 16th July 2012, pp.1-2.

340 Ibid, pp. 40-43.

341 Ibid, p. 55.

342 NERA Economic Consulting, *The Market Risk Premium: Analysis in Response to the AER's Draft Rate of Return Guidelines, A report for the Energy Networks Association,* October 2013.

343 Dimson, E, P. Marsh and M. Staunton, *Credit Suisse Global investment returns sourcebook 2013,* Credit Suisse, February 2013.

708. NERA suggested that the difference between the two estimates is due to the way returns incorporate dividends. NERA calculated an unconditional MRP using this data, by assuming a 35 cents market value for each dollar of franking credits. Its calculation indicated that an unconditional MRP is 6.5 per cent per annum.

709. The Authority notes that 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 MRP as there are no better forecasting methods available:[345] 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 impact on immediate returns, but the effect on long-term performance will be diluted. Moreover, volatility does not usually stay at abnormally high levels for long, and investor sentiment 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.

710. The Authority also notes evidence indicating that estimates of the MRP using historical data on equity risk premium are biased. For example, McKenzie and Partington[346] and Damodoran[347] are of the view that an estimate of the MRP using an historical average of the equity risk premium is likely to overestimate the true expectation due to the presence of survivorship bias. In this method of deriving an estimate for the MRP, a national stock exchange index is used as a proxy for the equity market return. For example, in Australia, a proxy for the equity market return is the Australian All Ordinaries Index. These authors argued that stocks with consistently negative returns, no longer in the market have been excluded from the Australian All Ordinaries Index.

711. Siegel (1999) considers that historical equity returns are likely to overstate returns actually realised and earned because of historically high transaction costs and the historical lack of low cost opportunities for diversification.[348] The implication is that the long-term forward-looking MRP is expected to be lower over time relative to the historical estimate. Brailsford, Handley and Maheswaran (2008), 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. This was attributed to lower estimated stock returns prior to 1958, and to a lower extent, higher bill returns prior to 1960.[349]

712. The Authority notes that the above evidence suggests that any estimate of the historical equity risk premium is conservative. Using a historical equity risk premium as one estimation method to determine a forward looking MRP is necessary, given the return on equity and equity risk premium are not directly observable. The Authority is also aware that well regarded financial services providers such as Credit Suisse and

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[344] Brailsford, T., J.Handley and K. Maheswaran, *The historical equity risk premium in Australia: Post-GFC and 128 years of data,* Accounting and Finance, 2012, pp. 237-247.

[345] Dimson, Marsh and Staunton, *Credit Suisse Global Investment Returns Sourcebook 2012*, February 2012, p. 37.

[346] McKenzie, M. and G. Partington, *Equity market risk premium*, 21 December 2011, pp. 6–7.

[347] Damodoran, A. *Equity risk premiums: determinants, estimation and implications—the 2012 edition,* Mach 2012, p. 24.

[348] Lally, *Cost of equity and the MRP*, July 2012, p. 8.

[349] Brailsford , Handley and Maheswaran (2008), *Re-examination of the Historical Equity Risk Premium in Australia*, Accounting and Finance, Vol.48, p. 95.

Duff and Phelps provide risk premium reports based on historical averages of equity risk premium data.[350] This information indicates that investors are likely to place some weight on historical information on equity risk premiums to form their expected MRP. The Authority is therefore of the view that historical estimates of the mean of the MRP provide relevant evidence for any forward looking MRP in the Australian context.

713. Based on the above academic evidence, the Authority is of the view that a long-term average of the historical data on equity risk premiums is relevant for estimating a forward looking MRP. The Authority considers that this approach is transparent and verifiable, and therefore fit for purpose. Using the historical average of risk premium approach, the Authority considers that the following studies are relevant for determining an appropriate range for the MRP for the purpose of the rate of return guidelines.

Table 14 Estimates of a forward looking MRP using the historical risk premium approach

Study/Author	Period	Assumed value of imputation credits	Term of a risk-free rate	Estimates of the MRP (Per cent)
Handley/ AER (2011)[351]	1883 – 2011 1988 - 2011	0.35	10 years	5.0 – 6.0
Brailsford, Handley and Maheswaran[352]	1883 – 2010 1988 - 2010	0.50	10 years	6.0 – 6.5
ERA	1972 – 2011 1988 - 2011	0.65	5 years	5.0 – 6.0
Value Adviser Associates[353]	1883 - 2010	1.00	10 years	6.0 – 7.0
Value Adviser Associates[354]	1883 – 2008 1958 -2008	0.5	10 years	6.1 – 7.2

Source: Complied by the Economic Regulation Authority

714. Based on the results in Table 14 the Authority is of the view that a relevant MRP based on historical averages of risk premium approach indicates the MRP is likely to fall within the range of 5.0 per cent and 7.0 per cent.

350 See Duff and Phelps, 2013, *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

351 Handley (2011), *An estimate of the historical equity risk premium for the period 1883 to 2011,* A report prepared for the Australian Energy Regulator, Table 2, p. 6.

352 Brailsford , Handley and Maheswaran (2012), *The historical equity risk premium in Australia: post-GFC and 128 years of data*, Accounting and Finance, Vol.52, pp.237-247, Table 2.

353 Value Adviser Associates (2011), *The provision of analysis supporting a value for Market Risk Premium,* a Report prepared for DBNGP (WA), p. 4.

354 Value Adviser Associates (2009), *The Market Risk Premium,* a Report prepared for WestNet Energy, p. 11.

11.2.5.1 Use of long term averages for the MRP and spot values of the risk free rate

715. DUET submitted that the use of 'spot' risk free rates in the CAPM formula is inconsistent with the use of long term averages of the MRP in the CAPM. It outlined that consistency could be achieved either through: (i) using a spot rate in the estimates of the risk free rate and the MRP; or (ii) using the long term average rate for both parameters.[355] DUET considered that the use of long term averages (for any of the CAPM parameters) would not satisfy the National Gas Rules' requirement for the cost of capital to be forward looking in the way that 'spot' parameters would.[356]

716. In its submission, CEG claimed inconsistency between the AER's (and thus indirectly the Authority's) MRP and the risk-free rate estimate. CEG is of the view that the inconsistency arose from the spot risk free rate being used as a forward looking long term forecast while MRP was something other than a 'spot' rate. As such, CEG submitted that the risk-free rate used in the estimation of the MRP and risk-free rate added in the CAPM equation need to be the same for the CAPM to be valid.[357] Their claim in relation to inconsistency between the risk-free rate of return (being the spot rate) and the estimate of the MRP via the risk-free rate (being the historical rate) can be expressed as below.

$$R_i = RF_{current} + \beta_i (RM_{historic} - RF_{historic}) \quad (14)$$

717. CEG also argued that current Australian regulatory practice indicates that the spot risk free rate is subject to fluctuations which are reflected in the cost of capital estimate (being the first component of the above equation) while the variations in the spot yield on equities are rejected (being the second component of the above equation). In addition, CEG was of the view that the combination of the volatile risk free spot rate (the first component of the above equation) with a stable historical MRP (the second component of the above equation) provides no natural hedge to businesses to compensate for their exposure to volatility. CEG argued that stability in total returns is more valuable than stability in individual components of the return.[358] Based on their arguments, CEG submitted that a long term average estimate for both the risk-free rate and MRP or prevailing actual spot rates for both of these parameters should be adopted in regulatory decisions in order to achieve internal consistency. They advocated the use of the former, using a 10-year historical average.[359]

718. GGT submitted evidence from Professor Alan Gregory regarding the inconsistency of using a long term average MRP. Professor Gregory's view is that an approach combining an historical MRP with a current spot rate of the risk free rate is inappropriate. CEG highlighted Gregory's view that an allowance should be made for any possible inverse relationship that exists.

719. Professor Gregory claims that combining an MRP that is derived from historical observations with a current spot rate is an inconsistent approach when no allowance is

[355] DUET Group, Public Submission on Draft Rate of Return Guidelines, 23 September 2013, pp. 2-3.

[356] DUET Group, *Public Submission on Draft Rate of Return Guidelines*, 23 September 2013, p. 2.

[357] Competition Economists Group, *Response to AER Vic Gas Draft Decisions: Internal Consistency of MRP and Risk Free Rate*, November 2012, pp.10-11.

[358] Competition Economists Group, *Response to AER Vic Gas Draft Decisions: Internal Consistency of MRP and Risk Free Rate*, November 2012, p. 20.

[359] Competition Economists Group, *Response to AER Vic Gas Draft Decisions: Internal Consistency of MRP and Risk Free Rate*, November 2012, pp. 16-17.

made for any possible inverse relationship between the risk free rate and MRP.360 Professor Gregory argued that UK regulators and IPART make allowances for this possible relationship.[361] Professor Gregory also argued that the following two possible approaches were identified which were believed to achieve consistency.

720. As discussed in section 11.2.5, the Authority is of the view that a long-term average of the historical data on equity risk premium can be used as a proxy for a forward looking estimate of the MRP. However, the Authority is now of the view that this approach is only appropriate (and therefore consistent) if no relationship exists between the MRP and risk free rate. In this scenario, the historical risk premium approach would be appropriate as it produces an estimate of the market risk premium that is unconditional on the risk free rate, consistent with no relationship existing between the two. However, as discussed previously, the evidence for this relationship is mixed. As a consequence, the Authority proposes using both the historical risk premium approach in conjunction with the dividend growth model to estimate a range of MRP values, to take into account the possibility of a relationship between the risk free rate.

11.2.6 The dividend growth model

721. The DGM estimates the required rate of return for an asset by equating the present value of expected cash flows with the observed price of the asset. The dividend growth model can be used to estimate the expected market return by equating the present value of *forecast* future dividends of an index, and equating this with the observed price of the index. By subtracting the relevant risk free rate, an estimate of the expected market risk premium can be derived. The dividend growth model 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 MRP.[362] As a consequence, the DGM would be directly applicable if the MRP and risk free rate were perfectly negatively correlated. In addition, the above evidence suggesting the MRP may be non-stationary supports the use of current and forward looking estimates such as those produced by the DGM.

722. The Authority is therefore of the view that the dividend growth model is a relevant model for informing estimates of the forward looking MRP, representing an appropriate MRP estimate if a negative relationship were to exist. This conclusion is based on consideration of the above conflicting empirical evidence regarding the relationship between the risk free rate and the MRP.

723. NERA surveyed the evidence regarding the use of the DGM for estimating the MRP. NERA noted that a study conducted by Campbell and Thompson (2008) indicated that using the dividend growth model to estimate the MRP results in more accurate forecasts of the realised MRP than simply using the historical MRP for US data.[363] NERA also reported that Li, Ng and Swaminathan (2013) found statistically significant evidence that using a multi-stage model can forecast the MRP with a horizon of up to four years.[364] In order to estimate the long-run growth rate for use in the dividend

360 Gregory, A, *The AER Approach to Establishing the Cost of Equity – Analysis of the Method Used to Establish the Risk Free Rate and the Market Risk Premium*, November 2012, p. 3.

361 Ibid, pp. 17-18.

362 Lally M, *The Dividend Growth Model,* 4 March 2013, p. 3.

363 Campbell, J. And S.B. Thompson, *Predicting excess stock returns out of sample: Can anything beat the historical average?* Review of Financial Studies, 2008, pp. 1509-1531.

364 Li, Y., D. Ng, and B. Swaminathan, *Predicting market returns using aggregate implied cost of capital,* Journal of Financial Economics, 2013.

growth model, NERA suggested the methodology outlined in Fitzgerald, Gray, Hall and Jeyaraj (2013) is appropriate.[365]

724. ATCO submitted that some versions of the DGM produce estimates of the MRP that do not vary unreasonably over time. Even if the DGM cannot be used to form a point estimate of the MRP, it was of the view that it could provide information as to whether the current MRP is commensurate with prevailing market conditions.[366]

725. In its Draft Rate of Return Guideline, on the advice of Professor Lally, the AER implemented a two-stage dividend growth model in order to estimate a return on equity.[367] In the traditional two-stage DGM, dividend forecasts are initially made based on an initial "growth phase", before falling to a lower rate of long term growth (the terminal phase). In the AER's implementation of the DGM, the initial growth phase comprises of three forecast dividends reported by Bloomberg, with future dividends assumed to grow at a long-term growth rate, g, after the final forecast dividend from Bloomberg.

726. The AER also utilised an "imputation factor" to reflect the value franking credits contribute to the return on equity an investor receives. The estimated net dividend is multiplied by this imputation factor in order to yield the gross dividend value.

727. The AER estimated the real rate of growth of a long-term dividend by estimating the expected growth rate of real Gross Domestic Product (**GDP**), which is 3 per cent per year based on Lally's estimation. However, an *adjustment factor* was also utilised by the AER based on Lally's advice. Professor Lally was of the view that the long-term growth rate of real GDP is expected to be higher than the real long-term growth rate of dividend. Lally's view is supported by a study by Bernstein and Arnott[368] who argued that, due to 'the net creation of shares', a deduction must be made from the expected growth rate of real GDP in order to estimate accurately the long-term growth rate of the real dividend. Lally considered that a deduction of either 0.5, 1.0 or 1.5 per cent is appropriate. As a result, the long-term growth rate of real dividends falls within the range between 1.5 per cent and 2.5 per cent per year.

728. The next step is to estimate the nominal growth of dividend. The nominal growth rate of dividends, *g*, is estimated using: (i) the midpoint of the RBA's inflation target of 2-3 per cent, which is 2.5 per cent per year; and (ii) the rate of long-term real dividend growth.

729. The Authority has adopted the AER's approach to estimate the MRP using the DGM. Further details of this application can be found in Appendix 15 – The Authority's Dividend Growth Model estimates of the market risk premium. The Authority has outlined issues with the DGM in Appendix 8 – Evaluation of models for the return on equity. The Authority has noted the extreme sensitivity of the estimates of the MRP that arise from changing the input assumptions of the DGM. As a consequence, the Authority considers that a range of DGM must be used to inform on appropriate values of the MRP. Table 15 contains the Authority's initial estimates of the MRP using the DGM under various scenarios.

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365 Fitzgerald, T., S.Gray, J.Hall and R.Jeyaraj, *Unconstrained estimates of the equity risk premium,* Review of Accounting Studies, 2013.

366 ATCO Gas Australia, *Draft Rate of Return Guidelines,* Public Submission, 25 September 2013, pp. 20-25.

367 Australian Energy Regulator, *Explanatory statement draft rate of return guideline*, *August 2013,* p. 220.

368 William Bernstein and Robert Arnott, 'Earnings Growth: The Two Percent Dilution', *Financial Analysts Journal,* October 2003, pp. 47-55.

Table 15 Implied MRP from the dividend growth models

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7
Assumed value of theta	1	0.7	0.55	0.35	0.55	0.55	0.35
Assumed value of real dividend growth	2.50%	2.50%	2.50%	2.50%	2.00%	1.50%	1.50%
Average value return on equity (30/06/2006 to 31/08/2013)	11.35%	10.90%	10.66%	10.36%	10.19%	9.72%	9.41%
Average value of implied market risk premium (30/06/2006 to 31/08/2013)	6.62%	6.16%	5.93%	5.63%	5.46%	4.99%	4.68%
Implied Market Risk Premium as at 30 August 2013	8.01%	7.57%	7.35%	7.06%	6.88%	6.41%	6.11%

Source: Economic Regulation Authority's analysis

730. The Authority has previously expressed the view that estimates of dividend forecasts are subjective. In addition, the Authority considers that evidence exists that a systematic bias exists in analyst forecasts of future dividends.[369] In particular, significant evidence exists suggesting that economic forecasting has a poor performance record.[370] The Authority has re-estimated the implied MRP using the same approach with the above biases removed. That is, the Authority has reduced the forecast dividends reported by Bloomberg by subtracting the estimates of these biases from the forecast dividends. were then reproduced using these bias adjusted forecast dividends. The results are below in Table 16.

369 Economic Regulation Authority, *Explanatory Statement for the Draft Rate of Return Guidelines,* 6 August 2013, p. 159.

370 See Fildes, R. and Makridakis, S. (1995). The impact of empirical accuracy studies on time series analysis and forecasting, *International Statistical Review,* 63, 3, 289-308; and Hendry, D. And Clements, M. (2003). Economic forecasting: some lessons from recent research, *Economic Modelling,* 20, pp. 301-329.

Table 16 The implied MRP from the dividend growth models – Biases removed

	Scenario 8	Scenario 9	Scenario 10	Scenario 11	Scenario 12	Scenario 13	Scenario 14
Assumed value of theta	1	0.7	0.55	0.35	0.55	0.55	0.35
Assumed value of real dividend growth	2.50%	2.50%	2.50%	2.50%	2.00%	1.50%	1.50%
Average value return on equity (30/06/2006 to 31/08/2013)	10.41%	10.01%	9.82%	9.56%	9.34%	8.87%	8.60%
Average value of implied market risk premium (30/06/2006 to 31/08/2013)	5.68%	5.29%	5.09%	4.86%	4.61%	4.13%	3.87%
Implied Market Risk Premium as at 30 August 2013	7.11%	6.73%	6.54%	6.29%	6.07%	5.59%	5.34%

Source: Bloomberg and Economic Regulation Authority's analysis

11.2.7 Other DGM estimates

731. The Authority considers that a range of DGM must be used to take into account the sensitivity to input assumptions. The Authority considers that the following studies are relevant for determining an appropriate range of a forward looking MRP using the dividend growth model at the current time (Table 17).

Table 17 Recent estimates of the MRP using the dividend growth model, per cent

Study/Author	Date	Dividend Yield	DPS growth	Risk free rate	MRP	MRP (Rounded to the nearest 0.5)
CEG	Mar 2012	5.68	6.60	3.77	8.52	8.5
Capital Research	Feb 2012	4.70	7.00	5.08	6.62	6.5
Capital Research	Feb 2012	5.23	7.00	5.08	7.15	7.0
Capital Research	Feb 2012	5.71	7.00	5.08	7.63	7.5
Capital Research	Mar 2012	6.29	7.00	3.73	9.56	9.5
NERA	Feb 2012	Bloomberg & IBES forecasts	5.65	3.96	7.72-7.75	7.5
NERA	Feb 2012		5.65	5.50	6.18-6.21	6.0
NERA	Mar 2012		5.65	3.99	7.69-7.72	7.5
CEG	Nov 2012	5.34	6.60	3.05	8.89	9.0
Lally	Mar 2013	5.34	A mix of long- and short-term dividend growth	3.26	5.90-8.39	7.0
SFG	Jun 2013				4.7 – 7.9	6.5
Median:						**7.0 - 7.5**

Source: AER, Multinet Final Decision, Table 5.3, page 124 (except for the SFG's study) and the ERA's rounding

732. In addition, the Authority is of the view that it is appropriate to consider only one estimate of the MRP from various estimates of the MRP using the DGM from the same author (Table 18). For example, Capital Research conducted 4 estimates of the MRP using the DGM in 2012. A forward looking MRP from its 4 estimates falls within a very wide range from 6.5 per cent and 9.5 per cent. This example supports the Authority's view that estimating the MRP using DGM is very sensitive to the input assumptions adopted in the model. A median of 7.0 and 7.5 per cent for the MRP will be considered, together with other estimates of MRP using the DGM, to determine an appropriate range of the MRP.

Table 18 Estimates of the MRP adopted to determine a appropriate range

Study/Author	Approach	Estimates of the MRP (Per cent)
CEG	DGM	8.5 – 9.0
Capital Research	DGM	7.0 – 7.5
NERA	DGM	6.0 – 7.5
Lally (AER)	DGM	6.0 – 8.5
ERA	DGM	4.0 – 6.5
SFG	DGM	4.0 – 8.0

Source: Economic Regulation Authority's analysis

733. The Authority considers that CEG's estimates of a forward looking MRP of 8.5 per cent and 9.0 per cent are significantly higher than all other estimates using the same approach. As presented in its own application of the dividend growth model, the Authority notes that a change of 50 to 100 basis points in the estimated MRP occurs when the biases present in forecast dividends are removed. In addition, due to a concern of upwardly biased estimates of an implied MRP using the DGM, the Authority considers that less weight should be given to estimates at the upper end of the range of the implied MRP from the DGM.

734. Based on the above estimates with limited weight given to the CEG's studies, the Authority is of the view that a forward looking MRP using the dividend growth model falls within the range of 6.0 per cent and 7.5 per cent.

11.2.8 An appropriate range for the MRP

735. The Authority is of the view that it is appropriate to use two approaches of estimating the MRP to determine an appropriate range: (i) the historical average approach in which historical data on equity risk premium are used; and (ii) the dividend growth model. The estimates of the MRP from these two approaches can be summarised as follows:

- Using the historical average approach, the Authority considers that the range of 5.0 per cent and 7.0 per cent for a forward looking MRP is appropriate.
- For the six estimates using the dividend growth model, the Authority considers that the range of 6.0 – 7.5 per cent is appropriate.

736. The Authority notes that the estimate of MRP, estimated using an historical data approach and a dividend growth model, falls within a wide range, depending on the method adopted to estimate the MRP. The Authority will exercise regulatory judgement at the time of a determination in order to estimate the appropriate point estimate within this range. The Authority considers that the current forward looking information set out in Appendix 29 – Other relevant material, account for market conditions prevailing at the time determinations are made. As a consequence, the Authority is of the view that this material will help inform it on the most relevant point within the estimated MRP range. The Authority will use its discretion based on

relevant information to determine a point estimate of the MRP at the time when the decision is made.

737. In conclusion, given all relevant available estimates before the Authority at this point in time, the Authority considers that a range of 5.0 per cent to 7.5 per cent is appropriate for the MRP.

12 Equity beta

739. Under the capital asset pricing model (**CAPM**) model, the total risk of an asset is divided into systematic and non-systematic risk. Systematic risk is a function of broad macroeconomic factors (such as economic growth rates) that affect all assets and cannot be eliminated by diversification of the investor's asset portfolio.

740. The key insight of the CAPM is that the contribution of an asset to the systematic risk of a portfolio of assets is the correct measure of the asset's risk (known as beta risk) and the only systematic determinant of the asset's return, over and above the return on a risk free asset.

741. In contrast, non-systematic risk relates to the attributes of a particular asset. The CAPM assumes this risk can be managed by portfolio diversification. Therefore, the investor in an asset does not require compensation for this risk.

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

$$R_e = R_f + \beta_e \left(R_m - R_f \right) \tag{15}$$

where

R_e is the required rate of return on equity;

R_f is the risk-free rate;

β_e is the equity beta that describes how a particular portfolio i will follow the market which is defined as;

$\beta_e = \text{cov}\left(r_i, r_M\right) / \text{var}\left(r_M\right)$; and

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

743. In the CAPM, the equity beta value is a scaling factor applied to the market risk premium, to reflect the relative risk for the return to equity of the firm in question. Two types of risks are generally considered to determine a value of equity beta for a particular firm: (i) the type of business, and associated capital assets, that the firm operates; and (ii) the amount of financial leverage (gearing) employed by the firm.

12.1 Approach

744. The Authority considers that empirical evidence must be used to inform its judgment for equity beta, as no a prior expectation exists for the equity beta of regulated gas distribution and transmission networks. The Authority considers the methodology

outlined by Henry is fit for purpose for these rates of return guidelines.[371] To this end, the Authority has conducted its own analysis primarily based on this advice.

745. The Authority considers that it is inappropriate to include overseas businesses in the sample which is used to estimate the equity beta. Such an inclusion is arbitrary and the benefits of a larger sample due to this inclusion may be outweighed by the distortions of a larger sample with non comparable businesses.

746. The Authority notes that, given the substantial variation and imprecision inherent in equity beta estimation, empirical evidence concerning a suitable range will be needed to inform its decision. The Authority will take into account the outcomes from a range of statistical techniques, including bootstrap analysis,[372] in order to inform the overall observed range of the equity beta. The Authority's approach is transparent and the findings can be replicated by interested parties.

747. Based on its analysis, the Authority considers that it is appropriate, at this time, to adopt a range for equity beta from 0.50 to 0.70.

748. The Authority will exercise judgement in order to determine the point estimate of the beta, with a view to ensuring the estimate best reflects the systematic risk associated the benchmark efficient entity. The Authority considers that relevant empirical evidence supports a view that there is some downward bias in equity beta estimates that are less than one, and upward bias in equity beta estimates that are greater than one. The Authority intends to undertake more work to quantify the extent of this potential bias. This work would then inform the degree to which the Authority might adjust up the point estimate of the equity beta within the estimated range, so as to account for the potential beta bias.

749. The Authority is of the view that the approach adopted for equity beta estimation is robust and fit for purpose. This view is based on the considerations of various empirical studies and other assessments from the information before the Authority. As a result, the Authority considers the methodologies adopted in this chapter meet the allowed rate of return objective.

12.2 Reasoning

12.2.1 The need for empirical evidence

750. Australian regulated businesses and their consultants generally agree that the business activities of regulated businesses have less systematic risk than average. However, they also have argued that these regulated businesses have much higher financial leverage, and therefore higher financial risk, than the average firm (given average gearing of 60 per cent for regulated businesses versus gearing of 30 per cent for the average firm). They consider that the two effects operate in different directions and that there is no compelling a priori reason to suggest which of these effects should dominate the other. As such, they have proposed that the appropriate a priori expectation is that the equity beta for these regulated businesses is no different from that of the average firm, which is 1.0.

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371 Henry, O (2009) "Estimation Beta", Advice Submitted to the Australian Competition and Consumer Commission.

372 Bootstrapping is a statistical methodology for ascertaining the accuracy of an estimated quantity by re-sampling the data at hand.

751. The Authority notes that higher levels of financial leverage are possible for network businesses because of their stable cash flows. The Authority also notes that 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.[373] Overall, the Authority 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.

752. In its submission on behalf of the Australian Pipeline Industry Association (**APIA**), the Brattle group submitted that as empirical beta estimates rely on historical data, there may be a delay in incorporating changes in systematic risk and therefore equity beta estimates are inherently backward-looking and hence imprecise.[374] In its submission, CEG also argued that the lack of statistical precision makes the empirical estimates of equity beta inappropriate. CEG submitted that using empirical estimates implies that investors form their forward-looking expectations of beta based on regression analysis.[375]

753. The Authority agrees that the return on equity derived from the Sharpe-Lintner CAPM is a forward looking estimate. The Authority does not agree that the appropriate a priori expectation of the equity beta for transmission and distribution businesses is at the market level of one. The Authority notes that there is no a priori expectation of an appropriate value of equity beta for regulated gas businesses in Australia. As a consequence, estimates of equity beta using historical data are required in order to inform an appropriate range for the equity beta of the benchmark efficient firm. Therefore, the Authority believes that any estimate of equity beta must be informed by empirical evidence.

754. The Australian Energy Regulator (**AER**) adopted this approach in its weighted average cost of capital (**WACC**) 2009 Review.[376] Professor Myers agrees with this point, suggesting that the required equity beta can be estimated using historical data.[377] Professor Myers also outlined the imprecision in estimating equity beta, suggesting that the true beta estimate could lie anywhere within a given confidence interval, not just the midpoint.[378] Australian regulators including the Authority and the AER have consistently acknowledged a high level of imprecision for any empirical estimates of equity beta. The Authority considers that issues of imprecision are best addressed via the use of multiple models and statistical techniques to inform a possible range for any equity beta estimate. Therefore the primary evidence used to inform the value for the equity beta of a regulated entity should be based on quantitative evidence.

12.2.2 Revisions to equity beta estimates

755. The National Economic Research Associates (**NERA**), on behalf of ATCO Gas Australia (**ATCO**), suggested that only the beta term has the "law of large numbers" properties. This implies that that beta is the only stable parameter in the CAPM model. NERA also submitted that betas published by investment analyst houses

373 Klein L.S., O'Brien T.J. and Peters S.R. 2002, Debt vs. Equity and Asymmetric Information: A review, *The Financial Review* 37, pp. 317-350.

374 The Brattle Group, *Estimating the Cost of Equity for Regulated Companies*, A report prepared for Australian Pipeline Industry Association, 17 Feb 2013.

375 Competition Economists Group, *Regression estimates of equity beta,* September 2013.

376 Australian Energy Regulator 2009-10, Final decision: WACC review, May 2009.

377 Myers S.C. *Estimating the Cost of Equity: Introduction and Overview*, A report prepared for Australian Pipeline Industry Association, 17 Feb 2013.

378 Ibid.

(such as Merrill Lynch) have adopted an adjustment procedure which adjusts the "raw" betas toward 1.0. NERA also noted that the "adjusted" betas have been used by North American regulators when they utilise CAPM in their regulatory decisions.[379] SFG is also of the view that an adjustment towards one for the estimated beta is required. This view is argued on the basis that 'the adjustment' is small compared to the dispersion between firm estimates.[380] In addition, this view is also on the basis that estimates of equity beta with low standard errors are likely to be observed purely by chance.

756. The Authority does not agree that an estimated beta should be adjusted toward the market equity beta of 1. The Authority notes that a typical revision to the raw beta is the Blume adjustment. The Blume adjustment applies a weight of 0.67 to the raw beta estimate and a weight of 0.33 to the market beta estimate of 1.0. Blume (1975) observed empirically that estimated beta coefficients tend to regress towards the grand mean of all betas over time; that is the value of one.[381] This argument was based on the view that projects will become less risky over time for high risk firms and new projects will have less extreme risk than existing projects.

757. The Authority is not aware of any Australian regulators, or overseas regulators such as the New Zealand Commerce Commission and Ofgem, that have made adjustments to the estimated betas.[382] Imrecon (2012) highlighted that the risks of utilities are inherently stable and that the nature of their regulation is constant. In addition, the AER rejected this adjustment in its WACC review in 2009 on the basis that the adjustment is arbitrary.[383] It therefore is inappropriate to apply Blume adjustments to firms in network sectors.[384] From an intuitive perspective, it is worth noting that the assets regulated firms may use to diversify their portfolios (consequently altering their betas) would usually fall outside the scope of regulation.

758. In addition, SFG Consulting (**SFG**) also argued that there is a higher probability of the equity beta being underestimated than overestimated when the estimates of equity beta are conducted on a given sample.[385] The Authority considers that this view fails to recognise that the Authority has, in past regulatory decisions, favoured estimates at the top end of the estimated ranges to address a high level of imprecision for estimates of equity beta.[386] In its submission, SFG also proposed that information other than stock returns such as analyst forecasts should be incorporated in estimating the value for beta.[387] The Authority notes that Australia has a very small number of analyst forecasts available for utilities compared to the US, precluding reliance on this type of information. In addition, the Authority is of the view that analyst forecasts are subject to upward biases (see Appendix 29 – Other relevant material).[388]

379 National Economic Research Associates, Inc, *The Source of the Fair Rate of Return for Investor-Owned Utilities in North America: the Applicability of those Methods for Jurisdictions in Australia*, 28 Feb 2013.

380 Ibid.

381 Blume, M (1975) *Betas and their regression tendencies'*, Journal of Finance, June.

382 Imrecon (2012) *RIIO reviews: Financeability study*, Report submitted to Ofgem, November 2012, p. 25.

383 Australian Energy Regulator 2009-10, Final decision: WACC review, May 2009.

384 Imrecon (2012) *RIIO reviews: Financeability study*, Report submitted to Ofgem, November 2012, p. 25.

385 SFG Consulting, *Beta estimation: Considerations for the Economic Regulation Authority,* 19 September 2013.

386 Economic Regulation Authority, *Final Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline*, 31 October 2011, p. 158.

387 Ibid.

388 Easton P and Sommers G (2007) Effect of Analysts' Optimism on Estimates of the Expected Rate of Return Implied by Earnings Forecasts, *Journal of Accounting Research,* Vol. 45 , No. 5.

12.2.3 Current approaches to estimating equity beta in utility regulation

759. In its 2009 WACC review for electricity transmission and distribution network service providers, the AER, with the assistance of Associate Professor Henry of the University of Melbourne, established a sample of Australian businesses, comprising gas-only network businesses, one electricity-only network business, network businesses active in both electricity and gas, and general utility businesses.[389] Given the limitations of available Australian data, the AER considered that gas network businesses could be considered as reasonable but not perfect comparators to electricity network businesses, given that both industries involve the transportation of energy.[390]

760. Based on empirical work by Henry, the AER concluded that a reasonable range of the equity beta for a gas or electricity distribution networks was between 0.4 and 0.7. Its final decision was to adopt a conservative approach to the estimation the equity beta that was commensurate with prevailing market conditions and the risks involved in providing reference services. The AER also considered the need for regulatory certainty. On this basis, the AER considered that a value of 0.8 provided the best estimate of the equity beta for gas and electricity transmission and distribution networks.[391]

761. The Authority has conducted its own analysis with regard to the estimates of equity beta. In 2012, the Authority used the same approach that was adopted by Henry but used an updated data set (which included data up to October 2011). This analysis formed the basis for the Authorities decision on equity beta in the Western Power final decision.[392]

762. All data for the Authority's application of Henry's study was sourced from Bloomberg. Data was collected on both a monthly and weekly sampling frequency. Henry advised that sampling the data at a weekly frequency is a reasonable compromise of the trade-off between the noisy nature of daily data and too few monthly observations to produce reliable estimates of beta. Consistent with Henry's approach, the Authority adopted both ordinary least squares (**OLS**) and Least Absolute Deviations (**LAD**) methods in this analysis.

763. The Authority's original empirical study was conducted in two stages.

- first, using a shorter dataset from 2002 to 2008 to be consistent with the period used in Henry's 2008 study; and
- second, using an updated dataset from 2002 to 2011.

764. The main objective of the first stage of the Authority's empirical analysis were: (i) to make a "like for like" comparison with Henry's results across this period, and (ii) to omit

389 Henry, O (2009) "Estimation Beta", Advice Submitted to the Australian Competition and Consumer Commission.

390 The sample consisted of: AGL (2002 to 2005); Alinta (2002 and 2007); Alinta Network Holdings Pty Ltd (2003 to 2006); Country Energy (2002 to 2006); Diversified Utility and Energy Trusts (2003 to 2008); ElectraNet Pty Ltd (2002 to 2008); Energy Australia (2002 to 2006); Envestra Ltd (2002 to 2008); Ergon Energy Corporation (2002 to 2008); ETSA Utilities (2002 to 2008); GasNet Australia (Operations) Pty Ltd (2002 to 2007); Integral Energy (2002 to 2006); SP AusNet Group (2006 to 2008), and SPI PowerNet Pty Ltd (2002 to 2005).

391 See for example: Australian Energy Regulator 2009-10, Final decision: WACC review, May 2009; or Powerlink Transmission determination, 2012-13 to 2016-17 (Draft Decision, 29 November 2011, p. 33).

392 Economic Regulation Authority (Western Australia) 2012, *Final decision on proposed revisions to the access arrangement for Western Power*, www.erawa.com.au.

the effect of events associated with the Global Financial Crisis which occurred post September 2008. The estimated betas from the Authority's 2012 analysis are not statistically different from Henry's 2009 estimates.

765. When the updated data set was used, the Authority noted that the weekly sample had 15 of the 18 estimates of equity beta that were not statistically different from Henry's estimates. The differences of the remaining 3 equity beta estimates between Henry 2009's study and the Authority 2012's study using the extended dataset include: (i) the beta estimate for Envestra (ENV) when both OLS and LAD methods were used; and (ii) the beta estimate for SKI using the LAD method at the five per cent level of confidence.

766. The Authority's analysis, using the extended dataset to October 2011, can be summarised as below:

- the estimates of the equity beta using monthly data range from 0.0675 to 0.9688, with a mean of 0.4569 and median of 0.4253; and
- the estimates of the equity beta using weekly data range from 0.2168 to 1.3378, with a mean of 0.5204 and median of 0.4261.

767. Given the results from both Henry's 2009 study and the Authority's analysis, the Authority, in the access arrangement for Western Power in 2012, decided an appropriate range for equity beta was between 0.5 and 0.8. The Authority was of the view that the point estimate of the equity beta of 0.65, being the average of the lower and upper bounds of the range adopted in 2009, was reasonable for the draft and final decisions on Western Power's Access Arrangement in 2012 for the following reasons:

- the estimated equity beta of 0.65 falls in the range of the estimates that came from the empirical studies by Henry in 2009, which produced the range of 0.4 and 0.7; and by the Authority in 2011, which produced the range of 0.5 and 0.8; and
- the midpoints are taken to reduce the undesired effects of outliers, such that their effect is averaged out.

768. Table 19 contains a summary of the adopted equity beta from recent Australian regulatory decisions. Australian economic regulators have adopted values of equity beta for regulated businesses within the range of 0.55 and 0.80.

Table 19 Estimates of Equity Beta adopted by Australian Regulators

Regulator	Year	Equity beta
ACCC[393]	2011	0.7
AER[394]	2012	0.8
ERA[395][396]	2012	0.65/0.8
IPART[397]	2012	0.6-0.8
QCA[398]	2012	0.55
ESCOSA[399]	2012	0.8

Source: Compiled by the Economic Regulation Authority

769. In 2013, the Authority extended the above analysis for the purpose of estimating equity beta for Australian regulated businesses in the Authority's Draft Guidelines.[400] This analysis extended the above analysis by using an updated data set (containing data to April 2013) in addition to introducing new econometric techniques. The 2013 analysis is described in detail below.

12.2.4 Estimating equity beta: Authority's analysis in 2013

770. The Authority has utilised the same companies used by Henry in his advice to the AER to form the basis of its analysis.

771. Table 20 below presents the sample of companies and data period used by Henry.[401] Description of business activities of these companies are provided in Appendix 18 – Descriptions of companies.

393 Australian Competition and Consumer Commission, *Inquiry to make final access determinations for declared fixed line services — Final report*, July 2011, p. 49.

394 Australian Energy Regulator, *Access Arrangement Information for the ACT, Queanbeyan and Palerang gas distribution network*, 1 July 2010 – 30 June 2015 p. 12.

395 Economic Regulation Authority (Western Australia), *Final decision on proposed revisions to the access arrangement for Western Power*, 2012.

396 Economic Regulation Authority, *Final Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline*, 31 October 2011, p. 158.

397 Independent Pricing and Regulatory Tribunal, *Review of prices for Sydney Water Corporation's water, sewerage, stormwater drainage and other services, From 1 July 2012 to 30 June 2016*, p. 197.

398 Queensland Competition Authority, *Final report, Sunwater irrigation price review 2012–17, Volume 1, May 2012*, p. 498.

399 Essential services commission of South Australia, *Advice on a regulatory rate of return for SA Water—Final advice*, February 2012, p. 49.

400 Economic Regulation Authority, Explanatory Statement for the Draft Rate of Return Guidelines, 6 August 2013.

401 Henry, O (2009) "Estimation Beta", Advice Submitted to the Australian Competition and Consumer Commission.

Table 20 Sample of companies and data period from the Authority's 2013 analysis

Name	Bloomberg's ticker	From	To
Envestra	ENV	14/12/2001	19/04/2013
APA Group	APA	14/12/2001	19/04/2013
GasNet Australian Group	GAS	21/12/2001	17/11/2006
Alinta Limited	AAN	14/12/2001	17/08/2007
Jemena	AGL	14/12/2001	13/10/2006
DUET Group	DUE	20/08/2004	19/04/2013
Hastings Diversified Utilities Funds	HDF	17/12/2004	23/11/2012
SP Ausnet	SPN	23/12/2005	19/04/2013
Spark Infrastructure Group	SKI	16/12/2005	19/04/2013
All ordinary Index	402AS30	4/01/2002	19/04/2013

Source: Bloomberg

772. GasNet Australian Group, Alinta Limited, and Jemena are excluded from the sample because, unlike the other companies, the three excluded companies do not have recent data as they have ceased trading. As a result, the sample used by the Authority contains only 6 companies.

773. Price data used was the last price for all stocks provided by the Australian Stock Exchange (**ASX**) using the Bloomberg Terminal. Dividend data used in the study was gross dividends including cash distributions, but omitting unusual items such as stock distributions and rights offerings. The dividend was then added to the closing price on the Friday after the ex-dividend dates as this is the first day the price would reflect the payout of the dividend in the data. For the All Ordinaries index, which represents 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. It is noted that net debt information for the six firms in the sample is the sum of short and long-term borrowings less cash and near cash items, marketable securities and collaterals. In addition, market capitalisation for the six firms was measured as the current monetary value of all outstanding shares stated in the pricing currency. Some adjustments were made to be consistent with Bloomberg's reporting of data. Further details can be found in Appendix 19 – Adjustments.

774. Returns in CAPM regressions are usually based on continuously compounded returns which is presented in equation (16) below. Both the AER[403] and Henry found no evidence that β estimates obtained from discretely compounded data, as presented in equation (17), are manifestly different from those obtained from continuously compounded data. As a consequence, the Authority has used continuously compounded returns as described in equation (16) for estimating equity beta.

[402] Australian Energy Regulator (2008), "Explanatory Statement: Electricity transmission and distribution network service providers Review of the weighted average cost of capital (WACC) parameters, www.aer.gov.au, p. 200.

$$r_{i,t}^{c} = \ln\left[(p_{i,t-1} + d_{i,t}) / p_{i,t-1} \right] \quad (16)$$

$$r_{i,t}^{d} = \frac{p_{i,t} - p_{i,t-1} + d_{i,t}}{p_{i,t-1}} \quad (17)$$

where

$r_{i,t}^{c}$ is the continuously compounded return for asset i in day t; taking into account dividend d;

$r_{i,t}^{d}$ is the discretely compounded return for asset i in day t; taking into account dividend d;

p_{it} is the price of asset i in day t; and

d_{it} is the dividend payout to asset i on day t.

775. Henry outlined in his advice to the AER that beta is estimated by applying regression analysis to the following equation:[404]

$$r_{i,t} = \alpha_i + \beta_i r_{m,t} + \varepsilon_{i,t} \quad (18)$$

where

β_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;

α_i is a constant specific to asset i; and

ε_{it} are the residuals.

776. Based on this advice, the Authority has adopted equation 18 as the basis for empirically estimating equity beta.

777. In his study, Henry outlined the possibility of the existence of heteroscedasticity in the estimate of beta. This means that the residuals may be related to the observation, $\mathrm{Var}[\varepsilon_{i,t}] = \sigma_i^2$. Henry suggested using the Least Absolute Deviations (**LAD**) estimator, to reduce the influence of outliers on the resulting beta estimate. The Authority has employed the Ordinary Least Squares (**OLS**) and LAD methods, in addition to: (i) the maximum likelihood robust methodology (**MM**), and (ii) the Theil-Sen methodology. The reason for their introduction, and resulting issues can be found in 12.2.5 below. Technical descriptions of these estimators are provided in Appendix 17 – Econometric techniques.

[404] Henry, O (2009) "Estimation Beta", Advice Submitted to the Australian Competition and Consumer Commission, www.accc.gov.au, p 2.

778. The MM estimator has previously been utilised in studies which have been used in regulatory decisions with respect to gamma.[405] The Authority has also adopted this MM method in its recent empirical study on the estimate of the market value of franking credits. The MM regression is a form of robust regression that has a high breakdown point (50 per cent) and high statistical efficiency (95 per cent). The MM regression has the highest breakdown point and statistical efficiency of robust regression estimators currently available, and for this reason, it is adopted in the Authority's study on equity beta in 2013. Further details on this MM method are provided in Appendix 17 – Econometric techniques.

779. Fabozzi (2013)[406] suggests the use of the Theil-Sen estimator for estimating the appropriate value for the equity beta. Fabozzi proposes this estimator in response to the OLS estimator being acutely sensitive to outliers. Appendix 17 – Econometric techniques contains a technical discussion on the Theil-Sen estimator. 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 Authority's adoption of the method in its 2013 study.

780. All regression results, associated standard errors and test statistics, were computed using R 2.13.2 open source software. All equity betas in the following analysis are de-levered using the relevant company's average gearing ratio over the period and re-levered using the 60 per cent assumption. The details of this de-levering/re-levering process can be found in Appendix 20 – De-levering and re-levering factors.

781. The estimates of equity beta for each company in the sample are presented in the following manner for comparison:

- *First*, estimated equity betas for those companies that are included in the sample of both the Authority's 2012 and 2013 studies. Only the OLS and the LAD methods are considered for consistency with the estimates obtained from the Authority's 2012 study (see Table 21).
- *Second*, estimated equity betas, using the updated data set to April 2013, using all four methods, namely the OLS; the LAD; the MM; and the Theil-Sen methods (see Table 22). The data set used below is from January 2002 to April 2013.

[405] SFG 2011, *Dividend drop-off estimate of theta*, A report to the Australian Competition Tribunal and the Australian Energy Regulator, Final Report, 21 March 2011.

[406] Fabozzi, F.J(2013) Encyclopaedia of Financial Models, Wiley Publications, p. 442.

Table 21 Estimated Equity Betas in the Authority studies in 2012 and 2013 using OLS and LAD

Company	APA	DUE	ENV	HDF	SKI	SPN
		The Authority's analysis in 2012				
OLS	0.6041	0.2971	0.3681	1.1873	0.5178	0.2677
LAD	0.5990	0.2438	0.3465	0.8907	0.3889	0.2452
N	540	400	540	383	330	330
		The Authority's analysis in 2013				
OLS	0.6138	0.2255	0.3714	1.2025	0.5427	0.1248
LAD	0.5556	0.2391	0.3548	0.9725	0.4390	0.2601
N	589	453	589	415	383	383

Source: The Economic Regulation Authority's estimates

782. The results show that the estimates of the equity beta have remained relatively stable over time.

783. For individual firm's betas, the Authority considers that the sample period of 5 years with weekly intervals is appropriate as it reduces the possibility of structural breaks in the data set, whilst having enough data points to estimate beta with statistical accuracy. Table 22 estimates each firm beta across the different regression methodologies, with a data set from April 2008 to April 2013.

Table 22 Estimates of equity beta for individual firms in 2013 using all four methods

	APA	DUE	ENV	HDF	SKI	SPN	Average
Gearing	0.5418	0.742	0.6884	0.3936	0.4436	0.6107	**0.5700**
OLS	0.5930	0.1746	0.4425	1.1970	0.5432	0.0490	**0.4999**
LAD	0.5549	0.2331	0.4434	1.1054	0.3668	0.2563	**0.4933**
Robust MM	0.6334	0.2507	0.4497	1.0015	0.4801	0.3043	**0.5199**
Thiel Sen	0.5643	0.2656	0.4456	1.0054	0.3915	0.2221	**0.4824**
Average	**0.5864**	**0.2310**	**0.4453**	**1.0773**	**0.4454**	**0.2079**	**0.4989**

Source: The Economic Regulation Authority's estimates

784. The results in Table 22 show that, on average, the MM robust regression produces higher estimates of equity beta than the OLS method. The Theil-Sen method produces the lowest estimates of equity beta. On average, both OLS and LAD methods produce the estimates of equity beta which fall between the two newly proposed methods: the MM and Theil-Sen methods. It is noted, however, that for individual companies, the two newly adopted methods in this 2013 analysis can produce estimates of equity beta that can be higher or lower than estimates derived using the two methods adopted in the Authority's analysis in 2012.[407]

785. As such, the Authority is of the view that there is no biased tendency to over- or under-estimate equity beta when the two new methods are adopted. In comparison with the estimate equity betas from the OLS method, equity betas estimated from the LAD, MM and Theil-Sen methods appear to be more consistent.

[407] The high resulting estimate for HDF is a result of their low average gearing resulting in a large levering factor to represent 60 per cent gearing which is then applied to the raw beta estimate.

786. In 2009, Henry's study contained six portfolios. The Authority's 2013 analysis contains only five portfolios because Bloomberg data for both SPN and SKI became available in the same week. As such, the sixth portfolio, which reflected the later 'drop in' date for SKI as in Henry's study, is not needed. Two scenarios are considered in this study which is consistent with the approach adopted in Henry's 2009 study: (i) equally-weighted portfolios; and (ii) value-weighted portfolios. As a result, the total of ten portfolios is created in this 2013 study. Of these 10 portfolios, five portfolios are equally-weighted, and the other five portfolios are value-weighted. The constructions of equally-weighted and value-weighted portfolios are illustrated in Appendix 21 – Portfolio construction.

787. The key purpose of a portfolio analysis is to allow a single portfolio to be created and, as such, a single corresponding equity beta for that portfolio can be estimated as an equity beta of the industry. It is noted that companies may enter and leave the industry at various points of time. As a result, portfolios are required to be recreated when there is a new composition of the industry (i.e. where there is a firm which leaves the industry and/or a firm that enters into the industry).

788. The structure of the portfolios and their starting dates are listed in Table 23 below.[408]

Table 23 Portfolios in the Authority's 2013 study

Portfolio	Start Date	Firms in Portfolio					
P0	4/01/2002	ENV	APA				
P1	5/09/2003	ENV	APA				
P2	20/08/2004	ENV	APA	DUE			
P3	17/12/2004	ENV	APA	DUE	HDF		
P4	23/12/2005	ENV	APA	DUE	HDF[409]	SPN	SKI

Source: Economic Regulation Authority analysis

789. The five equally-weighted portfolios consisting of n companies have all observations of returns weighted by $1/n$ to form a single set of portfolio return observations for each equally-weighted portfolio. Further details of this construction can be found in Appendix 21 – Portfolio construction.

[408] It is noted that time-varying portfolios, where non-constant portfolio weights are used, were not constructed due to the substantial measurement error that results from this approach. This concern has been raised in Henry's 2009 study.

[409] It is noted that data for HDF only covers the period from 23 December 2005 to 23 November 2012. All other companies in the portfolio have data available until 19 April 2013.

Table 24 Equally- Weighted Portfolio Beta Estimates

	P0	P1	P2	P3	P4	Average
Gearing	0.6187	0.6310	0.6752	0.6046	0.5854	**0.6230**
OLS Beta	0.4892	0.4938	0.3870	0.5497	0.4915	**0.4823**
LAD Beta	0.5335	0.5431	0.4123	0.5804	0.5903	**0.5319**
MM Beta	0.4863	0.4980	0.4104	0.5794	0.5644	**0.5077**
Theil-Sen Beta	0.4351	0.4592	0.3976	0.5461	0.5254	**0.4727**
Average	**0.4860**	**0.4985**	**0.4018**	**0.5639**	**0.5429**	**0.4986**
Observations	589	503	453	415	362	

Source: The Economic Regulation Authority's estimates

790. The results in Table 24 suggests that, on average, the LAD and MM methods produce higher beta estimates across the portfolios than the OLS and Theil-Sen methods. This is broadly consistent with the estimated equity betas for individual firms as presented in Table 22 above. Portfolio 3 starting in December 2004 produces the highest estimate on average across all four methods while Portfolio 2 produces the lowest estimates. The most up to date portfolio (Portfolio 4) produces the second highest estimate of around 0.54.

791. In order to calculate value-weighted Portfolios, the average market capitalisation was calculated for each firm, which remained listed until 2013, over the period from when they first appeared. 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. The averages were taken over a sample period for all firms in each portfolio. The weights were then applied to their relevant firms in the portfolio. Further details of this construction can be found in Appendix 21 – Portfolio construction.

Table 25 Value- Weighted Portfolio Beta Estimates

	P0	P1	P2	P3	P4	Average
Gearing	0.5929	0.6093	0.6638	0.6319	0.6002	**0.6196**
OLS Beta	0.5277	0.5274	0.3987	0.4733	0.3989	**0.4652**
LAD Beta	0.5555	0.5515	0.4362	0.5119	0.5072	**0.5125**
MM Beta	0.5279	0.5321	0.4321	0.5100	0.4936	**0.4991**
Theil-Sen Beta	0.4729	0.4880	0.4143	0.4944	0.4541	**0.4648**
Average	**0.5210**	**0.5248**	**0.4203**	**0.4974**	**0.4635**	**0.4854**
Observations	589	503	453	415	362	

Source: The Economic Regulation Authority's estimates

792. For the value-weighted portfolios, on average, the beta estimates from the LAD and MM methods are higher than those estimated from the OLS and the Theil-Sen methods. As presented in Table 25, *Portfolio 1* produces the highest estimates while *Portfolio 2* produces the lowest beta estimates. The latest portfolio (*Portfolio 4*) produces an average estimate of approximately 0.46 which is lower than the average estimate under the equally-weighted portfolio approach. However, the average of estimated equity beta across all portfolios under the value-weighted approach is 0.4854, which is lower than the average of 0.4986 under the equally-weighted portfolio approach.

793. It is argued that estimates of equity beta using historical data lack robustness and the estimates approaches do not take into account a significant issue known as thin trading. As such, the Authority has conducted its tests of robustness in response to these two concerns.

794. The following section presents tests of statistical significance for various scenarios: (i) estimated beta for individual firms; (ii) estimated beta for the equally-weighted portfolios; and (ii) estimated beta for the value-weighted portfolios. Each of these three scenarios is discussed in turn below.

795. Table 26 presents the t-statistics of beta estimates for individual firms. It is noted that the t-statistics over 1.96 indicate that the beta estimate is statistically different from zero at the 5 per cent level of significance. The Authority notes that the values for DUET (DUE) and SP Austnet (**SPN**) are the only two values that are not statistically significantly different from zero under the OLS method. However, the Authority notes that, for other methods including the LAD, Robust MM and Thiel-Sen estimates, all beta estimates are all statistically significant at the 5 per cent level of significance.

796. The Theil-Sen estimates are all significant at the 5 per cent level. Although a standard error cannot be calculated using this method, the fact that the lower band of the 95 per cent confidence interval does not contain zero indicates that the estimates are significant at the 5 per cent level of significance.

Table 26 Statistical significance of estimates of betas for individual firms

	APA	DUE	ENV	HDF	SKI	SPN
OLS						
t-statistic	7.0746	1.8116	6.0787	3.8758	2.9859	0.3038
Beta Upper bound	0.7572	0.3635	0.5851	1.8023	0.8998	0.3648
Beta Lower bound	0.4287	-0.0143	0.2998	0.5917	0.1866	-0.2669
LAD						
t-statistic	8.4091	5.5719	22.1069	19.5201	4.6622	3.7430
Beta Upper bound	0.6842	0.3151	0.4827	1.2164	0.5210	0.3905
Beta Lower bound	0.4256	0.1511	0.4041	0.9944	0.2126	0.1221
Robust MM						
t-statistic	8.9345	6.1857	8.2328	8.3040	5.0602	4.3751
Beta Upper bound	0.7723	0.3301	0.5567	1.2379	0.6661	0.4407
Beta Lower bound	0.4944	0.1712	0.3426	0.7651	0.2942	0.1680
Theil-Sen						
Upper Bound	0.7193	0.3727	0.5758	1.2942	0.6341	0.3920
Lower Bound	0.3988	0.1640	0.3174	0.7174	0.1559	0.0477
N	261	261	261	240	261	261
R-Square (OLS)	0.1619	0.0125	0.1249	0.0594	0.0333	0.0004

Source: The Economic Regulation Authority's estimates

797. In his study in 2009, Henry noted that a concern from SFG was that there is evidence of bias in regressions with the R^2 values which are less than ten percent in the samples of 48 observations.[410] However, the Authority is of the view that, given the

[410] Henry, O. 2009, "Estimation Beta", *Advice Submitted to the Australian Competition and Consumer Commission*, 48.

Authority's preference is to use weekly data, the number of observations in the sample is far greater than 48 observations, as presented in Table 26 above, this concern is not an issue in this study.

798. Tests of statistical significance of estimated beta for all four methods adopted in the equally-weighted portfolios are conducted. The outcomes from the tests are presented in Table 27 below.

Table 27 Statistical significance of the equally-weighted portfolio equity beta estimates

	P0	P1	P2	P3	P4
The OLS method:					
Standard Error	0.0427	0.0434	0.0425	0.0594	0.0617
t-statistic	11.47	11.37	9.10	9.26	7.97
Upper Bound	0.5728	0.5790	0.4703	0.6662	0.6124
Lower Bound	0.4056	0.4087	0.3036	0.4333	0.3707
The LAD method:					
Standard Error	0.0323	0.0338	0.0364	0.0413	0.0437
t-statistic	16.51	16.06	11.33	14.07	13.51
Upper Bound	0.5968	0.6094	0.4836	0.6613	0.6759
Lower Bound	0.4702	0.4769	0.3410	0.4996	0.5047
The MM method:					
Standard Error	0.0334	0.0335	0.0287	0.0357	0.0395
t-statistic	14.56	14.88	14.30	16.25	14.30
Upper Bound	0.5517	0.5636	0.4666	0.6493	0.6417
Lower Bound	0.4208	0.4324	0.3541	0.5095	0.4870
The Theil-Sen method:					
Upper Bound	0.5168	0.5389	0.4676	0.6362	0.6219
Lower Bound	0.3511	0.3739	0.3267	0.4591	0.4219

Source: The Economic Regulation Authority's estimates

799. The equally-weighted portfolio OLS beta estimates were all statistically significant at the 5 per cent level of significance. The most current and diversified portfolio (*Portfolio 4*) has the highest standard error, while the least diversified portfolio (*Portfolio 0*) has the lowest standard error. The Authority considerers that this difference most likely reflects the much larger sample size in *Portfolio 4* over which the variance can be scaled down.

800. It is noted that the LAD equally-weighted estimates draw inference from the strong assumption that they are t-distributed. All estimates are statistically significant at the 5 per cent level. The standard errors under this method are lower than those of the OLS estimates and tend to increase with the increase in sample size.

801. The equally-weighted portfolio MM robust estimates also draw inference from the strong assumption that they are t-distributed. All estimates are statistically significant at the 5 per cent level. The standard errors in this method are lower than those estimated from the OLS method and generally lower than those of the LAD estimates as well. The Authority notes that the standard errors in this method appear to be less sensitive to the reduction in sample size than in the estimates from the OLS and LAD methods.

802. The Authority notes that, given that none of the lower confidence intervals contain zero, the Theil-Sen estimates are all statistically significant at the 5 per cent level. Tests of statistical significance of estimated beta for all four methods adopted in the value-weighted portfolios are now conducted. The outcomes from the tests are presented in Table 28 below.

Table 28 Statistical significance of the value-weighted portfolio equity beta estimates

	P0	P1	P2	P3	P4
The OLS method:					
Standard Error	0.0469	0.0476	0.0453	0.0513	0.0605
t-statistic	11.25	11.07	8.80	9.23	6.60
Upper Bound	0.6197	0.6208	0.4875	0.5738	0.5175
Lower Bound	0.4357	0.4341	0.3100	0.3728	0.2804
The LAD method:					
Standard Error	0.0421	0.0429	0.0330	0.0337	0.0342
t-statistic	13.21	12.84	13.21	15.20	14.85
Upper Bound	0.6379	0.6357	0.5010	0.5779	0.5742
Lower Bound	0.4731	0.4674	0.3715	0.4459	0.4403
The MM method:					
Standard Error	0.0365	0.0360	0.0302	0.0332	0.0396
t-statistic	14.45	14.80	14.33	15.35	12.48
Upper Bound	0.5995	0.6026	0.4912	0.5751	0.5712
Lower Bound	0.4563	0.4616	0.3730	0.4449	0.4161
The Theil-Sen method:					
Upper Bound	0.5518	0.5706	0.4841	0.5923	0.5996
Lower Bound	0.3749	0.3959	0.3382	0.4274	0.4068

Source: The Economic Regulation Authority's estimates

803. All estimates using all four different methods are statistically significant at a 5 per cent level of significance. In addition, the Theil-Sen estimates are all statistically significant at 5 per cent given that none of the lower confidence intervals contain the value of zero.

804. Another concern in relation to regression analysis for estimating equity beta is that some securities do not trade regularly. As such, this may bias the OLS beta estimates toward zero. In his study, Henry had tested the evidence of thin trading by using Dimson's betas and test statistics.[411] This test is now adopted in this new study in 2013.

805. The following regression is used in order to get the estimates of lagged, coincident and leading betas.[412]

$$r_{i,t} = \alpha_i + \beta_{i-1} r_{m,t-1} + \beta_{i-1} r_{m,t} + \beta_{i-1} r_{m,t+1} + \varepsilon_{i,t} \quad (19)$$

411 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.

412 Other variations of this regression omit the leading term, such as Morningstar's 'sum beta'. This specification, however, is more robust as it accounts for lags that run both from the market to the individual stock and from the individual stock to the market.

where

$r_{i,t}$	is the return on asset i at time t;
α_i	is a constant;
$\beta_{i-1} r_{m,t-1}$	is the beta on the market return at time $t-1$;
$\beta_{i+1} r_{m,t+1}$	is the beta on the market return at time $t+1$; and
$\varepsilon_{i,t}$	is the regression error term.

806. The all three estimated betas are then summed to produce a Dimson's beta estimate.[413]

$$\hat{\beta}_i^D = \hat{\beta}_{i-1} + \hat{\beta}_i + \hat{\beta}_{i+1} \quad (20)$$

807. The null hypothesis $\beta_i^{OLS} = \beta_i^D$ is tested using the test statistics outlined in (21) below. The rejection of the null hypothesis is to present an evidence of thin trading.

$$t = \frac{\hat{\beta}_i - \hat{\beta}_i^D}{SE(\hat{\beta}_i)} \quad (21)$$

808. At a five per cent level of significance, absolute values for the t-test with values greater than 1.96 indicates evidence of thin trading.

809. The findings from this test are presented in Table 29 below. The Authority is of the view that there is no evidence of thin trading in the sample. This conclusion is similar with Henry's view in his 2009 study.

Table 29 Dimson's thin trading tests

	ENV	APA	DUE	HDF	SKI	SPN
Lagged Beta	0.0990	-0.0467	0.2365	0.1631	0.0974	0.1305
Standard Error	0.1000	0.0801	0.1501	0.2104	0.1332	0.1659
Beta	0.5680	0.5176	0.2707	0.7896	0.3905	0.0503
Standard Error	0.0934	0.0732	0.1494	0.2037	0.1308	0.1656
Lead Beta	0.0073	-0.1047	-0.1593	-0.1645	-0.1597	-0.0996
Standard Error	0.1002	0.0799	0.1506	0.2100	0.1331	0.1661
Dimson's Beta	**0.6744**	**0.3662**	**0.3479**	**0.7882**	**0.3281**	**0.0813**
t-test	**-1.1381**	**2.0697**	**-0.5168**	**0.0068**	**0.4769**	**-0.1869**

Source: The Economic Regulation Authority's estimates

12.2.5 Robust regression techniques

810. SFG submitted that the Authority has taken a position that favours "outlier-resistant regression techniques" in its Draft Determination.[414] The Authority notes that the AER

[413] 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.

first introduced so-called "outlier-resistant techniques" in its Review of the Weighted Average Cost of Capital for Electricity Transmission and Distribution Network Service Providers in 2009. The AER recognised outliers as:[415]

- business specific events such as merger announcement; and
- events those are unrepresentative of the market; for example, the technology bubble.

811. The AER expressed its caution against approaches which are used to remove outliers based on prior knowledge on the basis that they can be subjective. Based on advice from Henry, the AER was of the view that the use of methods that account for outliers, such as re-weighted ordinary least squares and LAD estimators may increase the likelihood of an unbiased beta estimate. The AER also noted that estimates of equity beta using re-weighted OLS provided by Allen Consulting Group generally resulted in lower estimates than those estimated from either OLS or LAD regression.[416] The AER also considered that events that cannot conclusively be labelled 'unrepresentative' (such as the commodities boom and subprime mortgage crisis) should be addressed by the application of robust regression.

812. The Authority agrees with the AER's view that outliers should not be removed on a subjective basis. However, the Authority considers that the use of robust regression is not primarily used to reduce the influence outliers have on equity beta estimation. Rather, the introduction of "outlier-resistant" technique has been as a consequence of the assumptions underpinning the OLS regression being violated.

813. The Authority notes that the OLS is only appropriate if the Gauss-Markov conditions are satisfied. The statistical literature contains vast evidence describing the failure of OLS in this situation to correctly estimate regression coefficients.[417] Formally, the equity beta coefficient is estimated by utilising a regression estimator on the following equation:

$$r_{i,t} = \alpha_i + \beta_i r_{m,t} + \varepsilon_{i,t} \qquad (22)$$

where

α_i is the return due to factors unrelated to market movements;

β_i is the equity beta; and

$\varepsilon_{i,t}$ is an error term.

414 SFG Consulting, *Beta estimation: Considerations for the Economic Regulation Authority,* 19 September 2013.

415 Australian Energy Regulator (2009), *Review of the Weighted Average Cost of Capital (WACC) Parameters: Electricity Transmission and Distribution Network Service Providers*, Final Decision, May, pp. 267-271.

416 Ibid.

417 Gross J, (2003) Linear *Regression,* Springer Publishing p. 53.

814. If equation (22) satisfies the conditions below (known as the Gauss-Markov assumptions), then the Best Linear Unbiased Estimator (**BLUE**) for equation (22) would be the Ordinary Least Squares estimator.[418]

$$E[\varepsilon_i] = 0.$$
$$Var[\varepsilon_i] = \sigma^2$$
$$Cov[\varepsilon_i, \varepsilon_j] = 0 \text{ if } i \neq j$$
$$\varepsilon_i \sim N(0, \sigma^2)$$

815. Evidence presented in Appendix 22 – Assumptions regarding OLS highlights the non-normality of data used for estimating equity beta. The Authority notes that it is also likely that the variance of the errors will change over time and the residuals are likely to be correlated. For example, during periods of high volatility, it is expected that larger errors would be observed. As a consequence, the Authority is of the view that the Gauss-Markov assumptions are violated when estimating equity beta. Andersen (2008) notes that unless data is well behaved, different robust estimators will give widely different results, and as a consequence, suggests utilising a variety of robust regression procedures, in addition to OLS, when undertaking regression analysis.[419] The Authority considers that it is appropriate to use other techniques such as the LAD, MM Robust Regression and Theil-Sen estimates, in conjunction with the OLS technique to estimate equity beta.

816. In its submissions,[420] SFG argued against the use of the LAD estimator for the purposes of estimating equity beta and as a consequence only OLS regression should be used.[421] SFG form this opinion based on the following claims:

817. SFG argued that LAD estimators are systematically biased. This means that the LAD estimators produce estimates of equity beta that are consistently lower than those derived from the OLS estimates. In addition, SFG was of the view that the LAD estimator is not generally used in beta estimation in both academic research and commercial practice. LAD regression places relatively less weight on observations with extreme stock and market returns.

818. SFG considered that the beta estimates from equation (22) above should satisfy the following criterion: "The market capitalisation weighted average of beta estimates must be equal to one, by definition, if the market is comprised entirely of the stocks being evaluated". SFG use this criterion to form the view that LAD estimators are systematically biased. Mathematically, this can be stated as follows:

$$r_{m,t} - r_{f,t} = \sum_{i=1}^{n} w_{i,t} \times \beta_{i,t} \times (r_{m,t} - r_{f,t}) \qquad (23)$$

418 Hill R.C , Griffiths W.E, Lim G.C , 2008, *Principles of Econometrics* , p. 32.

419 Andersen, R. (2008). *Modern Methods For Robust Regression.* Thousand Oakes: SAGE Publications, pp. 91-92.

420 Gray S, Hall J, Diamond N and Brooks R, *Comparison of OLS and LAD regression techniques for estimating beta*, SFG Consulting and Monash University 26 June 2013; and SFG Consulting, *Beta estimation: Considerations for the Economic Regulation Authority,* 19 September 2013.

421 Gray S, Hall J, Diamond N and Brooks R, *Comparison of OLS and LAD regression techniques for estimating beta*, SFG Consulting and Monash University 26 June 2013.

where

$r_{m,t}$ is the return of the market portfolio during period t;

$r_{f,t}$ is the risk free rate during period t;

$w_{i,t}$ is the proportion by value that stock i contains in the market index.[422]

819. Equation (23) states the excess market return $\left(r_{m,t} - r_{f,t}\right)$ of an index should equal the returns of each individual stock comprising the index, as predicted by the Capital Asset Pricing model $\left(\beta_{i,t}(r_{m,t} - r_{f,t})\right)$[423]. It follows that:

$$\frac{r_{m,t} - r_{f,t}}{r_{m,t} - r_{f,t}} = \frac{\sum_{i=1}^{n} w_{i,t}\beta_{i,t}(r_{m,t} - r_{f,t})}{r_{m,t} - r_{f,t}}; \text{ and} \quad (24)$$

$$1 = \sum_{i=1}^{n} w_{i,t}\beta_{i,t} . \quad (25)$$

820. Equation (25) is the criterion by which SFG argued for the "bias"[424] of OLS and LAD estimators with regards to the estimation of equity beta. That is, if a particular estimation technique produces a value of $\sum_{i=1}^{n} w_{i,t} \times \beta_{i,t}$ which is less than 1, then the estimate is considered biased downward, as the a prior expectation is that all estimated beta's should satisfy equation (26).

821. SFG used the following equation to estimate beta:

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_i(r_{m,t} - r_{f,t}) + \varepsilon_i \quad (26)$$

where

$\varepsilon_{i,t}$ is an error term during period t; and

α_i is the regression intercept.

822. SFG use a data set of 2,585 Australian-listed stocks using returns computed from 2 January 1976 to 4 May 2012. A four week return interval is used, using Friday

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422 *Note* $\sum_{i=1}^{n} w_{i,t}$ *=1, where n is the number of stocks in the index.*

423 *Note this criterion assumes that the CAPM is the correct model of asset returns.*

424 *We hyphenate bias as the Authors have departed from the traditional statistical meaning of bias in their criticisms.*

closing prices to calculate the returns used in (4). Equity betas for each firm are calculated using both OLS and LAD estimators. SFG then use these estimated betas, in conjunction with relevant market capitalisation weights to calculate the market capitalisation weighted average of beta estimates. A market capitalisation weighted average beta of one is considered unbiased as this reflects the beta of the market portfolio, which as above, is theoretically assumed to be one.

823. Based on criterion defined by equation (25), the following results are presented in SFG's submission:

- For beta estimates computed using 10 years of returns, the value weighted LAD estimate is 0.98, for OLS, it is 1.00;
- Over five year period, the value weighted LAD estimate is 0.96, OLS is 1.00;
- Over a three year period, the value weighted LAD estimate is 0.99, OLS is 1.00;
- Using only the top 20 stocks by market capitalisation, both OLS and LAD estimators produce a value of 1.02;
- Outside of the top 20 stocks, the value-weighted OLS estimate is 0.94 whilst the LAD estimator produces a value-weighted beta estimate of 0.85.

824. The Authority notes that equation (25) is based on the assumption that the alpha in equation (26) is zero. Whilst this is an assumption underpinning the CAPM, the Authority notes that the betas are estimated using equation (25), decomposes returns into two components: (i) a constant excess return (α); and (ii) sensitivity to market returns $(\beta_{i,t})$. The Authority notes that SFG only considered one component of this decomposition, the $\beta_{i,t}$. As a consequence, an appropriate measure of bias when estimating betas using equation (25) must include both the alpha and beta estimates for each stock because both variables are used to explain stock returns relative to the market returns. Equation (25) does not take into account the impact of alpha in explaining stock returns, and is therefore an inappropriate criterion for assessing the "bias" of a particular regression procedure. The Authority notes that SFG did not report the α values. SFG has also included a risk-free rate in equation (26), and utilised a 4-week interval (i.e. monthly data) which is contrary to the advice of Henry to the AER.[425] The use of a 4-week interval for calculating returns is also likely to produce larger alpha values relative to weekly intervals. The Authority therefore concludes that equation (25), as presented by SFG, is an inappropriate criterion to confirm that LAD estimators are biased for the purposes of equity beta estimation.

825. The Authority notes that econometric and statistical theory can give strong guidance as to whether an estimator of a statistical model is biased. The statistical definition of an unbiased estimator is defined as follows:

$$E[\hat{\theta}] = \theta \qquad (27)$$

826. The statistical property of unbiasedness is desirable as it ensures that an estimator will, on average, estimate the desired quantity correctly, and it will not exhibit a systematic deviation from the true value of the desired quantity. The statistical literature contains a body of evidence concerning the LAD estimator. For example,

[425] Henry, O (2008), *Econometric advice and beta estimation*, Advice to the AER, November 2008.p. 2.

Taylor (1974) concluded that the LAD estimator "is unbiased if there exists a unique solution to the linear programming problem.[426] The Authority notes that none of its LAD estimates produced multiple solutions. In addition, Narula (1982) considered that the absolute errors regression is less sensitive to the outliers and, as such, it will perform better for long-tailed error distributions than OLS.[427] The study also found that the absolute errors estimates are maximum likelihood and hence they are asymptotically efficient when the errors follow the Laplace distribution. Puig and Stephens (2000) also concluded that the Laplace distribution, used to model the errors, provides a motivation for the use of LAD (or L1) regression.[428] As a consequence, the Authority is of the view that applying the LAD estimator is unbiased.

827. On the basis of the above academic evidence, tests were carried out to determine if the errors found in equity beta estimation are normal or Laplace distributed as outlined in Puig and Stephens (2000).[429] The results and discussion can be found in Appendix 23 – Equity beta estimates using bootstrapping. In addition, the Authority has utilised the Bootstrap technique in order to ascertain the accuracy of each regression estimator. Doing so will allow a direct estimate of the bias present in a statistical estimator, using the available data. The Authority considers that the need for using multiple regression estimators to estimate equity beta is sound, and does not accept SFG's (and CEG's) advocated reliance on a single estimation technique.[430,431]

12.2.6 Response to the Authority's Draft Decision

828. CEG, a consultant for DBP, submitted its own analysis regarding estimating equity beta.[432] In its submission, CEG submitted that effort has been made to replicate the ERA's estimates of equity beta as reported in the Draft Guidelines.[433] However, CEG concluded that it was unable to produce similar estimates and found significant differences in the estimated values for equity beta in comparison with the Authority's study. CEG submitted that it was unable to reproduce the estimates from the Authority's 2013 study on equity beta. For the purpose of comparison, the differences between CEG's estimates and the Authority's estimates of equity beta across various approaches are summarised in Table 30 below.

829. It is noted that the negative figures indicate CEG's estimates are higher than the ERA's estimates of equity beta and the positive figures indicate the reverse.

426 Taylor, L.D. (1974). *Estimation by minimizing the sum of absolute errors*. In Frontiers in Econometrics, (ed. P. Zarembka), pp. 169-190, New York: Academic Press.

427 Narula, S.C (1982), *The Minimum Sum of Absolute Errors Regression: A State of the Art Survey,* Interenational Statistical Review, Vol.50, No.3.

428 Puig.P and Stephens M.A "Tests of Fit for the Laplace Distribution, with Applications", *Technometrics Vol. 42, No.4 (Nov, 2000), pp. 417-424.*

429 Ibid.

430 Gray S, Hall J, Diamond N and Brooks R, *Comparison of OLS and LAD regression techniques for estimating beta*, SFG Consulting and Monash University 26 June 2013.

431 Competition Economists Group, *Regression estimates of equity beta,* September 2013.

432 Ibid.

433 Economic Regulation Authority, Explanatory Statement for the Draft Rate of Return Guidelines, 6 August 2013.

Table 30 Differences between CEG's and ERA's estimates of equity beta

	APA	DUE	ENV	HDF	SKI	SPN	Average
Gearing	0.5418	0.7420	0.6884	0.3936	0.4436	0.6107	0.5700
OLS	-0.0323	-0.146	0.0558	-0.0362	0.0013	-0.2238	-0.0635
LAD	-0.0435	-0.013	0.094	0.1957	-0.0799	-0.0255	0.0213
Robust MM	0.0153	-0.0375	0.114	0.0949	-0.0147	-0.0382	0.0223
Theil Sen	0.0209	-0.0303	0.1188	0.1303	-0.0509	-0.1014	0.0146
Average	-0.0099	-0.0567	0.0957	0.0961	-0.036	-0.0973	**-0.0013**

Source: CEG

830. The major differences between the Authority's and CEG's equity beta estimates using the OLS are for DUET and SP Ausnet. CEG's estimates were higher by 0.1460 for DUET and 0.2238 for SP Ausnet. However, the Authority notes that, across all regression procedures and firms, the average of all differences is only 0.0013. The Authority is of the view that this small difference between the two studies which are conducted independently confirms the validity of using various regression procedures to estimate equity beta for Australian regulated firms.

831. The Authority has also identified the possible sources of the differences for the estimates of beta for DUET and SP Ausnet:

- The length of sampling period adopted in each study; and
- Dividends are incorporated differently into the data.

832. First, the length of the sampling period adopted in each study is different. The Authority notes that CEG, in its study, has utilised a sample of price observations for stocks back to 4 January 2002. In contrast, the Authority has consistently used a five-year period which is consistent with the length of the regulatory control period. The Authority has also conducted its study in 2012 on the sample which is longer than 5 year. However, in its 2013 study, the study was conducted on the sample covering a 5-year period from 19 April 2008 to 19 April 2013. The Authority notes that there is no significant difference of the estimated equity betas in these two studies. However, given different sampling period were adopted in the Authority's 2013 study and the CEG's study, adopting a different sampling period may be one source of difference.

833. Second, it is not clear how CEG has incorporated dividend events into returns. In its study, CEG noted that entitlements' adjustment factors were incorporated as dividend events in the Authority's analysis. CEG argued that this inclusion is inappropriate. Recent discussions with Bloomberg, a data provider, indicate that the entitlements' adjustment factors should not be included in the returns because these entitlements' adjustment factors are not reported in dollar values. In the 2013 study, it was assumed that these adjustment factors are reported in dollar values and as such, they are included in the returns for relevant stocks. Table 31 below contains the relevant entitlement factors.

Table 31 Adjusted dividend events used in the 2013 estimates of equity beta

Firms Ticker	Ex-Date	Entitlements' Adjustment Factor
DUET AU Equity	4/08/2011	0.991667
DUET AU Equity	31/03/2009	0.966319
SPN AU Equity	16/05/2012	0.991226
SPN AU Equity	12/05/2009	0.973333

Source: Bloomberg

834. The Authority conducted its own analysis to take into account: (i) the sampling period backdated to 4 January 2002 to be consistent with the CEG's analysis; and (ii) an exclusion of the adjustment factors reported by Bloomberg from the dividend events for relevant companies including DUET and SP Ausnet. The new findings are reported in Table 32 below.

835. Table 32 below shows the Authority updated equity beta estimate that match the period CEG have used and show the effect of including the entitlement adjustment factors. When the data sample is extended back to 4 January 2002, the differences in OLS estimates for DUE become negligible. The differences between the OLS estimates for SP Ausnet are however significant over the full sample both with and without entitlements. This suggests that there are other issues driving the differences. It is noted that CEG uses a total returns index instead of calculating returns using the method outlined in Henry (2009).[434] This could possibly account for the remaining differences.

Table 32 DUET and SP Ausnet equity beta comparisons

	DUE	SPN
Original ERA Estimates (2013)	0.1746	0.0490
CEG Estimates	0.3206	0.2728
Difference	**- 0.1460**	**- 0.2238**
Revised ERA Estimates (Entitlements excluded and backdated to 4 Jan 2002)	0.3020	0.3929
Difference	**- 0.0186**	**0.1201**

Source: Economic Regulation Authority's analysis

836. The Authority has accepted that entitlements adjustment factors should not be included in the returns because these entitlements' adjustment factors are not reported in dollar values. As discussed, these entitlements adjustment factors affect data for two businesses in the sample, DUET and SP Ausnet. Data has now been revised to exclude these entitlements adjustment factors from the returns from both DUET and SP Ausnet. New estimates of equity beta are now reported in Table 33 below.

[434] Henry, O (2008), *Econometric advice and beta estimation*, Advice to the AER, November 2008, p. 4.

Table 33 Summary statistics of regression results.

	APA	DUE	ENV	HDF	SKI	SPN	Average
Gearing	0.5418	0.7420	0.6884	0.3936	0.4436	0.6107	0.5700
OLS	0.5930	0.2711	0.4425	1.3076	0.5799	0.3654	0.5932
LAD	0.5549	0.2262	0.4434	1.092	0.3663	0.2563	0.4898
Robust MM	0.6467	0.2188	0.4589	0.9881	0.4449	0.3087	0.5110
Theil Sen	0.5643	0.258	0.4456	1.0362	0.4069	0.2470	0.4930
Average	0.5897	0.2435	0.4479	1.106	0.4495	0.2943	0.5218

Source: Economic Regulation Authority's analysis

837. The Authority notes that estimates of equity beta fall within the range of 0.24 and 1.11 with the average estimate of 0.52 across individual firms and across four different approaches when entitlement factors are excluded.

838. In its submission, CEG also noted that its estimates using an OLS equally-weighted portfolio for Portfolio 2; Portfolio 3; and Portfolio 4 are materially higher. The Authority is of the view that the above two reasons, being (i) different sampling periods; and (ii) inclusion of adjustment factors in the returns in the ERA's analysis, are the main sources for differences. Table 34 presents the findings.

Table 34 Equally-weighted portfolio equity beta comparisons

	Portfolio 2	Portfolio 3	Portfolio 4
ERA Original Estimates	0.3870	0.5497	0.4915
CEG Estimates	0.4234	0.5869	0.5384
ERA Revised Estimates	0.4300	0.6076	0.5707
Difference	**0.0066**	**0.0207**	**-0.0323**
Standard Error	0.0483	0.0707	0.0686

Source: Economic Regulation Authority's analysis

839. Based on these findings, the Authority is of the view that the differences are less than one standard error of the estimates. As such, the differences in the estimates are immaterial and should not be considered. CEG also made the same claims for the OLS value weighted portfolio estimates for Portfolio 2; Portfolio 3; and Portfolio 4. The Authority's revised estimates do provide evidence to draw the same conclusion as applied to the OLS equally weighted portfolios estimates, as presented in Table 35.

Table 35 Value-weighted portfolio equity beta comparisons

	Portfolio 2	Portfolio 3	Portfolio 4
ERA Original Estimates	0.3987	0.4733	0.3989
CEG Estimates	0.4392	0.5170	0.4622
ERA Revised Estimates	0.4399	0.5236	0.4965
Difference	**0.0007**	**0.0066**	**0.0343**
Standard Error	0.0508	0.0585	0.0626

Source: Economic Regulation Authority's analysis

840. The Authority conducted analysis to take into account: (i) the sampling period backdated to 4 January 2002 to be consistent with the CEG's analysis; and (ii) an exclusion of the adjustment factors reported by Bloomberg from the dividend events for relevant companies including DUET and SP Ausnet.

841. When the data sample is extended back to 4 January 2002, the differences in OLS estimates for DUET become negligible. The differences between the OLS estimates for SP Ausnet are however significant over the full sample for both *with* and *without* entitlements. This suggests that there are other issues driving the differences. It is noted that CEG uses a total returns index instead of calculating returns using the method outlined in Henry (2009).[435] This could possibly account for the remaining differences.

12.2.7 Construction of the sample of firms

842. In its submission, CEG criticised the Authority's use of 6 firms for the purpose of estimating equity beta, and suggested extending the sample to include overseas businesses.[436] The Authority notes that it constructed the original sample of 9 businesses in Table 20 based on the advice of Henry to the AER.[437] However, three businesses were dropped from the sample in the updated 2013 analysis as these firms ceased trading in this period. The Authority considers that it is important only firms comparable to the benchmark efficient entity be included in the sample in order to estimate the most relevant equity beta. Increasing the number of firms in the sample that have little or no comparable featured to the benchmark entity will dilute the relevance of the estimated equity beta.

843. CEG also submitted that the sample size can be extended by including US firms. CEG provided evidence suggesting that the equity beta for US utility companies is, on average, 0.87. The Authority has conducted its own analysis based on the sample of 56 US companies proposed by CEG. It is noted that the sample's gearing level including US firms is significantly lower than the 60 per cent benchmarked in Australia. As a consequence, the Authority considers that, for consistency with the estimates of equity beta using a sample of the Australian businesses, the estimated betas should be levered to the average actual gearing of the US sample. Both the market value (**MV**) and book value (**BV**) of gearing have been estimated for the purpose of re-levering firms' betas to the US benchmark level of gearing. The procedure of de-levering and re-levering is set out in Appendix 20 – De-levering and re-levering factors. The results of this analysis are below in Table 36.

435 Henry, O (2008), *Econometric advice and beta estimation*, Advice to the AER, November 2008, p. 4.

436 Competition Economists Group, *Regression estimates of equity beta,* September 2013.

437 Henry, O (2008), *Econometric advice and beta estimation*, Advice to the AER, November 2008.

Table 36 Equity Beta Analysis for the US Utility Company

Ticker	Average Gearing BV	Average Gearing MV	CEG Reported Beta	Delevering Factor	Raw Beta	Relevering Factor (BV)	Relevering Factor (MV)	BV Gear Beta	MV Gear Beta
SO	55.60	37.66	0.54	0.64	0.35	1.40	1.12	0.49	0.39
ED	50.43	41.89	0.52	0.69	0.36	1.31	1.05	0.47	0.37
LG	52.54	38.67	0.52	0.65	0.34	1.38	1.10	0.47	0.37
UNS	74.32	63.10	0.60	1.08	0.65	0.83	0.66	0.54	0.43
WEC	59.41	44.86	0.59	0.73	0.43	1.24	0.99	0.53	0.42
NWN	50.96	37.36	0.61	0.64	0.39	1.41	1.13	0.55	0.44
NU	61.06	51.40	0.70	0.82	0.58	1.09	0.87	0.63	0.50
SJI	53.30	33.30	0.81	0.60	0.49	1.50	1.20	0.73	0.58
WGL	42.81	31.51	0.78	0.58	0.46	1.54	1.23	0.70	0.56
NJR	48.35	27.96	0.82	0.56	0.46	1.62	1.30	0.74	0.59
POM	60.03	57.43	0.80	0.94	0.75	0.96	0.77	0.72	0.58
WR	58.09	53.54	0.77	0.86	0.66	1.04	0.84	0.69	0.55
CNP	80.52	64.76	0.69	1.14	0.78	0.79	0.63	0.62	0.50
DTE	58.59	51.98	0.83	0.83	0.69	1.08	0.86	0.75	0.60
MGEE	43.79	27.97	0.76	0.56	0.42	1.62	1.30	0.68	0.55
SCG	57.72	46.74	0.79	0.75	0.59	1.20	0.96	0.71	0.57
NVE	65.25	63.79	0.68	1.10	0.75	0.81	0.65	0.61	0.49
PNY	49.76	32.38	0.77	0.59	0.46	1.52	1.22	0.69	0.55
ATO	53.58	45.37	0.81	0.73	0.59	1.23	0.98	0.73	0.58
GAS	56.84	43.98	0.84	0.71	0.60	1.26	1.01	0.76	0.60
CMS	73.18	67.01	0.56	1.21	0.68	0.74	0.59	0.50	0.40
VVC	56.68	43.74	0.77	0.71	0.55	1.26	1.01	0.69	0.55
FE	59.46	47.25	0.81	0.76	0.61	1.19	0.95	0.73	0.58
SWX	58.27	49.58	0.98	0.79	0.78	1.13	0.91	0.88	0.70
AVA	55.58	50.73	0.88	0.81	0.71	1.11	0.89	0.79	0.63
NI	59.16	55.95	0.86	0.91	0.78	0.99	0.79	0.77	0.62
PPL	63.25	41.92	0.78	0.69	0.54	1.31	1.04	0.70	0.56
POR	47.88	42.38	1.00	0.69	0.69	1.30	1.04	0.90	0.72
CHG	42.85	30.93	0.84	0.58	0.49	1.55	1.24	0.76	0.60
XEL	57.64	50.21	0.59	0.80	0.47	1.12	0.90	0.53	0.42
NEE	57.35	42.16	0.87	0.69	0.60	1.30	1.04	0.78	0.63
EE	54.12	42.36	1.00	0.69	0.69	1.30	1.04	0.90	0.72
ETR	54.30	39.51	0.88	0.66	0.58	1.36	1.09	0.79	0.63
IDA	52.11	46.53	0.79	0.75	0.59	1.20	0.96	0.71	0.57
EDE	53.42	46.35	0.86	0.75	0.64	1.21	0.96	0.77	0.62
NWE	60.10	47.31	0.92	0.76	0.70	1.18	0.95	0.83	0.66
AEE	49.35	42.99	1.12	0.70	0.79	1.28	1.03	1.01	0.81
EIX	58.63	47.04	0.96	0.76	0.73	1.19	0.95	0.86	0.69
LNT	46.06	38.60	0.96	0.65	0.63	1.38	1.10	0.86	0.69
PNW	51.51	45.48	0.85	0.73	0.62	1.23	0.98	0.76	0.61
PCG	58.22	40.57	0.69	0.67	0.46	1.34	1.07	0.62	0.50
PEG	59.81	41.56	0.92	0.68	0.63	1.31	1.05	0.83	0.66
AEP	59.03	49.06	0.75	0.79	0.59	1.15	0.92	0.67	0.54
TE	64.95	51.98	0.93	0.83	0.77	1.08	0.86	0.84	0.67
ITC	69.92	42.51	1.13	0.70	0.79	1.29	1.03	1.02	0.81
UIL	55.11	44.89	0.97	0.73	0.70	1.24	0.99	0.87	0.70
TEG	48.17	39.96	1.21	0.67	0.81	1.35	1.08	1.09	0.87
DUK	47.18	41.34	0.66	0.68	0.45	1.32	1.06	0.59	0.47
OGE	54.50	39.21	1.19	0.66	0.78	1.37	1.09	1.07	0.86
CNL	52.74	38.72	0.87	0.65	0.57	1.38	1.10	0.78	0.63
GXP	54.11	48.87	1.03	0.78	0.81	1.15	0.92	0.93	0.74
PNM	53.38	55.45	1.18	0.90	1.06	1.00	0.80	1.06	0.85
SRE	49.84	35.52	1.20	0.62	0.74	1.45	1.16	1.08	0.86
BKH	52.58	44.38	1.32	0.72	0.95	1.25	1.00	1.19	0.95
ALE	41.92	26.20	1.26	0.54	0.68	1.66	1.33	1.13	0.91
OTTR	43.73	32.33	1.80	0.59	1.06	1.52	1.22	1.62	1.29
Average	**55.52**	**44.40**	**0.87**	**0.74**	**0.63**	**1.25**	**1.00**	**0.78**	**0.62**

Source: Economic Regulation Authority's analysis

844. The average level of gearing for the US sample was 55.52 per cent based on book values and 44.4 per cent based on market values. The firms' betas were de-levered and re-levered. The average re-levered beta estimates were 0.78 and 0.62 for the book value and market value respectively. These estimates of equity beta using US sample are significantly lower than the average estimate of 0.87 provided by CEG. The Authority considers that the CAPM model adopted by the Australian regulators is a domestic version. As such, Australian data is preferred for any empirical studies regarding the appropriate equity beta for regulated entities.

12.2.8 The choice of the sampling period and interval for equity beta estimation

845. In its submission, CEG criticised the Authority's analysis for the use of the time period from 4/01/2002 to 19/04/2013. CEG submitted that adopting this sampling period implies that investors only consider this sampling period appropriate to form their view on a forward-looking beta. The Authority notes that this time period was advised by Henry to avoid the effects of the 'dot com bubble' in his advice to the AER in 2008.[438] When the analysis is updated for regulatory decisions in the future, the sample period will be updated accordingly.

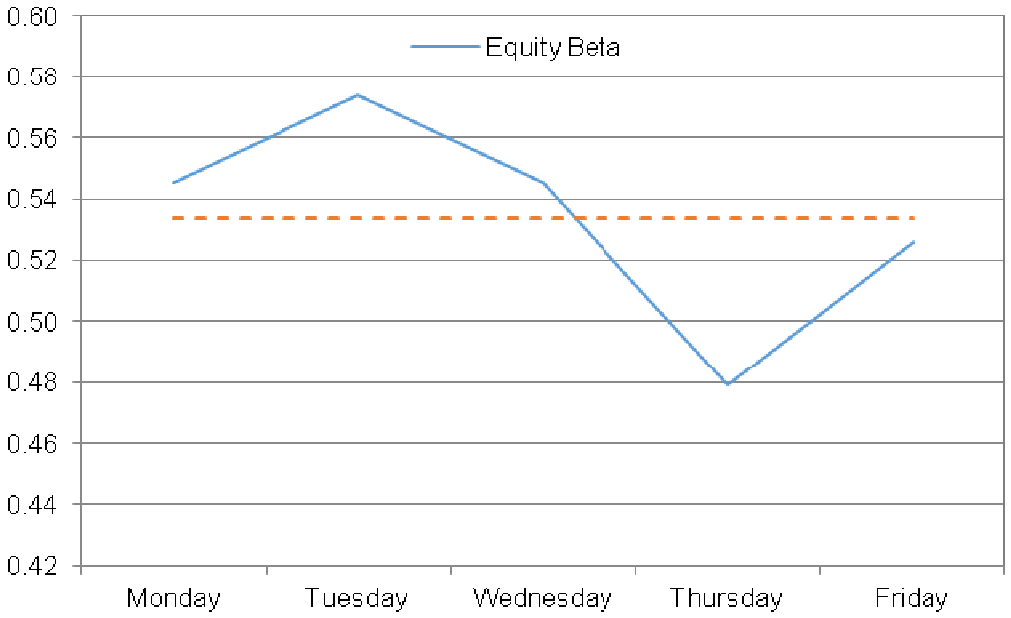
846. CEG also submitted evidence demonstrating that the estimate of equity beta is dependent on the sampling interval chosen to calculate returns. For example altering the day of the week that returns are calculate from, or if the sampling interval is changed to a daily or monthly interval results in a wide range of equity beta estimates.

847. To investigate the sensitivity that sampling intervals have on equity beta estimation, the Authority has replicated the methodology outlined in the draft determination but altered the day of the week from which the returns have been calculated from. This resulted in 5 data sets, each conditional on the day of the week returns are calculated from. The data set was for the same period of April 2008 to April 2013. Each firm's equity beta was calculated across the four different regression estimators. An average equity beta was calculated across the individual firms and regression procedures for each data set. This produces an average equity beta estimate conditional on the day of the week returns are calculated from. The results are demonstrated graphically below in Figure 1. A significant day-of-the week effect appears to be evident with higher covariance of returns on Tuesday and lower covariance of returns on Thursday.[439]

438 Competition Economists Group, *Regression estimates of equity beta,* September 2013.

439 It is noted that beta is a measure of covariance between the returns on the market and the stock in question; not returns in isolation. Therefore the day-of- the week effect in returns such as those documented in Kohers. G, Kohers. N, Pandey. V and Kohers, T (2004) '*The Disappearing Day-of-the-week Effect in The World's Largest Equity Markets*' Applied Economics Letters, Vol. 11, pp. 167-171 are different to the effect that is under consideration here.

Figure 19 Authority's estimate of equity beta average using different week days



Source: Economic Regulation Authority's analysis

848. The Authority notes that the use of closing data is a commonly used convention in the finance literature. This is also the convention adopted by Henry in his advice to the AER.[440] The Authority notes that an average of the various day of the week betas are not significantly different from the Friday based beta estimate (0.5261 versus the average of 0.5340, a difference of 0.0078). As a consequence the Authority considers it appropriate to utilise Friday based returns for the purposes of equity beta estimation. The Authority will also utilise confidence intervals in order to estimate acceptable ranges for equity beta and not rely on point estimates for equity beta, diminishing the relevance of the choice of weekday.

849. The Authority is of the view that weekly data is preferred to monthly data. It is noted that estimates of equity beta using monthly data create a smaller sample which is likely to result in a reduced statistical efficiency of the estimates. In addition, the Authority notes that estimates using monthly data are also vulnerable to the "day-of-the-week effect". This means that if prices are dependent on the day-of-the-week, then this effect is required to be controlled to ensure that returns are observed on the same weekday (Monday, Tuesday, Wednesday, Thursday, Friday). This effect cannot be controlled when the monthly data is used because a calendar month can end on any day of the week.

850. In his advice to the AER in 2008, Henry discussed the issue of daily versus monthly estimates.[441] He then concluded that weekly data is an appropriate trade off between noisy daily data and lack of degrees of freedom (due to smaller samples) using monthly data. In addition, the Authority notes that the average of the estimates based on daily data that CEG has presented appears to be comparable to the average of the estimates based on weekly data closing Friday.[442] The Authority therefore concludes that weekly intervals are appropriate for equity beta estimation.

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440 Henry, O (2008), *Econometric advice and beta estimation*, Advice to the AER, November 2008.

441 Ibid.

442 Competition Economists Group, *Regression estimates of equity beta,* September 2013, Figure 3.

12.2.9 Bootstrap Analysis

851. In order to ascertain the statistical accuracy of each regression estimator, the Authority has estimated the sampling distribution for each equity beta estimate using the Bootstrap approach. The empirically observed or 'bootstrapped' distributions allow the Authority to more robustly check the statistical accuracy of each robust estimator with respect to the OLS estimator. This also allows more accurate confidence intervals to be calculated between the different estimators, allowing for direct comparisons between each estimation procedure. This is in contrast to the conventional assumption which assumes a t-distribution for the equity beta coefficients.

852. Bootstrapping is the statistical procedure by which the sampling distribution of a relevant statistic is estimated by re-sampling the available data.[443] In addition to being able to ascertain the statistical accuracy of estimators, bootstrapping allows theoretical quantities of the sampling distribution to be calculated, such as the median, percentiles and standard error. Bootstrapping is advantageous over traditional statistical analysis in that no parametric assumptions are made regarding the sampling distribution of a statistic.[444] In particular, no assumption regarding the normality of errors is required. This allows the Authority to calculate confidence intervals more robustly, given that the assumptions underpinning traditional regression analysis are violated. Appendix 23 – Equity beta estimates using bootstrapping presents a discussion on how the Authority has implemented the bootstrap procedure and issues arising from its implementation.

853. The Authority has used the data from its 2013 analysis for each firm, using a weekly sampling interval ending on Friday for the period of 5 years from 19 April 2008 to 19 April 2013. Exactly 10,000 bootstrap replications were calculated in order to estimate each sampling distribution. Appendix 24 contains a graphical representation of each of the bootstrapped distribution and Appendix 25 contains relevant estimated percentile quantities. The results are set out in Table 37 and Figure 20.

854. The Authority notes that there is no significant bias present within any of the regression estimators as estimated by the bootstrap approach. With respect to the bootstrapped standard error, as presented in Table 37, the OLS estimator has the highest standard error across all estimated firms, with the exception of the LAD estimator for SKI. This means that the OLS estimation procedure exhibits a higher level of imprecision of its estimates relative to the other estimators. This is not a surprising result given the violation of the OLS assumptions, and its tendency to breakdown even due to slight violations of the Gauss-Markov assumptions, as previously discussed.

855. The Authority considers that confidence intervals calculated using this bootstrap approach are more accurate than the traditional approach, which assume a parametric form regarding the regression coefficients. Confidence intervals calculated using the bootstrap approach are directly comparable across regression estimators, whereas they are not under the traditional approach. As a consequence, the Authority considers that it is appropriate to use confidence intervals derived from the bootstrap approach to inform the Authority's judgement in relation to the appropriate range for equity beta. The Authority notes that the 95 per cent confidence interval using the bootstrapping procedure falls within the range of 0.3 and 0.72 when an average of the end points for each firm are taken.

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443 Fox J (2002), *An R and S-PLUS Companion to Applied Regression,* Appendix p 1, Sage Publishing.

444 Mooney C.Z, Duval R.D, *Bootstrapping: A Nonparametric Approach to Statistical Inference Issues 94-95,* Sage Publishing, p. 4.

12.2.10 Recursive Beta Estimates

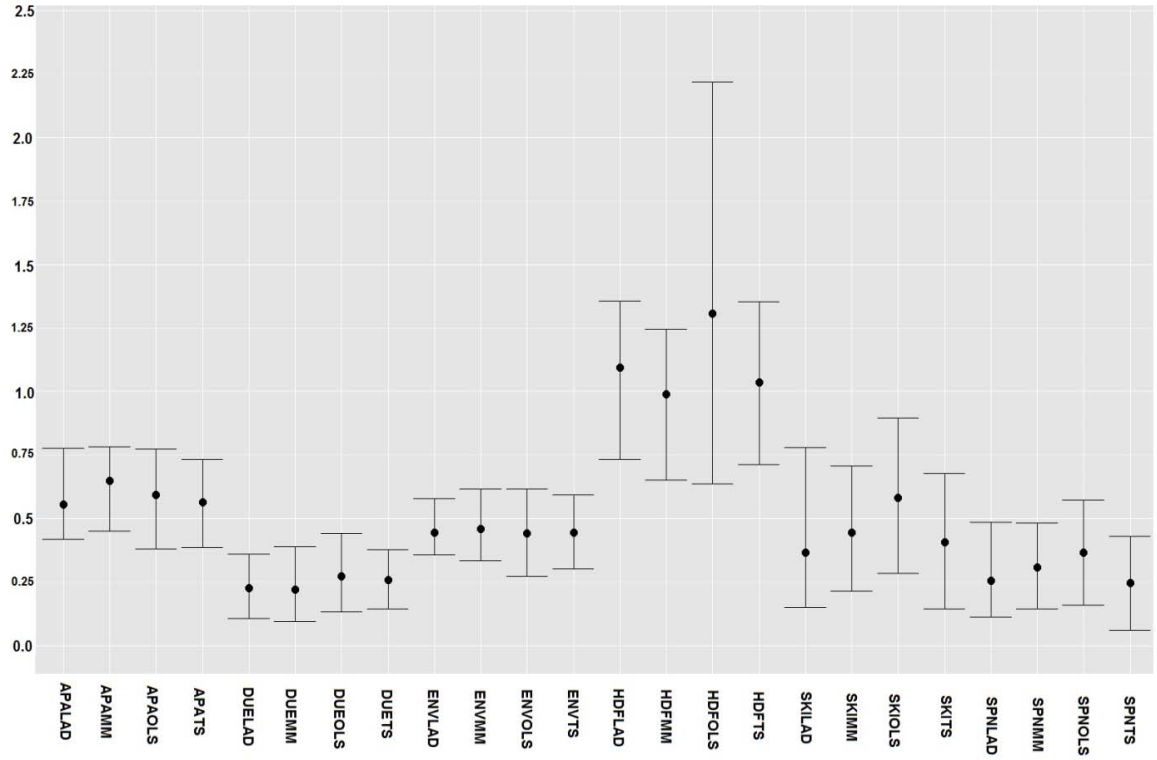
856. The Authority notes that there is evidence indicating that equity beta estimates are not constant through time for individual firms or portfolios. In his advice to the AER, Henry produced recursive estimates of portfolio betas and concluded that there is no strong evidence of instability in the estimates of β_i. The Authority has conducted its own analysis of how the equity beta estimate changes through time with respect to firm betas.

Table 37 Summary of Statistics of Bootstrap Results, B=10,000, n=260

	APA	DUE	ENV	HDF	SKI	SPN
OLS Estimate	**0.5930**	**0.2711**	**0.4425**	**1.308**	**0.5799**	**0.3654**
Mean	0.5891	0.2741	0.4440	1.312	0.5801	0.3638
$\widehat{bias}_B$	-0.0039	0.003	0.0015	0.004	0.0002	-0.0016
Median	0.5938	0.2687	0.4436	1.269	0.5760	0.3620
95% Confidence Interval	[0.380-0.773]	[0.133-0.441]	[0.273-0.616]	[0.636-2.218]	[0.2830-0.8964]	[0.1598-0.5730]
Bootstrapped Standard Error	0.1004	0.0791	0.0862	0.4045	0.1559	0.1042
LAD Estimate	**0.5549**	**0.2262**	**0.4434**	**1.092**	**0.3663**	**0.2562**
Mean	0.5870	0.2224	0.4529	1.0670	0.4039	0.2691
$\widehat{bias}_B$	0.0321	-0.0038	0.0095	-0.025	0.0376	0.0129
Median	0.5771	0.2272	0.4418	1.0900	0.3673	0.2557
95% Confidence Interval	[0.417-0.776]	[0.107-0.360]	[0.358-0.579]	[0.731-1.357]	[0.151-0.779]	[0.113-0.485]
Bootstrapped Standard Error	0.0967	0.0681	0.0611	0.1543	0.1626	0.0997
MM Estimate	**0.6467**	**0.2188**	**0.4589**	**0.9881**	**0.4449**	**0.3087**
Mean	0.6365	0.2266	0.4623	0.9787	0.4484	0.3100
$\widehat{bias}_B$	-0.0102	0.0078	0.0034	-0.0094	0.0035	0.0013
Median	0.6436	0.2207	0.4583	0.9920	0.4424	0.3067
95% Confidence Interval	[0.451-0.782]	[0.0955-0.390]	[0.3322-0.6147]	[0.6510-1.248]	[0.2144-0.7054]	[0.1437-0.4826]
Bootstrapped Standard Error	0.0846	0.0771	0.0698	0.1495	0.1222	0.0854
TS Estimate	**0.5643**	**0.2580**	**0.4456**	**1.036**	**0.4069**	**0.2470**
Mean	0.5617	0.2581	0.4464	1.035	0.4086	0.2469
$\widehat{bias}_B$	-0.0026	0.0001	0.0008	-0.001	0.0017	-0.0001
Median	0.5641	0.2574	0.4458	1.037	0.4070	0.2466
95% Confidence Interval	[0.3858-0.7317]	[0.1452-0.3774]	[0.3023-0.5935]	[0.7107-1.354]	[0.1456-0.6758]	[0.0610-0.4293]
Bootstrapped Standard Error	0.0886	0.0590	0.0733	0.1614	0.1337	0.0936

Source: Economic Regulation Authority's analysis

Figure 20 95 per cent Confidence Intervals and Estimated Coefficient for Equity Beta by Firm and Regression Technique using Bootstrap



Source: Economic Regulation Authority's analysis

857. The Authority has produced rolling beta estimates for each firm using a weekly sampling interval ending on Friday. This involves recursively estimating the beta estimates by varying the dates included in the calculation. Each estimate of beta is calculated by taking the start date, and the date corresponding to 5 years in the future and using the returns in this interval as the sample. The next equity beta is calculated by incrementing the start and end dates by one month. Beta estimates for each firm are calculated from the point in time where 5 years of data is first available for each firm. The results are presented graphically below:

Figure 21 ENV Rolling Betas, 3/01/2007-19/04/2013

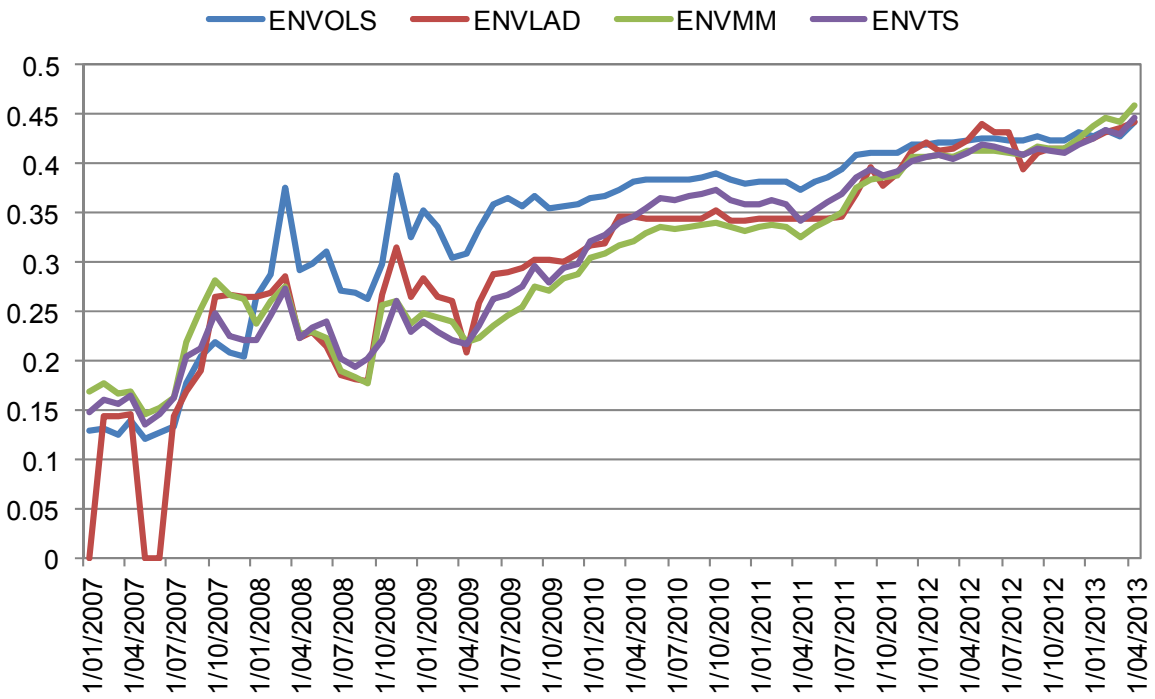


Figure 22 APA Rolling Betas, 3/01/2007-19/04/2013

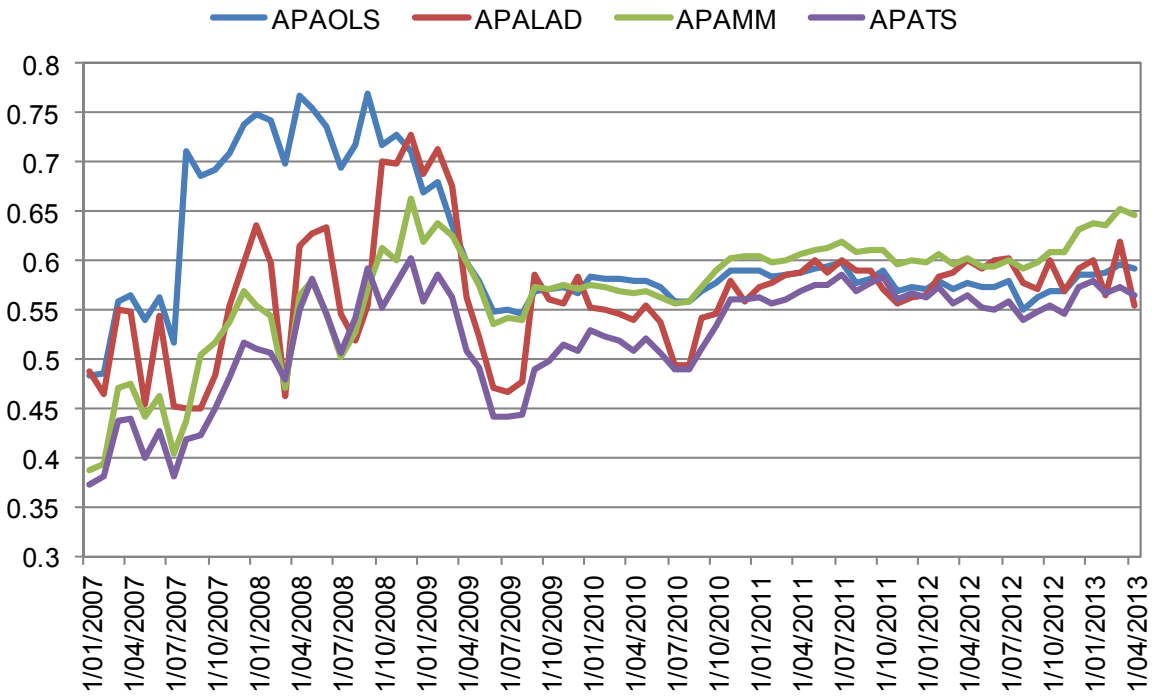


Figure 23 DUE Rolling Betas, 13/08/2009-19/04/2013

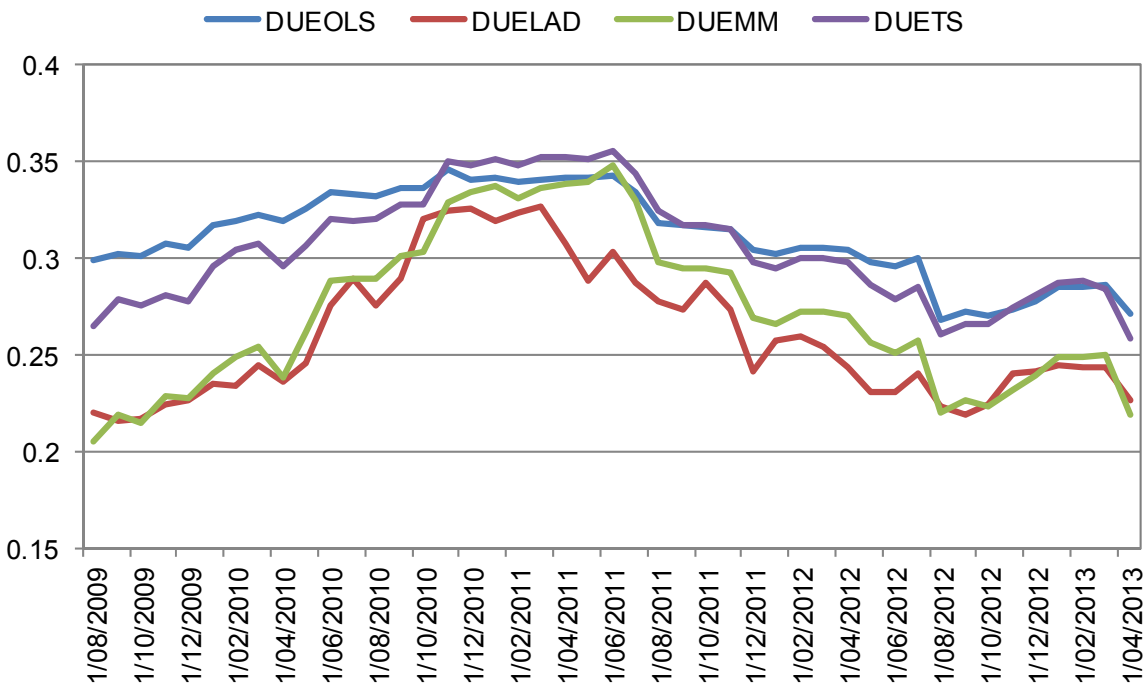


Figure 24 HDF Rolling Betas, 13/12/2009-19/04/2013

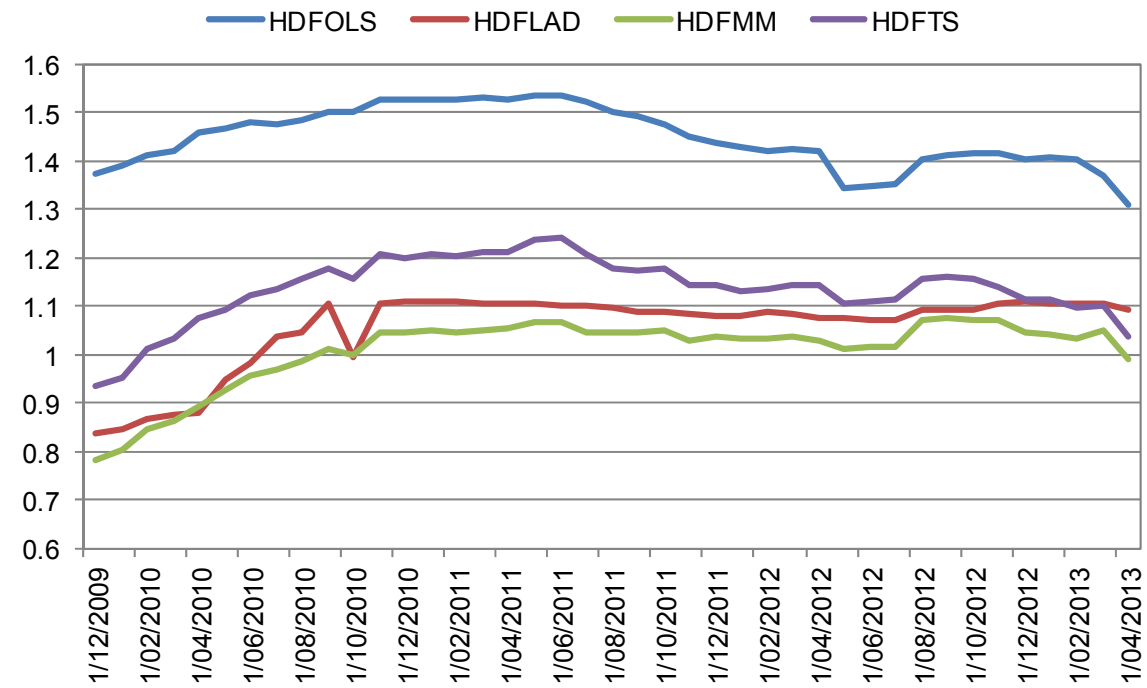


Figure 25 SKI Rolling Betas, 16/12/2010-19/04/2013

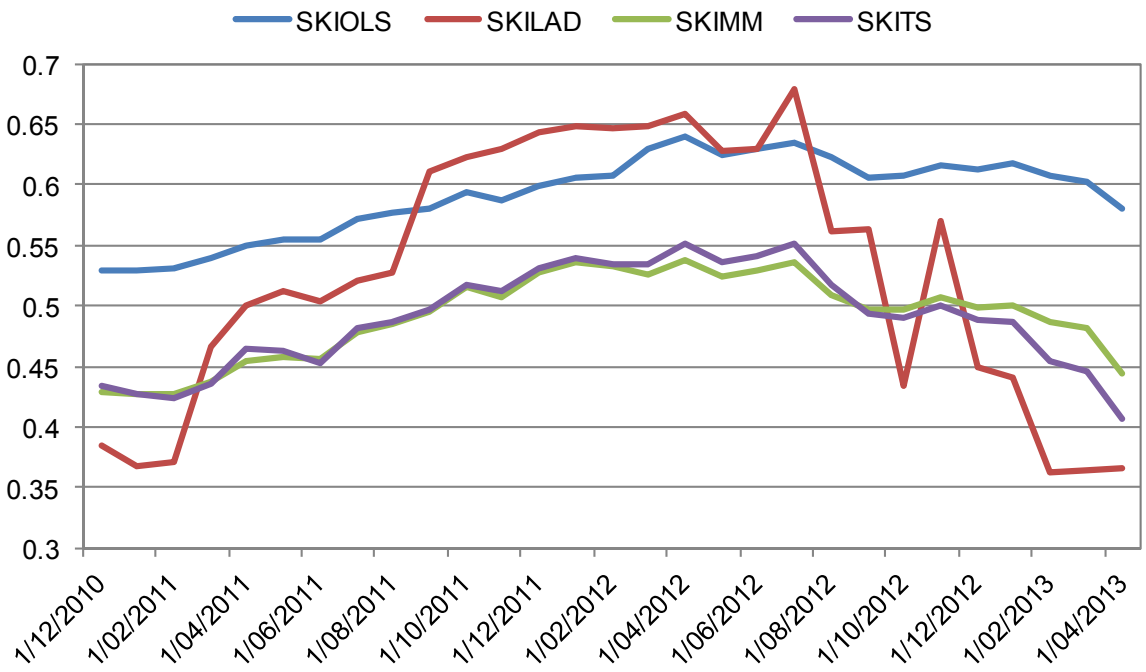
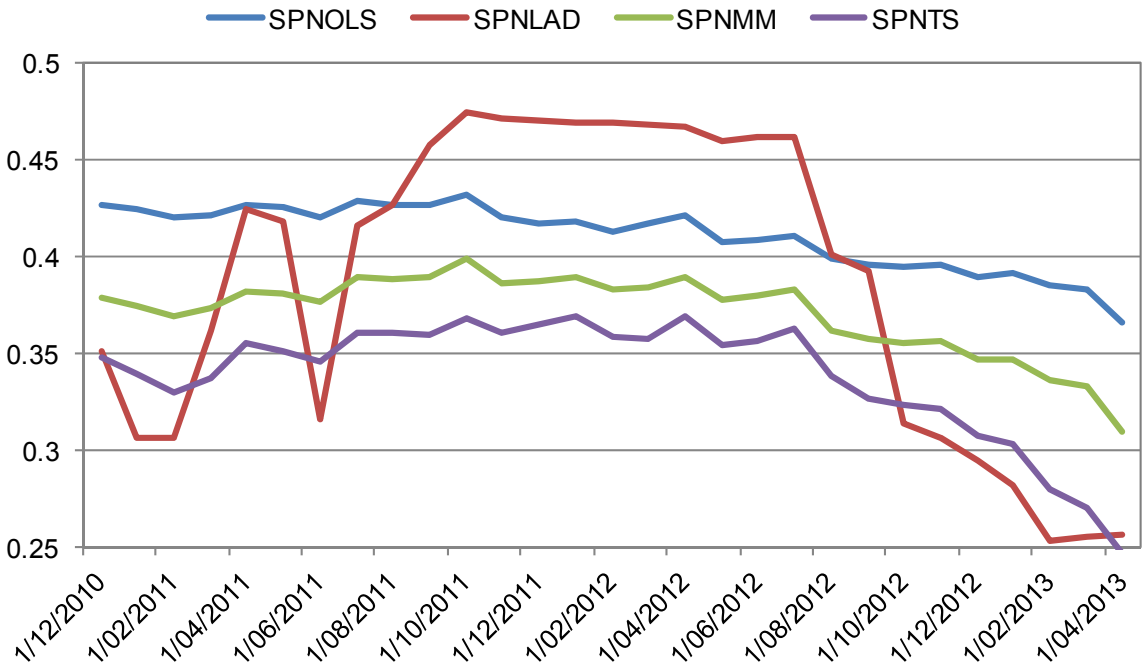


Figure 26 SPN Rolling Betas, 14/12/2010-19/04/2013



858. The Authority notes that the beta parameter shows variation through time, regression procedures and across firms. As a consequence, the Authority intends to re-estimate the value for equity beta at the beginning of new access arrangements to incorporate the most relevant information for its decision, using the methodology outlined previously.

12.2.11 Additional equity beta issues

859. The Authority will consider other relevant empirical evidence for informing a range for equity beta, and the point estimate of the equity beta, at the time of an access arrangement. The Authority considers that relevant empirical evidence supports the view that there is some downward bias in equity beta estimates that are less than one, and upward bias in equity beta estimates that are greater than one. The Authority intends to undertake more work to quantify the extent of this potential bias. This work would then inform the degree to which the Authority might adjust up the point estimate of the equity beta within the estimated range, so as to account for the potential beta bias.

860. The Authority also recognises that regulated firms face a range of different risks in the provision of reference services, as compared to the benchmark efficient entity (see chapter 4 – The benchmark efficient entity and risk). As a consequence the Authority will make a judgment, based on evidence put forward by the proponent at the time of an access arrangement, as to any material and substantiated differences in risk faced by the regulated entity in the provision of reference services, as compared to the risks of the benchmark efficient entity. This may result in a revision to the equity beta estimate.

861. The Authority will exercise its judgement as to whether any additional evidence is relevant for informing the range of permissible equity beta values, and the point estimate of the equity beta. This evaluation will be consistent with the requirements of the NGL and the NGR.

12.2.12 Conclusion

862. The Authority is of the view that the above methodology used to estimate equity beta has proven to be robust, with sound theoretical and empirical backing. As a consequence, the Authority considers this methodology fit for purpose for these rates of return guidelines. Given the statistical imprecision inherent in equity beta estimation, the Authority will take into account the range of values estimated using the bootstrap technique to inform the possible range for equity beta.

863. The Authority will take into account qualitative evidence to inform its judgement on equity beta in order to determine a point estimate within the range of estimated beta estimates.

864. Given that equity beta estimates have been shown to fluctuate over time, equity beta estimates will be re-estimated at the start of an access arrangement and apply over the length of the regulatory period.

865. The approach of using various techniques to estimate equity beta is supported by the small difference between the CEG's and the ERA's studies even though these two studies are conducted on different datasets and based on different assumptions.

13 Debt and equity raising costs

866. Debt and equity raising costs are the administrative costs and other charges incurred by businesses in the process of raising or refinancing debt or equity. This chapter sets out the Authority's considerations with regard to these costs.

13.1 Approach

13.1.1 Debt raising costs

867. The Authority is of the view that debt raising costs should be incorporated as a component in the rate of return on debt. However, these debt raising costs should only include the direct cost components recommended by the Allen Consulting Group **(ACG**) in its 2004 report to the ACCC and accepted by Australian regulators since then. These costs will be recompensed in proportion to the average annual issuance, and will cover: (i) gross underwriting fees; (ii) legal and roadshow fees; (iii) company credit rating fees; (iv) issue credit rating fees; (v) registry fees; and (vi) paying fees.

868. The Authority considers that indirect costs are not appropriate to be included in the estimate of debt raising costs and will not be compensated.

869. The Authority considers that the estimate of 12.5 basis points per annum is currently the most relevant estimate of debt raising costs for the benchmark efficient entity. The Authority will re-evaluate this position at the time of an access arrangement if relevant new information provided to it.

870. In addition, the Authority recognises that there is a cost involved with hedging. The Authority considers that an annual swap allowance of 2.5 basis points per annum should be provided to firms on the whole of the debt portfolio to compensate for the cost of conducting hedging for the exposure to movements in the risk-free rate. The hedging cost allowance would also be added to the return on debt.

871. In total, 15 basis points per annum allowance will be provided to regulated entities to reflect debt-raising and hedging costs.

13.1.2 Equity raising costs

872. The Authority also considers that an allowance for the transaction costs of raising equity is justified where an adjustment is required to maintain the debt to equity ratio at 60 per cent.

873. The Authority will estimate equity raising costs for regulated businesses as follows:

- retained earnings of 30 per cent of after-tax profits will be available to increase equity at zero cost;
- dividends will be assumed to be paid at the benchmark payout ratio of 70 per cent of after-tax profits, consistent with the payout ratio used in the estimation of gamma;
- 25 per cent of dividends paid out will be treated as being reinvested through Dividend Re-investment Plans, with an equity raising cost allowance of one per cent applied;

- any further required equity is raised at the Seasoned Equity Offering (**SEO**) cost of 3 per cent – with these costs added to the regulated asset base, at the same time and in proportion to the underlying capital expenditure, and depreciated over the life of the assets.

13.2 Reasoning

13.2.1 Debt raising costs

874. Regulators across Australia have typically included an allowance to account for debt raising costs in their regulatory decisions. Debt raising costs may include underwriting fees, legal fees, company credit rating fees and any other costs incurred in raising debt finance. A company has to pay debt raising costs over and above the debt risk premium. Such debt raising costs are likely to vary between each issuance of debt depending on the borrower, lender and market conditions.

875. The debt raising allowance is treated differently by different regulators. For example, the Australian Competition and Consumer Commission (**ACCC**) (post 2002) and then, the Australian Energy Regulator (**AER**), have considered this allowance as a cost item in the operating expenses whereas all other State-based regulators, including the Authority in previous decisions, have incorporated this allowance in the rate of return calculations. 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. More detail on the ACCC and AER's estimates is set out at Appendix 26 – Empirical evidence on debt raising costs.

876. Based on the advice from the Allen Consulting Group (**ACG**) in December 2004, the ACCC concluded that debt raising costs were a legitimate expense that should be recovered through the revenues of a regulated utility.[445] This conclusion is consistent with the ACCC's decisions on the issue of debt raising costs in its regulatory decisions prior to 2004.[446,447]

877. The costs included in the estimates of the debt raising costs, as indicated by the ACG in its 2004 estimate and adopted by the ACCC, are 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 instruments, 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

445 The Australian Competition and Consumer Commission, 2005, Final Decision, *NSW and ACT Transmission Network Revenue Cap, TransGrid 2004/5 to 2008/9*, April 2005, p. 144.

446 The Australian Competition and Consumer Commission, 2002, Final Decision, *South Australian Transmission Network Revenue Cap, 2003 to 2007/8*, December 2002, p. 25.

447 In this decision, the ACCC incorporated an allowance of debt raising costs in the regulated cost of capital.

- paying fee: payment of a coupon and principal to the security holder on behalf of the issuer.

878. In addition, in its report to the ACCC in December 2004, ACG considered that some transaction costs associated with debt would continue to be incurred for the whole value of the investment.[448] ACG was also of 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 (**WACC**) or as a direct allowance to operating expenses.[449]

879. ACG's 2004 study determined debt raising costs based on long-term bond issues, consistent with the assumptions applied in determining the costs of debt for a benchmark regulated entity. Debt raising costs were based on costs associated with Australian international bond issues and for Australian medium term notes sold jointly in Australia and overseas. Estimates of these costs were equivalent to 8 to 10.4 basis points per annum when expressed as an increment to the debt margin.[450]

880. The Authority and other Australian regulators, except the ACCC and AER, have consistently adopted an estimate of debt raising costs of 12.5 basis points per annum (**bppa**) in previous regulatory decisions (Table 38). This allowance is based on the ACCC's 2004 estimates. As noted above, the ACCC and the AER have incorporated these costs in the operating expense cash flows. It is noted that the Independent Pricing and Regulatory Tribunal (**IPART**) recently increased this allowance to 20 basis points per year. IPART was of the view that this revised allowance of debt raising costs of 20 basis points better reflected its adopted term to maturity of 5 years.[451] Other evidence has been also provided to the AER by Associate Professor Handley from the University of Melbourne in April 2010 confirming that cost components in its estimates of the debt raising costs are appropriate.[452]

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

449 Allen Consulting Group, 2004, *Debt and equity raising transaction costs: Final report to ACCC*, December 2004, p. xix.

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

451 Independent Pricing and Regulatory Tribunal, 2011, *Final Decision – Developing the approach to estimating the debt margin*, April 2011, p. 3.

452 Handley, J., April 2010, *A Note on the Completion Method*, Report prepared for the Australian Energy Regulator

Table 38 Debt raising costs in the Australian regulatory practices

Regulator	Year	Allowance (bppa)
ACCC[453]	2011	8.02 - 8.9
AER[454]	2012	Circa of 10 but treated as an operating expense
ERA[455] [456]	2012	12.5
IPART[457]	2012	20
QCA[458]	2012	12.5
ESCOSA[459]	2012	0

Source: Compiled by the Economic Regulation Authority

881. The Authority has not received submissions regarding the estimation of debt raising costs. However, a number of issues surrounding the estimation of debt raising costs have been raised previously by regulated businesses. Specifically, submissions to the Authority, the AER, and other Australian regulators have contained a range of issues that relate to debt raising costs. The Authority has identified six issues that it considers warrant further consideration. Each of these issues is outlined below.

882. In its 2012 application to the Australian Competition Tribunal, DBNGP (WA) Transmission Pty Ltd claimed that the ACG report on *Debt and Equity Raising Transaction Costs* had become obsolete because this report was prepared in 2004.[460]

883. In evaluating the argument that the 2004 ACG's study is obsolete, the Authority viewed recent literature on the debt raising costs of utilities. The Authority established that current estimates of debt raising costs are consistent with the ACG estimates, or lower, for example:

- PricewaterhouseCoopers was appointed by Powerlink to estimate the debt and equity raising costs of Powerlink's debt program for 2013-2017. PricewaterhouseCoopers employed the same methodology as did ACG in 2004 (Appendix 26 – Empirical evidence on debt raising costs).

453 Australian Competition and Consumer Commission, Inquiry to make final access determinations for declared fixed line services — Final report, July 2011, p. 71.

454 Australian Energy Regulator, Access Arrangement Information for the ACT, Queanbeyan and Palerang gas distribution network, 1 July 2010 – 30 June 2015 p. 80.

455 Economic Regulation Authority (Western Australia), Final decision on proposed revisions to the access arrangement for Western Power, 2012, p. 21.

456 Economic Regulation Authority, Final Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline, 31 October 2011, p. 158

457 Independent Pricing and Regulatory Tribunal, Review of prices for Sydney Water Corporation's water, sewerage, stormwater drainage and other services, From 1 July 2012 to 30 June 2016, p. 206.

458 Queensland Competition Authority, Final report, Sunwater irrigation price review 2012–17, Volume 1, May 2012, p. 498.

459 "The Commission has not added an additional margin to the debt risk premium to reflect the transaction costs that SA Water will incur when raising debt" (Essential services commission of South Australia, *Advice on a Regulatory Rate of Return for SA Water- Final Advice, February 2012,* p. 22).

460 The Australian Competition Tribunal, 2012, *Application by DBNGP (WA) Transmission Pty Ltd (no 3) [2012] ACompT 14 to the Australian Competition Tribunal,* p. 69.

PricewaterhouseCoopers found that a debt raising cost of 9.1 basis points per annum was appropriate for Powerlink debt program of $4,000 million.[461]

- The AER sought advice from Associate Professor Handley on debt raising costs, to inform its final decisions for Network Services Providers. Associate Professor Handley examined submissions from the Network Service Providers, previous decisions made by regulators and literature on the estimation debt raising costs. Associate Professor Handley found that a reasonable estimate of the debt raising costs was between 8 and 12 bppa.[462]

884. Furthermore, the Tribunal, reviewing the Dampier to Bunbury Natural Gas Pipeline access arrangement decision in 2012, did not find that the ACG report was obsolete. The Tribunal did note that the report did not lend itself to comparative analysis; however, it held that there was nothing in it which suggested that it was 'obsolete' or not relevant to the issue of debt raising costs. Based on these findings, the Authority does not consider that the ACG report is no longer relevant for an estimate of the debt raising costs for regulatory purposes.

885. The Authority is not aware of any new alternatives to the ACG method. Recent estimates of debt raising costs – including Deloitte's 2010 estimate; PricewaterhouseCoopers' 2011 estimate; the AER's 2013 estimate; and the Authority's estimate in 2013 – have all adopted the same approach as in ACG's 2004 estimate. Notwithstanding this, the Authority is open to consideration of any new methods proposed by regulated businesses. The Authority is of the view that the approach is robust and this approach has been adopted by the Australian regulators over the last 10 years. In addition, the Authority considers that the approach is still fit for purpose for these rates of return guidelines with input data to be updated as soon as it becomes available.

886. Competition Economist Group (**CEG**) has argued that the use of international private placement markets to estimate underwriting fees was not appropriate because the approach cannot adequately identify the costs of underwriting in Australia.[463,464] CEG was of the view that using the private placement market as a proxy for Australian underwriting fees results in an underestimate of the actual cost of underwriting.

887. The Authority considers that it is appropriate to use overseas private placement markets as a proxy for underwriting fees in Australia.[465] The Authority agrees with ACG's findings that:[466]

> Given the extent of international competition in the bond markets and the fact that these markets should equilibrate over time, ACG believes that this benchmark... [of 5.7 basis points for underwriting fees] is a reasonable proxy for Australian bond underwriting fees.

888. In its Final Decision on Victorian Electricity Distribution Network Service Providers, Distribution Determination 2011-2015, the AER also determined that fees charged by overseas banks to Australian companies issuing bonds in international markets could

[461] PricewaterhouseCoopers, 2011, *Appendix K Debt and Equity Raising Costs,* Report for Powerlink Queensland, p. 20.

[462] Associate Professor Handley, 2009, *A note on the Costs of Raising Debt and Equity Capital,* p. 30.

[463] Competition Economist Group 2008, *Nominal Risk Free Rate, Debt Risk Premium and Debt and Equity Raising Costs*, report prepared for TransGrid, www.aer.gov.au.

[464] Allen Consulting Group found that there was a lack of underwriting data in Australia. This prohibits the accurate estimation of underwriting fees. As such, in its 2004 report, the ACG found that international private placement markets were a viable proxy to estimate underwriting fees.

[465] This is consistent with the AER's findings.

[466] Allen Consulting Group, 2004, *Debt and Equity Raising Transaction Costs,* p. 53.

be used as an objective and robust source of data to estimate domestic underwriting fees. Furthermore, there is insufficient data available detailing underwriting fees for bond issues in the Australian market to allow for an accurate benchmark to be produced using Australian data.[467] As such, the Authority considers that the use of international private placement markets data is the best proxy for underwriting fees, until sufficient data is available in Australia.

889. CEG also has argued that indirect costs should be included in estimation of debt raising costs. An example of an indirect cost is the underpricing of debt at the time of issuance.[468,469] CEG suggested that such a cost is a cost to the issuer because the revenue from issuance in the presence of underpricing is lower than if there was no underpricing. CEG submitted to the AER that currently there is no allowance for indirect costs in the estimate of debt raising costs. The Authority notes that the AER considered the inclusion of underpricing and other indirect costs would be inconsistent with the assumptions of a BBB+ credit rated company.[470] The inconsistency is derived from the view that a company with a BBB+ credit rating should not have to underprice its bonds in order to sell them in the market. The Authority considers that the validity of including indirect debt raising costs should be evaluated within the estimate of the debt risk premium. This approach is supported by Associate Professor Handley. In his advice, Handley was of the view that:[471]

> ...such an adjustment should then be made to the cost of debt rather than as an allowance for capital raising costs.

890. On this basis, the Authority is of the view that indirect costs should not be included in the allowance for debt raising costs.

891. In a submission to 'Rule Change Proposals (ERC0134/ERC0135)',[472] ETSA Utilities, CitiPower and Powercor Australia stated that debt raising costs should be clearly categorised in financial statements. They argued that currently, the Rate of Return for Gas Transmission and Distribution Network Guidelines do not provide any formal guidance as to how the non-interest 'other debt costs' should be categorised by the utility. Different types of 'other debt costs' are currently treated differently by the regulators.[473] This results in inconsistencies in approaches between the utilities. These regulated businesses consider that 'other debt costs' are "already reported as financing costs and not [operating expenses] in the financial statements of a Network Service Provider."[474]

892. The Authority understands the need for the Rate of Return for Gas Transmission and Distribution Network Guidelines to explicitly state how 'other debt costs' should be

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467 This view is supported by PricewaterhouseCoopers, 2011 *Powerlink Debt and Equity Raising Costs,* p. 15.

468 Competition Economist Group 2008, *Nominal Risk Free Rate, Debt Risk Premium and Debt and Equity Raising Costs*, report prepared for TransGrid, www.aer.gov.au.

469 Underpricing costs are those which represent the discount, to the fair market price, at which the new securities are issued to investors. Professor Handley, 2009, *A note on the Costs of Raising Debt and Equity Capital* , p. 3.

470 Competition Economists Group, 2009, *Debt and equity raising costs: A response to the AER 2008 draft decisions for electricity distribution and transmission*, p. 35.

471 Associate Professor Handley, 2009, *A note on the Costs of Raising Debt and Equity Capital,* p. 16.

472 ETSA Utilities, CitiPower and Powercor Australia, 2011, *Joint Response to AER and EURCC Rule Change Proposals (ERC0134/ERC0135)*, p. 154.

473 For example, costs associated with raising debt have been included in the opex block, whilst hedging costs are considered to be implicitly included in the WACC (via the cost of debt).

474 ETSA Utilities, CitiPower and Powercor Australia, 2011 *Joint Response to AER and EURCC Rule Change Proposals (ERC0134/ERC0135),* p. 154.

treated, and what these costs should specifically include.[475] As previously indicated, the Authority considers that debt raising costs should include, underwriting fees, legal and road show fees, company credit rating fees, issue credit rating fees, registry fees, and paying fees. The Authority notes that debt raising costs may either be included as a margin in the return on debt, or as an explicit cash flow in operating expenses. The Authority is of the view that it is appropriate to include the costs as a component of the rate of return.

893. As an illustration, the Authority has conducted its own hypothetical estimate of the debt raising cost for the purpose of this rate of return guidelines. In this estimate, the approach used in the ACG 2004 report is adopted. Table 39 below presents the results from this exercise, which assumes that a regulated business has a regulatory asset value (RAB) of A$3,200 million. Given the assumed gearing of 60 per cent, the amount of debt to be raised or refinanced is A$1,920 million, which requires approximately 8 standard-size issues. More detail on the components of the estimate is provided at Appendix 26 – Empirical evidence on debt raising costs. In this hypothetical example, depending on the number of issues, debt raising costs range from 11.8 bppa to 13.8 bppa. However, these estimates will vary depending on some key assumptions. It is noted that all costs are amortised over 5 years.

Table 39 The Authority's estimate of debt raising costs (bppa), 2013

Fee	Explanation/Source	1 Issue	2 Issues	4 Issues	6 Issues	10 Issues
Total Amount Raised	Multiples of median MTN issue size ($250m)	$250m	$500m	$1,000m	$1,500m	$2,500m
Gross Underwriting Fees	Bloomberg for Australian international issues, upfront per issue, amortised	8.31	8.31	8.31	8.31	8.31
Legal and Roadshow	$195K upfront per issue, amortised	1.85	1.85	1.85	1.85	1.85
Company Credit Rating	$55K for the entire company, per year	2.20	1.10	0.55	0.37	0.22
Issue credit rating	4.5 bps up-front per issue, amortised	1.07	1.07	1.07	1.07	1.07
Registry fees	$4K upfront per issue, amortised	0.04	0.04	0.04	0.04	0.04
Paying fees	$9K per issue per year	0.36	0.36	0.36	0.36	0.36
Totals	**Basis points p.a.**	**13.8**	**12.7**	**12.2**	**12.0**	**11.8**

Source: ACG; Bloomberg; AER; and the Economic Regulation Authority's analysis

894. The Authority notes that data sources for estimates of debt raising costs are relatively limited. As such, employing various sources of data in the estimates is appropriate. For example, when estimating gross underwriting fees, one of the key components to be included in the estimate of debt raising costs, the data available from Australian bonds issued overseas is considered appropriate. The Authority is of the view that Australian data is the most desirable. However, in circumstances where Australian data is not available, then relevant data from overseas may form a good proxy for the Australian market.

895. The Authority considers that there are advantages to moving to the cash flow approach, given the explicit recognition that firms stagger their debt issuances. Inspection of Table 39 reveals that a number of the contributing costs are fixed costs

[475] Debt raising costs may include underwriting fees, legal fees, company credit rating fees and any other costs incurred in raising debt finance.

per issuance. By estimating the average amount of debt required to be refinanced each year, the Authority considers that this would result in a more accurate estimate of debt raising costs. This approach is consistent with the Authority's adoption of the annual update for the cost of debt allowance (Chapter 6 – Return on debt). The Authority is of the view that the approach set out in the ACG's 2004 study is appropriate for the purpose of estimating debt raising costs. This approach has been adopted by Australian economic regulators in their regulatory decisions over the last 10 years. As such, the Authority considers that any estimate of debt raising costs derived using the same approach is fit for purpose. The Authority believes that the current estimate of 12.5 bppa is the most relevant estimate of debt raising costs for the purposes of these guidelines.

896. Given the assessment that firms will hedge the on-the-day rate, a swap allowance of 2.5 bppa will be awarded to firms to compensate for the cost of conducting hedging for the exposure to movements in the risk-free rate. The allowance will be based on the aggregate amount of debt, and provided annually. The Authority's determination to annually update the cost of debt was discussed in Chapter 6 – Return on debt.

897. In total of 15 bppa allowance will be awarded to regulated business to reflect debt-raising and hedging costs.

13.2.2 Equity raising costs

898. In order to maintain the benchmark debt to equity ratio following increases in the regulated asset base, the firm may need to issue new equity. The issuance of new equity will have transactions costs, depending on the way in which the equity is raised. The Authority received no submissions addressing this issue.

899. In its most recent decision on Western Power's access arrangement, the Authority provided an allowance for equity raising costs in the operating expense cash flows as follows:

- retained earnings of 30 per cent of after-tax profits are available at zero cost;
- dividends are paid at the benchmark payout ratio of 70 per cent of after-tax profits, with 25 per cent of dividends treated as being reinvested through Dividend Re-investment Plans, with an equity raising cost allowance of one per cent applied;
- any further required equity is raised at the Seasoned Equity Offering cost of 3 per cent – with these costs added to the asset base and depreciated over the life of the assets.

900. This approach is consistent with the approach adopted to date by the Australian Energy Regulator. The Authority considers that an allowance for the transaction costs of raising equity is justified where an adjustment is required to maintain the debt to equity ratio.

901. The accepted hierarchy for capital raising is:

- retained earnings (and by corollary dividend reinvestment);
- debt;
- new equity injections.

902. The level of retained earnings relates to the dividend the business is expected to pay – retained earnings are after-tax profits, less dividends. The Authority considers that a

payout ratio of 70 per cent of after tax profits is a typical benchmark for the dividend payout ratio, leaving 30 per cent of after tax profits as retained earnings. The 70 per cent rate is the same as the payout ratio F utilised for the calculation of the WACC (see Chapter 14 – Gamma). The Authority notes that retained earnings are available to the firm without incurring any costs.

903. Evidence from recent data analysed by the Authority covering six utilities suggests that around 25 per cent of annual dividends, on average, are subject to reinvestment plans (Table 40).

904. The AER has previously adopted a cost for dividend reinvestment of 1 per cent. The Authority notes that the AER, in deciding on its approach, took account of a number of studies, as well as its own investigations, concluding:[476]

> The AER has undertaken its own research of the costs of DRPs among domestic energy network businesses. The AER observed that where reported, costs as a portion of equity raised had a median of 0.75 per cent and a mean of 1 per cent. On the basis of all the information considered including the ACG report [zero costs] and Carlton's anecdotal evidence [1.25 per cent], the AER considers that a conservative estimate of 1 per cent is appropriate. The AER considers that this figure is the appropriate unit cost to be applied to the amount of equity assumed to be raised through a DRP.

905. On this basis, the Authority accepts 1 per cent as a reasonable cost for dividend reinvestment.

906. The quoted cost of SEOs tends to be around 3 per cent. This amount derives from work in 2004 by the ACG, which recommended:[477]

> If a rights issue (or other SEO) were found to be required, ACG recommends a benchmark transaction cost of 3%, adding the amount of SEO transaction costs to the capital base (RAV) and depreciating over the life of the assets purchased with funds raised by the notional, benchmarked SEO.

907. Shareholders, if they accepted that a major investment was warranted, could accept a lower dividend, for a period, as a means to inject equity – given that this has the lowest financing cost. However, the Authority accepts that many investors seek dividend stability, and that firms seek to service this requirement. Further, decisions by investors to invest additional funds in the business necessarily would be made within the context of their overall portfolios – some investors might view a dividend reduction as inconsistent with their risk preferences. Finally, any reduction in dividends would potentially waste franking credits, which are important for some investors.

[476] Australian Energy Regulator 2009, *Australian Capital Territory Distribution Determination 2009-10 to 2013-14*, www.aer.gov.au, p. 258.

[477] The Allen Consulting Group 2004, *Debt and Equity Raising Transactions Costs*, www.aer.gov.au, p. 69.

Table 40 Dividend re-investment ratios

Name	Year	Dividends ($m OD)	Reinvested ($m OD)	Re-invest. Ratio	5 Year Av.
Origin Energy	2011	226,000,000	61,000,000	26.99%	
	2010	220,000,000	65,000,000	29.55%	
	2009	218,000,000	19,000,000	8.72%	22.74%
	2008	201,040,000	45,000,000	22.38%	
	2007	158,654,000	41,350,000	26.06%	
AGL Energy	2011	143,000,000	61,900,000	43.29%	
	2010	125,500,000	36,400,000	29.00%	
	2009	119,900,000	58,700,000	48.96%	29.38%
	2008	112,700,000	28,900,000	25.64%	
	2007	-	-	No plan	
SP Ausnet	2011	131,400,000	74,800,000	56.93%	
	2010	157,400,000	46,900,000	29.80%	
	2009	124,000,000	26,600,000	21.45%	21.63%
	2008	-	-	No plan	
	2007	-	-	No plan	
DUET Group	2011	-	-	No plan	
	2010	84,709,000	27,072,206	31.96%	
	2009	82,277,000	18,935,563	23.01%	18.56%
	2008	106,420,000	18,885,523	17.75%	
	2007	92,136,000	18,500,000	20.08%	
Spark Infrastructure Group	2011	-	-	No plan	
	2010	-	-	No plan	
	2009	68,178,378	25,226,000	37%	7.40%
	2008	-	-	No plan	
	2007	-	-	No plan	
Envestra Limited	2011	77,500,000	44,300,000	57.16%	
	2010	73,000,000	42,300,000	57.95%	
	2009	75,800,000	32,100,000	42.35%	51.01%
	2008	81,700,000	34,600,000	42.35%	
	2007	77,800,000	43,000,000	55.27%	
All six companies					**24.5%**

Source: Annual reports

908. The Authority therefore considers that given the evidence for dividend reinvestment comprising 25 per cent of dividends (see above), and given that many investors would prefer to make an explicit decision on whether to re-invest dividends in a business, any additional capital raising requirement that is over and above standard re-investment rates has the nature of SEO, and hence should be charged at the higher SEO cost of raising equity.

909. Finally, ACG imply that some leeway in the debt to equity ratio might also be considered:[478]

> There will be a limit to the degree to which a company can increase its gearing to undertake such projects, and at the same time maintain financial viability. Regulators must ensure that the revenue target allowance provides for the regulated utility to maintain its financial viability and a notional investment grade credit rating...
>
> There can be instances of regulated businesses where incremental capital expenditure is very lumpy and a significant equity injection is necessary, as the notional capital structure would be breached for a considerable period (or expected debt covenants associated with the notional capital structure would otherwise be breached). However, ACG is not aware of any specific Australian case in which an SEO raising has been clearly justified for a regulated asset.

910. However, the Authority considers that the benchmark regulatory model assumes a fixed debt to equity ratio in order to reflect the returns that would accrue to a service provider in a commercial enterprise with a similar nature and degree of non-diversifiable risk as the regulated entity. For such an entity, where a large lumpy capital investment is being undertaken that cannot be financed out of retained earnings or standard rates of dividend reinvestment, then new equity raising is justified, with the attendant costs. It is assumed that where equity is raised, an additional amount of equity is raised to cover the SEO transactions costs of raising that equity.

911. Certain parts of the equity raising transactions costs may be deductible for tax purposes in the year of the equity raising – including legal fees, accountants' fees and prospectus costs. However, the Authority considers that these costs are relatively small and hence may be ignored for the purposes of regulatory modelling. SEO investments will generally be required to maintain the debt to equity ratio when there is significant new investment in assets. In this case, the SEO costs are associated with that new investment.

912. On this basis, the Authority considers that SEO costs should be added to the regulated asset base, and depreciated over the life of the assets. To the extent that forecast capital was not spent, then it would not rolled be into the regulated asset base. Then the associated equity raising cost would not be capitalised either.

913. In conclusion, the Authority will estimate equity raising costs for regulated businesses as follows:

- retained earnings of 30 per cent of after-tax profits will be available to increase equity at zero cost;
- dividends will be assumed to be paid at the benchmark payout ratio of 70 per cent of after-tax profits, consistent with the payout ratio used in the estimation of gamma;
- 25 per cent of dividends paid out will be treated as being reinvested through Dividend Re-investment Plans, with an equity raising cost allowance of one per cent applied;
- any further required equity is raised at the SEO cost of 3 per cent – with these costs added to the regulated asset base, at the same time and in proportion to the underlying capital expenditure, and depreciated over the life of the assets.

[478] The Allen Consulting Group 2004, *Debt and Equity Raising Transactions Costs*, www.aer.gov.au, p. 62 and p. 69.

14 Gamma

914. The Authority is required by the new National Gas Rules (**NGR**) to set out its approach to estimating the value of gamma, a parameter in the post tax revenue model. The gamma parameter takes into account the impact the imputation tax system has on the weighted average cost of capital (**WACC**). The imputation tax system removes the possibility of corporate profits 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, a franking credit is distributed to investors at the time dividends are paid, providing a potential offset to those investors' taxation liabilities. A full imputation tax system for companies was adopted in Australia on 1 July 1987.

915. Gamma is the parameter in the WACC that takes into account the value generated by the distribution of franking credits to investors. As a general rule, investors will accept a lower required rate of return on an investment that has franking credits compared with an investment that has similar risk and no franking credits. The precise value investors place on franking credits is ambiguous, given that individual investors have differing circumstances (e.g. differential marginal tax rates and eligibility). In addition, the distribution of franking credits by companies differs primarily as a result of differences in shares of profit that are liable for taxation and the proportion of profits paid as dividends. As a consequence of this variability, the precise value of gamma required under the NGR is difficult to identify.

14.1 Approach

916. The Authority considers that it is appropriate to estimate gamma as the product of two components: (i) the payout ratio (F); and (ii) the market value of imputation credits (θ). This can be represented as follows:

$$\gamma = F.\ \theta \tag{28}$$

917. The Australian Completion Tribunal (the **Tribunal**) has recently adopted a market value of imputation credits of 0.35, together with a payout ratio of 0.70 to produce a gamma estimate of 0.25 in the case of Energex Limited.[479]

918. The Authority considers that an estimate of the payout ratio of 70 per cent is appropriate based on the empirical evidence currently available. This estimate is consistent with the Tribunal's decision with regard to the value of the payout ratio.

919. The Authority notes that three methodologies exist for estimating theta; (i) tax statistics, (ii) dividend drop off (**DDO**) studies; and (iii) the simultaneous price methodology. The Authority notes that tax statistics can only provide an upper bound for the value of theta; whilst simultaneous price studies suffer from a lack of relevant data.

920. The Authority considers that dividend drop-off studies offer a key advantage in that they calculate an observed market value for franking credits. The Authority therefore considers that the dividend drop-off methodology is the most appropriate methodology

[479] Australian Competition Tribunal, Application by Energex Limited (Distribution Ratio (Gamma)) (No 5) [2011] ACompT 9 (12 May 2011), paragraph 42.

for estimating theta. However, dividend drop-off studies are known to suffer from a variety of estimation issues that result in the estimated value of theta being vulnerable to the dividend sample, parametric form of the regression equation and regression technique used. As a consequence, the Authority is of the view that it is more appropriate to use a range of dividend drop-off studies. Given significant changes to the taxation system in the year 2000/01, the Authority considers it appropriate to use post-2000 studies only.

Table 41 Estimated value of theta from relevant dividend drop-off studies

Author	Year	Data	Theta
SFG[480]	2011/ 2013	DatAnalysis, 2000 -2010	0 - 0.35
ERA[481]	2013	Bloomberg, 2001 -2012	0.35 – 0.55

Source: Compiled by the Economic Regulation Authority

921. Table 41 outlines that the permissible range for theta suggested by dividend drop off studies the Authority considers relevant. Given the Tribunal decision, the Authority believes that for the purposes of these guidelines the permissible range of theta is 0.35-0.55. Given the payout ratio of 0.70, the Authority is of the view that the estimated range for gamma is 0.25 to 0.385.

14.2 Reasoning

14.2.1 Gamma in utility regulation

922. 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. A theoretical framework presenting how franking credits alter the after-tax cost of capital was proposed by Officer (1994).[482] This framework is outlined in Appendix 27. It is widely accepted by Australian regulators that the value generated by franking credits is represented by the parameter gamma (γ), which is a product of two components:

- the fraction of imputation credits created that are assumed to be distributed to shareholders (F);
- the market value of imputation credits distributed as a proportion of their face value (θ).

923. It follows that gamma can be represented by the formula set out in equation (28) above.[483]

480 SFG Consulting 2011, Dividend drop-off estimate of theta, Final Report, 21 March.

481 Vo, D., Gellard, B., Mero, S. (2013) *'Estimating the Market Value of Franking Credits, Empirical Evidence from Australia' Conference Paper*, Australian Conference of Economists 2013.

482 RR Officer , Accounting & Finance *The Cost of a Company Under an Imputation Tax System,* May 1994 *p. 1-17.*1994 *p1-17.*1994 *p. 1-17.*

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

924. The Authority has previously adopted a theta of 0.35, together with a payout ratio of 0.70 to produce a gamma of 0.25. These values have been used in the Authority's Draft and Final Decisions on the Proposed Revisions to the Access Arrangement for the Western Power Network.[484] The Authority's adoption of gamma equal to 0.25 is consistent with the Tribunal's decision on the value of gamma in the case of Energex Limited.[485]

925. Despite the Tribunal's rulings on the value of gamma of 0.25, other Australian regulators have continued to apply higher gamma values. Table 42 summarises recent Australian regulatory decisions following the Tribunal's ruling.

Table 42 Estimates of gamma adopted by Australian regulators

Regulator	Year	Gamma
ACCC[486]	2011	0.45
AER	2012	0.25
ERA[487]	2011	0.25
IPART[488]	2012	0.25
QCA[489]	2012	0.5
ESCOSA[490]	2012	0.5

Source: Compiled by the Economic Regulation Authority

14.2.2 The estimated value of the payout ratio

926. Based on a report by SFG Consulting (**SFG**), Dampier to Bunbury Natural Gas Pipeline submitted that the distribution rate, F, can be estimated with reference to observed market data.[491] SFG argued that the payout ratio cannot be set according to a theoretical assumption that is inconsistent with the observed market data. SFG submitted that the Tribunal had ruled that the empirical estimate should be used and that the appropriate estimate is 70 per cent. ENA presents evidence for the empirical estimation of the distribution rate, concluding that 0.7 remains the best empirical estimate for F .[492]

484 Economic Regulation Authority, 2012, *Final Decision on Proposed Revisions to the Access Arrangement for the Western Power Network,* p. 422.

485 Australian Competition Tribunal, Application by Energex Limited (Distribution Ratio (Gamma)) (No 5) [2011] ACompT 9 (12 May 2011), paragraph 42.

486 Australian Competition and Consumer Commission, Inquiry to make final access determinations for declared fixed line services—Final report, July 2011, p. 49.

487 Economic Regulation Authority (Western Australia), Final decision on proposed revisions to the access arrangement for the Dampier to Bunbury natural gas pipeline, October 2011, p. 141.

488 Independent Pricing and Regulatory Tribunal, *Review of imputation credits (gamma)*, March 2012, p. 1.

489 Queensland Competition Authority, Final report, Sunwater irrigation price review 2012–17, Volume 1, May 2012, p. 498.

490 Essential services commission of South Australia, Advice on a regulatory rate of return for SA Water—Final advice, February 2012, p. 49.

491 Strategic Finance Group, *Estimating Gamma, Report for DBP*. 4 March 2012.

492 Energy Networks Association, *Response to Draft Rate of Return Guideline of the Australian Energy Regulator,* 11 October 2013. p. 53

927. Empirical evidence assembled by Hathaway and Officer (2004) suggests the annual payout ratio of a company in Australia is 0.71.[493] As a consequence, 71 per cent of the return of equity is assumed to be in the form of dividends with corresponding franking credits attached. Therefore, it is assumed that 71 per cent of all imputation credits are distributed to shareholders in the same year they are created. In 2011, the Tribunal ruled that the appropriate value for the payout (distribution) ratio, F, was 0.70, based on the analysis undertaken by Hathaway and Officer.[494]

928. The Authority is of the view that existing evidence supports the use of a range for the payout ratio of between 70 per cent and 100 per cent. The lower bound of 70 per cent is based on empirical evidence of Hathaway and Officer, and the upper bound of 100 per cent is based on the assumption that all profits are distributed by firms in the year they are created. However, in the absence of any new evidence or analysis, the Authority has no basis to depart from the finding of the Tribunal and considers that an appropriate estimate of the payout ratio is 0.70.

14.2.3 The estimated value of theta

929. The estimate of theta (**θ**) has attracted significant debate in the context of utility regulation. As noted in the Authority's consultation paper, there have been a number of studies conducted which have attempted to estimate the value of theta. In estimating a value for theta, regulators and academics have relied on three different approaches: (i) tax statistics, (ii) dividend drop off studies; and (iii) the simultaneous price methodology. The current practice used in estimating the value of theta for the purposes of regulation is the dividend drop off methodology. Each of these three approaches is discussed in turn below.

14.2.3.1 Tax statistics methodology

930. Tax statistics estimate the utilisation of imputation credits, which is a measure of the imputation credits redeemed by shareholders. This methodology 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. 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. It follows that the average market value of a franking credit is equal to the proportion of franking credits redeemed.[495]

931. Hathaway and Officer (2004) examined national tax statistics in order to estimate the average value of redeemed imputation credits from 1988 to 2002.[496] They calculated that 71 per cent of company tax payments had been distributed as imputation credits on average and estimated that 40 to 50 percent of the distributed credits were redeemed by taxable investors. Taking these two factors into account indicated to the authors that the statutory company tax rate is reduced by 28 to 36 percent. This suggested that the effective rate of company taxation is around 19 to 21 percent. They estimated a value of gamma within a range of 0.38 to 0.44. However, they noted

493 Hathaway, N.J., and Officer, R.R. (2004), *The Value of Imputation Tax Credits,* Working paper, Melbourne Business School.

494 Ibid.

495 NERA Economic Consulting, *The Value of Imputation Credits*, A report for the ENA, Grid Australia and APIA, 11 September 2008, p. 23.

496 NJ Hathaway & RR Officer, *The Value of Imputation Tax Credits,* working paper, Melbourne Business School, 2004, p. 14.

that some of their data is not reliable.[497] Handley and Maheswaran (2008)[498] examined the reduction in individual's tax liabilities due to imputation credits from 1988 to 2004. 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.

932. The Authority considers that tax statistics, while not suffering methodology issues, are irrelevant for the direct estimation of theta because they fail to take into account the costs investors incur in obtaining franking credits. These costs result in franking credits being valued at less than their face value. In order to qualify for franking credits, investors must take on risk by purchasing and/or holding stocks. In addition, domestic investors forgo the benefits of international diversification and incur transaction costs by qualifying for franking credits. International investors, who cannot utilise franking credits to reduce their personal taxation liability, place no value on franking credits. As a result, tax statistics cannot provide an accurate measure of the market value of franking credits. Tax statistics can only provide a theoretical upper bound in a situation where franking credits are costless to obtain. The Tribunal has recently addressed the use of tax statistics studies. The Tribunal ruled that aggregate tax statistics should not be used to produce an estimate of theta. The Tribunal was of the view that tax statistics can only be used to produce an upper bound that can be used as a cross-check of the reasonableness of an estimate produced by some other means. The Tribunal noted that the correct approach to estimating theta is through the use of market data rather than tax statistics.[499]

933. The use of tax statistics was highlighted in submissions to the Authority. Energy Networks Association (**ENA**) submitted that taxation statistics can only provide an upper bound estimate for the estimate of theta. Dampier to Bunbury Pipeline (**DBP**) noted the Authority's continued support of market based methods in contrast to the AER's position of using taxation statistics to inform the value of theta.[500] DBP consider that the AER has deviated from best practice on this issue, and noted that the use of taxation statistics has previously been dismissed by the Tribunal.

14.2.3.2 Simultaneous price studies

934. The simultaneous price methodology infers a value for franking credits (and a corresponding value for cash dividends) by observing prices of shares in a company (which entitle the holder to dividends and the associated franking credits) and derivatives contracts on the same stock (which involve no such entitlement). The difference in the prices of the stock and the implied price of the stock from the derivatives contract provides an estimate of the value of the dividend and the associated franking credit.

935. Cannavan, Finn and Gray (2004)[501] inferred the value of franking credits from the relative prices of derivatives contracts on the individual stocks on which they are based. These authors note the problems with the dividend drop off methodology such

[497] NJ Hathaway & RR Officer, *The Value of Imputation Tax Credits,* working paper, Melbourne Business School, 2004, p. 14.

[498] Handley, J. And Maheswaran, K. (2008), "A Measure of the Efficacy of the Australian Imputation Tax System", *the Economic Record*, Vol 84, No. 264, pp. 82-94.

[499] Australian Competition Tribunal, *Application by Energex Limited (Distribution Ratio (Gamma))* (No 3) [2010] ACompT 9 (24 December 2010).

[500] DBNGP (WA) Transmission Pty Ltd 2013, *Response to ERA Draft Regulatory Guidelines*, 23 September, p. 41.

[501] Cannavan, D, Finn F. & Gray,S. 'The value of dividend imputation tax credits in Australia', Journal of Financial Economics,73,2004, p. 192.

as considerable heteroscedasticity, multicolinearity, the assumption of a constant value of theta across companies and time as well as microstructure effects. By comparing the prices paid for futures contracts and low exercise price options with the price of the shares, the market value of franking credits is inferred. The study utilised shares from ANZ, BHP, Westpac, Newscorp, National Australia Bank, Western Mining Corporation, MIM Holdings Limited and Rio Tinto and the derivatives written on those shares. They consider the impact of the introduction of the 45 day holding period rule tax on the value of gamma. It was concluded that cash dividends are fully valued by the market. Prior to the introduction of the 45 day holding period rule, franking credits were valued at up to 50 per cent, whilst after the introduction, they were valued at zero.[502]

936. SFG submitted that the best available estimate of theta was using the simultaneous security price method from the above 2004 study by Cannavan, Finn and Gray.[503] As a consequence, they suggested that the value of theta should be zero. SFG noted that this estimate of theta in the study is conditional on cash dividends being valued at full face value.

937. The Authority agrees that simultaneous price studies may be useful for the purpose of estimating the appropriate value for theta. This is a consequence of the simultaneous price methodology having the advantage of providing a market based estimate for the value of franking credits, without the methodological issues associated with the dividend drop off technique. However, the Authority is only aware of a single such study having been undertaken in Australia. In addition, the Authority considers that this study only examined a very limited number of derivative contracts; the estimate of theta from this study cannot be a representative estimate of the market value of franking credits for the entire Australian financial market. As a consequence, while simultaneous price studies offer an estimate of the market value of franking credits, they are limited by the small sample size of securities available. The Authority concludes that simultaneous price studies are not appropriate for estimating the value of theta at this time.

14.2.3.3 Dividend drop-off studies

938. 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. By performing this analysis over a long period of time and across a large number of dividend events, an average market valuation of franking credits can be obtained.

939. DDO studies are based on the assumption of 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 other influence other then 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.

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502 Cannavan, D, Finn F. & Gray,S. 'The value of dividend imputation tax credits in Australia', *Journal of Financial Economics*,73,2004, p. 192.

503 Strategic Finance Group, *Estimating Gamma, Report for DBP*. 4 March 2012.

In addition, given that investors will not fully value the combined package of the gross dividend[504], the expected price drop-off should be less than that of the face value.

940. Formally, this assertion can be expressed as:

$$E \mid P_{c,i} - P_{x,i} \mid = \gamma_1 D_i + \gamma_2 FC_i \quad (29)$$

where

$E \mid P_{c,i} - P_{x,i} \mid$ is the expected price drop-off from the cum-dividend day price $P_{c,i}$, to the ex-dividend day price $P_{x,i}$;

γ_1 is the value investors place on the cash dividend (also referred to as the net dividend) D_i, as a proportion of its face value; and

γ_2 is the value investors place on the franking credit FC_i, as a proportion of its face value.

941. To estimate the values of γ_1 and γ_2, regression procedures are employed by collecting data on historical dividend events. The regression equation to be estimated is:

$$P_{c,i} - P_{x,i} = \gamma_1 D_i + \gamma_2 FC_i + \varepsilon_i \quad (30)$$

942. Where ε_i is an error term designed to capture all other factors that influence the DDO outside of the cash dividend and franking credit. It is often assumed that ε_i is a normally distributed random variable with $E[\varepsilon_i] = 0$.[505]

943. There are a number of variations of the dividend drop-off studies that have been conducted in Australia, including Walker and Partington (1999), Hathaway and Officer (2004) and Beggs and Skeels (2006). Table 31 below contains a summary of the various DDO studies conducted in Australia. ENA has recently submitted a report from Professor Stephen Gray, the Author of the previous dividend drop off study considered by the Tribunal.[506] This updated report updates the original data set with new dividend data from September 2010 to October 2012. Gray utilised the same methodology from his original dividend-drop off study.[507] Gray concludes that the appropriate value of theta is still 0.35, and that the results from his earlier study remain valid when this updated dataset is considered.

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504 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.

505 The combined value of the net dividend (D_i) and franking credit (FC_i) is referred to as the gross dividend (G_i).

506 Ibid.

507 SFG Consulting 2011, *Dividend drop-off estimate of theta, Report for the Australian Competition Tribunal*, 21 March 2013.

944. The key advantage of DDO studies is that they can be used to provide an estimate of the observed market value of dividends and imputation credits. However, it has been noted that DDO studies have substantial measurement and estimation issues. A recent paper by McKenzie and Partington has highlighted the imprecision inherent in the dividend drop off methodology.[508] 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 theta from various dividend drop-off studies. Appendix 28 contains a detailed discussion on the estimation issues of dividend drop off studies. The estimation issues associated with dividend drop off studies manifest themselves by the lack of consensus in the literature about the estimate of theta, with its value varying between 0 and 0.57 in recent studies. Table 43 below presents findings from the most recent dividend drop off studies in Australia:

Table 43 Estimated Value of Theta from Various Australian DDO Studies

Author	Year	Data	Techniques	Theta
Brown & Clarke[509]	1993	Statex, Melbourne and Australian Stock Exchange publications, 1973 - 1991	OLS Regression	0.72
Hathaway & Officer[510]	2004	Australian Tax Office and ASX/S&P 500, 1986 - 2004	Generalised Least Squares	0.49
Bellamy & Gray[511]	2004	1995 -2002	Unknown	0.00
Beggs & Skeels[512]	2006	CommSec Share Portfolio 1986 - 2004	Generalised Least Squares	0.57
SFG[513]	2007	Securities Industry Research Centre of Asia-Pacific and FinAnalysis, 1998 - 2006	Generalised Least Squares	0.23
SFG[514 515]	2011/2013	DatAnalysis, 2000 -2012	Generalised Least Squares	0.35

Source: Compiled by the Economic Regulation Authority

945. ATCO Gas Australia (**ATCO**) submitted that it was of the view that the dividend drop off study undertaken by SFG in 2011 for the Australian Energy Regulator to be the best estimate of gamma that is currently available. ATCO notes however that it is possible that in the future, a new estimate of gamma may be estimated. SFG also

508 McKenzie, MD & 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.

509 Brown, P. and Clarke, A. (1993), 'The Ex-Dividend Day Behaviour of Australian Share Prices Before and After Dividend Imputation', *Australian Journal of Management,* 1993.

510 Hathaway, N.J. and Officer R.R. (2004), The Value of Imputation Tax Credits, Working paper, Melbourne Business School.

511 Gray, S. and Bellamy, D. (2005). Using stock price changes to estimate the value of dividend franking credits. In: P. Gray and E. Margiolis, 2005 Annual Conference Program & Abstracts. AFAANZ 2005 Conference, Melbourne, (108-108). 3-5 July, 2005.

512 Beggs, D.J. and Skeels, C.L. (2006), 'Market Arbitrage of Cash Dividends and Franking Credits', *The Economic Record*, Vol. 82, No. 258, pp .239–252.

513 Strategic Finance Group (SFG), *The impact of franking credits on the cost of capital of Australian companies*, Report prepared for ENA, APIA and Grid Australia, October 2007, pp. 35, 45.

514 SFG, Dividend drop-off estimate of theta, Final Report, 21 March 2011.

515 SFG Consulting 2013, *Updated dividend drop-off estimate of theta, Report for the Energy Networks Association,* 7 June 2013.

agreed with the Tribunal that the best available dividend drop-off estimate of theta is 0.35 – from the earlier SFG study in 2011.

946. The Tribunal considered the issue of gamma in its decision on the application of Energex Limited.[516] The Tribunal ruled that the appropriate value for the distribution ration, F, was 0.70 based on the analysis of Hathaway and Officer (2004).[517] On the estimate of theta, the Tribunal relied solely on the use of DDO studies. Of particular note, the Tribunal chose to disregard the use of the Beggs and Skeels (2006) study.[518] The Tribunal concluded that SFG's final 2011 study was the best DDO study available, and as a consequence, the Tribunal used the results of the study in its determination of theta. The Tribunal also noted that the estimate of gamma is an "ongoing intellectual and empirical endeavour".[519] The Tribunal ruled that an appropriate value for gamma is 0.25, given the value of the distribution ratio F of 0.70 and a value of θ of 0.35.

947. Given the lack of consensus on the market value of franking credits θ, the Authority conducted its own study in 2013.[520] A dividend sample was constructed using well known filters available from the literature and previous DDO studies. Regression techniques and parametric forms of the dividend drop–off equation were also sourced from the literature and other studies. Initial estimates of the value of theta were calculated and then a sensitivity analysis was performed to ascertain the robustness of the estimates.

948. The dividend sample was constructed by observing all securities listed on the Australian Stock Exchange for the period from 1 July 2001 to 1 July 2012 using the Bloomberg terminal. The sample period was selected to begin from 1 July 2001 to avoid structural changes in the company tax rate and imputation credit system in Australia. Only equities listed on the Australian Stock Exchange (ASX) were included. Duplicates were removed to leave a list of 2,595 unique tickers. Of these, anything that was not classed as "common stock" was excluded.

949. Dividend distribution events for the period were obtained using the Bloomberg spreadsheet calculator "xdvd". Any distribution event that was not classed as regular cash, interim, final or special cash was removed. All dividends that occurred on the same day for a particular stock were aggregated.[521] Dividend events that are classified as special cash only were then removed, as is consistent with other dividend drop off studies.[522,523] In addition, companies that engaged in stock splits/share buy

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516 Australian Competition Tribunal, Application by Energex Limited (Gamma) (No 5) [2011] ACompT 9 (12 May 2011), paragraph 42.

517 NJ Hathaway & RR Officer, *The Value of Imputation Tax Credits,* working paper, Melbourne Business School, 2004.

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

519 Australian Competition Tribunal, Application by Energex Limited (Gamma) (No 5) [2011] ACompT 9 (12 May 2011), paragraph 45.

520 Vo, D., Gellard, B., Mero, S. (2013) *'Estimating the Market Value of Franking Credits, Empirical Evidence from Australia' Conference Paper*, Australian Conference of Economists 2013.

521 Special cash dividends are known to be distributed with final or interim dividends.

522 DJ Beggs & CL Skeels, 'Market Arbitrage of Cash Dividends and Franking Credits', *The Economic Record*, vol 82, no 258, 2006, *Appendix II*.

523 Whilst individual special cash dividends are considered unreliable, it is common for companies to distribute a special cash dividend in conjunction with a final or interim dividend. Removing the special cash dividends before the aggregation would imply that the price drop off is due solely to the other dividend, creating an upward bias in the estimate of theta.

backs 5 days either side of a dividend event where removed from the sample.[524] [525] This left a list of 8,224 dividend events for 827 unique tickers.

950. The following fields were collected for each dividend event:

- The cum-dividend date closing price.[526]
- The ex-dividend date closing price.[527]
- The gross dividend.[528]
- The net dividend.[529]
- The market capitalisation of the underlying stock on the ex-dividend date.[530]
- The market capitalisation of the all ordinaries index on the ex-dividend date.[531]
- The currency of the dividend event.[532]
- The exchange rate for the dividend currency on the ex-dividend date. [533]
- The return of the All Ordinaries Index on the ex-dividend date.[534]

951. The sample was further reduced to include only companies that make up at least 0.03 per cent of the All Ordinaries index on the day of the ex-dividend date. This is consistent with other dividend drop off studies and with the approach taken by the AER.[535] [536] Any stock found to be paying a dividend denominated in currency other than the Australian dollar was converted to Australian dollars using the closing price exchange rate on the ex-dividend date.[537] Any dividend event that had missing data was removed from the sample. The final sample contains 3,309 dividend events.

952. To mitigate the issues that exist with dividend drop-off studies, the Authority estimated the value of theta using regression techniques that are robust to deviations from traditional regression assumptions. Given the weaknesses of OLS regression, the Authority derived the estimate of theta using Least Absolute Deviations (**LAD**) and Robust regressions. Estimates of theta using the OLS regressions were calculated for comparison purposes. LAD regression has been used by the Authority in past decisions relating to the estimation of equity beta, as it reduces the influence of outliers on the estimate.[538] In addition, various forms of robust regression have been

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

525 This ensures that the price change due to a capitalisation change has no impact on the estimate of theta.

526 Using the *PX_LAST* field in Bloomberg

527 Ibid.

528 Field part of the xdvd spreadsheet

529 Ibid.

530 Using the field in Bloomberg CUR_MKT_CAP

531 Ibid.

532 Field part of the xdvd spreadsheet

533 Using the PX_LAST field for the given currency

534 Calculated by observing the price of the all ordinaries index on the ex-dividend day and the previous trading day using the PX_LAST field in Bloomberg

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

536 SFG, *Dividend drop-off estimate of theta, Final Report*, 21 March 2011

537 It is not clear if this was performed in previous DDO studies.

538 Economic Regulation Authority, Final Decision on Proposed Revisions to the Access Arrangement for the Western Power Network, September 2012, p. 406.

developed for their ability to handle violations of regression assumptions.[539] MM regression has the highest breakdown point and statistical efficiency of robust regression estimators currently available, as a consequence it was also utilised by the Authority in this study. Robust regression was first suggested by McKenzie and Partington in their dividend drop off analysis.[540]

953. Dividend drop off studies are known to contain heteroscedasticity. In order to perform Ordinary Least Squares (**OLS**) analysis, a constant variance term (or homoscedasticity) is required. It is common to adjust the dividend drop-off equation in order to account for this by assuming that the error term of the regression is associated with a variable in the dividend event. The models used by the Authority were sourced from the literature and are shown in Table 44 below.

Table 44 Models used in Authority's 2013 study

Model	Parametric Form	Scaling Factor	Form of Heteroscedasticity
Model 1	$\frac{P_{c,i}-P_{e,i}}{P_{c,i}}=\gamma_1'\frac{D_i}{P_{c,i}}+\gamma_2'\frac{FC_i}{P_{c,i}}+\varepsilon_i'$	$P_{c,i}$	$\sigma_i^2=kP^2{}_{c,i}$
Model 2	$\frac{P_{c,i}-P_{x,i}}{D_i}=\gamma_1''+\gamma_2''\frac{FC_i}{D_i}+\varepsilon_i''$	D_i	$\sigma_i^2=kD_i^2$ [541]
Model 3	$\frac{P_{c,i}-P_{x,i}}{D_{ii}s_{e,i}}=\gamma_1'''\frac{1}{s_{e,i}}+\gamma_2'''\frac{FC_i}{D_is_{e,i}}+\varepsilon'''_i$	$D_is_{e,i}$	$\sigma_i^2=k(D_is_{e,i})^2$
Model 4	$\frac{P_{c,i}-P_{x,i}}{P_{c,i}s_{e,i}}=\gamma_1''''\frac{D_i}{P_{c,i}s_{e,i}}+\gamma_2''''\frac{FC_i}{P_{c,i}s_{e,i}}+\varepsilon''''_i$	$P_{c,i}s_{e,i}$	$\sigma_i^2=k\left(P_{c,i}s_{e,i}\right)^2$

where

$P_{c,i}$ is the cum-dividend price of dividend event i;

$P_{x,i}$ is the ex-dividend day price of dividend event i;

D_i is the cash dividend of dividend event i;

FC_i is the franking credit of dividend event i;

γ_1 is the market value of the cash dividend;

539 Huber, P.J (1996). *Robust Statistical Procedure,. Second edition,* Philadelphia, SIAM p. 1.

540 McKenzie, MD & 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

γ_2 is the market value of the franking credit;

σ_i^2 is the variance of the error term of dividend event i, $Var[\varepsilon_i] = \sigma_i^2$; and

$s_{e,i}$ is the historical excess return volatility of stock i.

954. Table 44 contains the four models that were used by the Authority to estimate theta. SFG also utilised these models in their DDO study.[542] Models 1 and 2 are equivalent to the models utilised by Hathaway and Officer in their 2004 study,[543] although they use franking proportion as opposed to the franking credit variable.[544]

955. The final econometric issue relates to the so-called "market return correction". Several DDO studies utilise an adjustment for taking into account the market returns on the ex-dividend day price.[545] [546] This approach assumes that each stock has a beta of 1, and returns are fully explained by the Sharp-Linter Capital Asset Pricing Model. Such an assumption is particularly strong especially in the context of this study where the stocks included have a market capitalisation greater than 0.03 per cent of the All Ordinaries Index. It has been argued by McKenzie and Partington (2010) that this adjustment will have no impact on the final value of theta. Beggs and Skeels (2006) noted that this adjustment is imperfect.

956. However, this adjustment is commonly adopted and was notably adopted in the SFG's paper in 2011. This was on the recommendation of the AER as SFG did not perform the market return correction in their 2007 DDO study.[547] The adjustment was performed in the Authority's study to enable a comparison of results to those from other studies. The Authority is of the view that applying the market correction is incorrect in determining an appropriate value for theta. Market fluctuations mask investor's true valuations of franking credits, but are random and therefore already accounted for by the error term in the regression models. The Authority notes that the theoretical model of dividend drop off (equation 29) assumes that the resulting drop off is caused *only* by the distribution of franking credits and net dividends. The error term, ε_i is designed to capture all other factors that influence the DDO outside of this model. Additionally, the Authority considers that the required market value of franking credits is one that in unconditional on market movements. That is, the required value for theta is one that does not assume aggregate market movements are known in advance for investors.

957. The value of theta was found to fall within a wide range from 0.11 to 0.73 using standard econometric techniques and 0.35 to 0.55 using more robust techniques. The study showed that the DDO methodology is extremely sensitive to: (i) the underlying construction of the sample, (ii) the parametric specification of the model; and (iii) the regression technique applied. It was observed that the presence of a relatively small percentage of observations can heavily influence the estimate of theta. The issue of heteroscedasticity and the presence of outliers were controlled for, but multicolinearity

542 Strategic Finance Group, *Dividend Drop-Off Estimate of Theta, Final Report*, 21 March 2011.

543 Hathaway, N.J., and Officer, R.R. (2004), *The Value of Imputation Tax Credits,* Working paper, Melbourne Business School.

544 It can be shown they are equal.

545 Strategic Finance Group, *Dividend drop-off estimate of theta, Final Report*, 21 March 2011.

546 Beggs, D. & Skeels, C. 'Market Arbitrage of Cash Dividends and Franking Credits', *The Economic Record*, vol 82, no 258, 2006, pp. 239–252.

547 Strategic Finance Group (SFG), *The impact of franking credits on the cost of capital of Australian companies*, Report prepared for ENA, APIA and Grid Australia, October 2007, pp. 35, 45.

is still an issue as it is an inherent property of the data. Further details on the Authority's empirical study on the estimate of theta can be found in Appendix 25 and Appendix 27. As a result of this study, the Authority considers that any estimate of theta is essentially a function of the most influential observations due to the extreme multicolinearity present in the data. Indeed, this multicolinearity explains the large divergence and lack of consensus in the economic and financial literature.

958. With respect to the gamma parameter, DBP supported the use of the Authority's recent econometric work on gamma stating that they "do not have any in-principle concerns with the Authority's work on gamma".[548] DBP noted the ERA's continued use of dividend drop off studies is in contrast to the AER's position of using taxation statistics to inform the value of theta.[549] DBP consider that the AER has deviated from best practice on this issue, and noted that the use of taxation statistics has previously been dismissed by the Tribunal.

959. The Authority considers that dividend drop off studies offer a key advantage in that they calculate an observed market value of franking credits. However, dividend drop off studies are known to suffer from a wide variety of estimation issues that result in the estimated value of theta being vulnerable to the dividend sample, parametric form of the regression equation and regression technique used.[550,551] These issues are highlighted in Appendix 28. As a consequence, the Authority is of the view that it is more appropriate to use a range of dividend drop-off studies. Given significant changes in the year 2000/01, as set out in Vo et al (2013) the Authority considers it appropriate to use post-2000 studies only.[552] In addition, due to the lack of statistical precision inherent in the estimation of theta, the Authority considers that a range of values implied by these studies should be considered. The Authority considers the most relevant dividend drop off studies currently available are the Tribunal accepted SFG study and the analysis contained in Vo et al (2013).[553] Based on this evidence, the Authority concludes that an acceptable range for theta is currently between 0.35 to 0.55.

14.2.4 Adjustment of gamma in the rate of return

960. SFG submitted to the Authority that the dominant market practice is to make no adjustment in relation to imputation credits.[554] However, SFG noted that the current approach by Australian regulators is to make two adjustments. First, the estimate of market risk premium (**MRP**) is "grossed-up" to incorporate the assumed effect of imputation credits. Second, the with-imputation estimate of the required return on equity is adjusted downwards to determine the ex-imputation required return on equity. Handley (2010) has advised the AER that the first step involves a "gross-up" and then

548 DBNGP (WA) Transmission Pty Ltd 2013, *Response to ERA Draft Regulatory Guidelines*, 23 September, p. 41.

549 DBNGP (WA) Transmission Pty Ltd 2013, *Response to ERA Draft Regulatory Guidelines*, 23 September, p. 41.

550 Vo, D., Gellard, B., Mero, S. (2013) 'Estimating the Market Value of Franking Credits, Empirical Evidence from Australia' Conference Paper, *Australian Conference of Economists 2013.*

551 McKenzie, MD & 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.

552 Vo, D., Gellard, B., Mero, S. (2013) *'Estimating the Market Value of Franking Credits, Empirical Evidence from Australia' Conference Paper*, *Australian Conference of Economists 2013.*

553 Ibid.

554 Strategic Finance Group, *Estimating Gamma, Report for DBP*. 4 March 2012.

the second step should have "the effect of reversing that gross-up."[3] SFG considered that a minimum requirement under the Rules is that the regulator is required to:

- implement the market practice approach, specifying its estimate of the MRP unadjusted for imputation credits;
- demonstrate that the two steps of the regulatory approach have the effect of reversing each other in accordance with Handley (2010); and
- as a general WACC estimation principle, for a given parameter, the same value must be adopted consistently throughout a single WACC estimation process. This principle is a requirement under NGR 87(4)(b).

961. The Authority notes there are three separate sub-issues raised by SFG under this issue.

962. First, SFG submitted that market professionals make no adjustment for imputation credits when estimating WACC or when valuing firms. Consistent with its previous decisions, the Authority had considered the advice of McKenzie and Partington (2010) to the AER on the issue.[555] McKenzie and Partington advised that the 2008 Truong, Partington and Peat study found that the majority of firms do not account for the value of imputation credits because it is too difficult to do so.[556] In addition, this study also finds that only 6 out of 89 firms surveyed cited that the reason they did not incorporate a value for gamma was because they considered that imputation credits have zero market value. In addition, on the advice to the AER, Handley states that, under the conventional approach to valuation (i.e. no imputation credits), Australian firms and independent valuation practitioners recognise that there is no explicit recognition of the value of imputation credits in either the cash flows or in the discount rate.[557] On this basis, imputation credits are not assumed to have zero value but rather they are simply not explicitly taken into account in either the cash flows or in the discount rate. Based on the above considerations, together with the fact that imputation credits have value to investors and the presence of domestic investors in the regulated Australian utilities, the Authority is of the view that setting the value of gamma to zero is not appropriate.

963. *Second*, this issue is related to the "grossed up" and the "reverse of the grossed up" taking into account the value of imputation credits. The Authority is aware that Professor Handley, the AER's consultant, has responded to this concern.[558] A key response can be briefly summarised below. Handley[559] distinguished two types of cost of equity. The conventional cost of equity represents the "*after-company-after-some-personal tax*" cost of equity, because company profits have been taxed before they are paid out as dividends to shareholders. The grossed-up cost of equity represents the "*after-company-before-personal tax*" cost of equity because the payment of imputation credits removes the effect of taxation on company profits that are eventually paid out as dividends. As such, the investor will not be double taxed on their dividend returns –

555 McKenzie and Partington, Report to the AER, Evidence and submissions on gamma, 25 March 2010, pp. 27-28.

556 G. Truong, G. Partington and M. Peat, 'Cost of capital estimation and capital budgeting practices in Australia', *Australian Journal of Management*, Vol. 33, No. 1, June 2008.

557 Handley, Report prepared for the Australian Energy Regulator on the estimation of gamma, 19 March 2010, pp. 3-4.

558 Handley, Report prepared for the Australian Energy Regulator on the estimation of gamma, 19 March 2010, p. 10.

559 Handley, Report prepared for the Australian Energy Regulator on the estimation of gamma, 19 March 2010, p. 10.

the imputation credits paid can be collected from the tax office either as an offset or a tax refund.

964. The conventional cost of equity is therefore formulated as follows:

$$r_e^{adjusted} = r_e \left[\frac{1-T}{1-T(1-\gamma)} \right] \quad (31)$$

where

r_e is the grossed-up cost of equity; and

T is the corporate tax rate.

965. Handley demonstrated that if the change to the grossed-up cost of equity is correctly incorporated, an increase in gamma would increase both the grossed-up cost of equity and the conventional cost of equity.[560] Based on Handley's advice, the Authority considers SFG's criticisms invalid.

966. *Third*, SFG submitted that the same value of gamma (more specifically, the payout ratio) must be used consistently in the entire process of the rate of return estimation process. However, Professor Handley's advice to the AER indicated that two classes of empirical evidence may generally relied upon, and used differently:[561]

- U.S. dividend yield studies provide evidence that dividends are "fully valued" – cash dividends are valued at 100 cents per dollar. This means that differential taxes have no effect on prices, and so differential taxes do not need to be taken into account in estimating equity returns.
- U.S. dividend drop-off studies provide evidence that dividends are "less than fully valued", which means that cash dividends are valued at less than 100 cents in the dollar (due to the impact of differential taxes), and so differential taxes do need to be taken into account in estimating gamma.

967. As such, Handley was of the view that the AER, in its 2009 WACC Review, was relying on the appropriate evidence in the appropriate context (i.e. dividend yield studies in relation to the CAPM and drop-off studies in relation to gamma). Based on the above considerations, and in line with its previous decisions, the Authority is of the view that there is no inconsistency when the estimates of the value of cash dividends are used differently: (i) less-than-100 cents per dollar when theta (then gamma) is estimated and (ii) 100 cents per dollar when return on equity is estimated.

560 Handley, Report prepared for the Australian Energy Regulator on the estimation of gamma, 19 March 2010, p. 21.

561 Handley, Report prepared for the Australian Energy Regulator on the estimation of gamma, 19 March 2010, pp. 24-5.

15 Inflation

968. Inflation is defined as the rate of change in the general level of prices of goods and services. A nominal rate of return incorporates the 'real' rate of return, as well as a component rate that reflects expectations of inflation.

969. In line with the requirements of the National Gas Rules (**NGR**), the Authority will utilise a nominal vanilla rate of return for its future decisions.

970. 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 NGR, a reliable method for estimating the inflation rate that will prevail over the 5 years of the relevant access arrangement is required.

971. 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;[562]
- to back out the expected inflation underpinning the nominal building block allowances in the tariff variation mechanism, to allow account for subsequent actual inflation.

972. The expected rate of inflation will also allow stakeholders to determine the real rates of change in tariffs, as well as the real rate of return, which is an important contributor to the real changes in tariffs.

15.1 Approach

973. The expected inflation rate will be estimated using the Treasury bond implied inflation approach. The approach uses the Fisher equation and the observed yields of 5-year Commonwealth Government Securities (**CGS**) (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).[563,564]

974. The Authority will estimate the expected inflation rate consistent with the estimate of the risk-free rate by adopting an averaging period of 40 trading days prior to an access arrangement determination.

975. Linear interpolation will be used 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.[565]

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562 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 2010, *Amendment: Electricity transmission network service providers: Post tax revenue model*, www.aer.gov.au).

563 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.

564 ERA (September 2012) Final Decision, *Proposed Revisions to the Access Arrangement for the Western Power Network*

565 It is not common to observe a CGS bond with an expiry date that exactly matches that of the regulatory period end. As such, 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 term of the resulting average expected inflation rate is 5 years, consistent with the length of the access arrangement period.

976. The Authority considers that this approach is appropriate for deriving expected rates of inflation. 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.

977. However, the Authority is aware that under some circumstances this approach may be problematic. For example, during the recent global financial crisis there were liquidity issues in the Treasury indexed bonds market which significantly increased the potential for bias in the estimate of a real risk-free rate. In such circumstances, another approach – such as the Reserve Bank of Australia's (**RBA**) Inflation Forecast approach method – may be preferred (see paragraph 995 below).

15.2 Reasoning

978. The Authority currently uses the Treasury bond implied inflation approach in order to estimate the inflation rate expected to prevail over the course of a regulatory control period. The Authority notes that Australian regulators have adopted 3 methods for estimating expected inflation (i) The Treasury Bond approach (ii) Inflation Swap approach (iii) RBA Inflation forecast approach. Table 45 contains a summary of the approaches used by Australian regulators in past regulatory decisions for estimating the expected inflation rate.

15.2.1 The Treasury bond implied inflation approach

979. The Treasury bond implied inflation approach derives the expected inflation rate using the Fisher equation from observed yields of, for example:

- 5-year CGSs – 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.[566]

980. Linear interpolation is used to derive both the nominal risk-free rate and the real risk-free rate. Estimates tend to be either for a term of 5 or 10 years (Table 45). 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.

the regulatory period end date by assuming a linear increase in yields between the straddle dates on the two bonds observed.

566 ERA (September 2012) Final Decision, *Proposed Revisions to the Access Arrangement for the Western Power Network.*

Table 45 Estimating the expected Inflation rate in Australian regulatory decisions

Regulator	Year	Industry	Methodology	Term of expected inflation
ACCC[567]	2011	Fixed Line Services (Telecommunications)	RBA Inflation forecast method.	10 Years
AER[568]	2012	Gas Distribution Network	RBA Inflation forecast method.	10 Years
ERA[569]	2012	Electricity Distribution/Transmission	Treasury bond Implied Inflation method.	5 Years
ERA[570]	2011	Gas Transmission	RBA Inflation forecast method.	5 Years
IPART[571]	2012	Water, sewerage, stormwater drainage and other services	Implied Inflation via Inflation swaps	10 Years[572]
QCA[573]	2012	Water, sewerage, stormwater drainage and other services	Midpoint of RBA Inflation Target Range (2.5%)	5 Years
ESCOSA[574]	2012	Water, sewerage, stormwater drainage and other services	Treasury bond Implied Inflation method.	10 Years

Source: Compiled by the Economic Regulation Authority

981. The rationale for this approach is due to the yields between the yield on CGS and Treasury Indexed bonds differing only by an inflation component. The yield on CGS can be decomposed into three components: (i) The real yield[575]; (ii) compensation for a reduction in purchasing power caused by the expected inflation rate (iii) 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.[576] In comparison, the yield on treasury indexed bonds contains only the real yield and a term premia. By using the Fisher equation, a "break-even" inflation rate can be estimated which estimates the inflation rate *and* inflation premium component of the CGS.

567 Australian Competition and Consumer Commission, *Inquiry to make final access determinations for declared fixed line services — Final report*, July 2011, p. 34.

568 Australian Energy Regulator, *Access Arrangement final decision Envestra Ltd 2013-17 Part 1,* March 2013, p. 30.

569 Economic Regulation Authority (Western Australia), *Final decision on proposed revisions to the access arrangement for Western Power*, 2012.

570 Economic Regulation Authority, *Final Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline*, 31 October 2011, p. 158.

571 Independent Pricing and Regulatory Tribunal, *Review of prices for Sydney Water Corporation's water, sewerage, stormwater drainage and other services, From 1 July 2012 to 30 June 2016*, p. 205.

572 Independent Pricing and Regulatory Tribunal, *Adjusting for expected inflation in deriving the cost of capital, Analysis and Policy Development – Final Decision*, 1 May 2009 p. 6.

573 Queensland Competition Authority, *Final report, Sunwater irrigation price review 2012–17, Volume 1, May 2012*, p. 201.

574 Essential services commission of South Australia, *Advice on a regulatory rate of return for SA Water—Final advice*, February 2012, p. 9.

575 The real yield is defined as the compensation bond holders demand for foregoing consumption.

576 The Australian Treasury (August 2012) *Measuring market inflation expectations.*

982. 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 that instant in time. The period around the Global Financial Crisis 2008-2009 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 Authority discontinued the use of this methodology in its regulatory decisions in 2009.[577]

983. In recent years, however, the liquidity of the Treasury index bonds has improved,[578] and the Authority has again adopted the Treasury bond approach in deriving the estimate for expected inflation over a future regulatory control period.

984. It has been suggested that a bias exists in the Treasury bonds approach, due to investors demanding an inflation premium to compensate for being exposed to the uncertainty around the future inflation rate.[579] Another criticism of this approach is the relatively small quantity of Treasury indexed bonds, with maturities every five years, on issue.[580] This is in contrast to the large quantity of CGS currently on issue. As a consequence, the interpolation of Treasury indexed bonds is significantly less accurate than the corresponding interpolation for CGS. However, the Authority considers that, on balance, the implied bond approach produces more accurate estimates, now that the liquidity of index bonds has improved and apparent liquidity premiums have subsided.

985. The Authority has in its past determinations matched the term of the expected rate of inflation with that of the risk-free rate in order to ensure consistency within the WACC parameters. It is therefore appropriate that the term of the expected inflation rate be 5 years. It is also appropriate to match the averaging period used elsewhere for estimating the risk free rate – 40 days – to ensure consistency.

15.2.2 Alternative methodologies

15.2.2.1 Inflation swaps

986. An alternative market based measure of inflation expectations, involving observing the fixed rate of zero-coupon inflation swaps, has been suggested to overcome the problems associated with the Treasury index bonds implied inflation approach.[581,582]

987. A zero-coupon inflation swap is a contract which involves two parties who agree to exchange cash flows determined by the rate of inflation at the end of the contract. One party agrees to pay a fixed rate specified at the start of the contract, whilst the counterparty agrees to pay the realised rate of inflation at the end of the contract. In principle, only the difference between the two rates is paid. The payments are calculated by multiplying the difference in the two rates by the principle value of the contract. Therefore, the principle underlying the swap contract is not exchanged.

988. Inflation swaps are quoted in terms of the fixed rate a dealer is either willing to pay or receive in order to enter into the agreement. The midpoint of these two rates is seen

577 Economic Regulation Authority, *Final Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline*, 31 October 2011, p. 158.

578 Email and Telephone Correspondence with the Australian Office of Financial Management , 24 and 25 July 2012.

579 The Australian Treasury (August 2012) *Measuring market inflation expectations.*

580 Reserve Bank of Australia (March 2012) *Extracting Information from Financial Market Instruments.*

581 The Australian Treasury (August 2012) *Measuring market inflation expectations.*

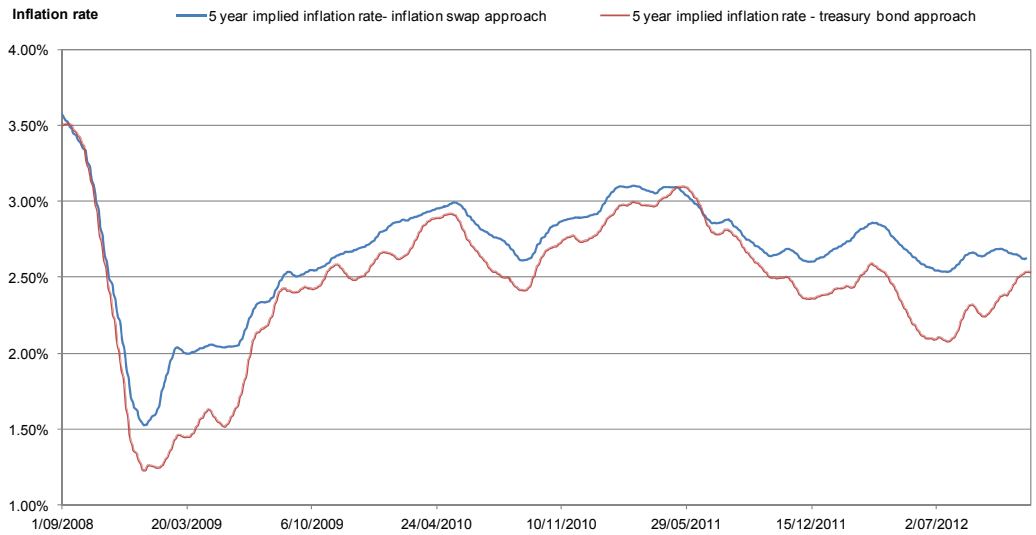
582 Reserve Bank of Australia (March 2012) *Extracting Information from Financial Market Instruments.*

to be the market's inflation expectation over the term of the contract. Inflation swap rates are not subject to the liquidity premium that impact bond markets due to the fact they are over-the-counter contracts. That is, inflation swaps are available on request and therefore do not carry a premium for lack of volume. In addition, whilst inflation swap rates may incorporate a premium for counterparty risk, it is likely to be small due to the legal protection of the agreements in the event of a counterparty default and the fact that principles are not exchanged.[583]

989. Inflation swaps carry an inflation premium similar to that found in CGS.[584] The inflation premium is compensation for the volatility of the realised inflation rate over the term of the swap. In addition, tighter banking regulations, requiring banks to hold larger capital against derivative exposures, has added a premium to the inflation swap rates. Further, hedgers are likely to pay a premium over the expected inflation rate in order to reduce their exposure to the inflation rate. Therefore, there may be an upward bias component in the fixed inflation swap rate.

990. The Authority has conducted its own analysis to identify any differences in the expected inflation rate derived from the Treasury indexed bond approach and the inflation swap approach. The Authority has estimated the rate of inflation using both approaches through time in order for a comparison to be made. The first approach is to estimate the expected inflation rate derived from the Fisher equation from the observed yields on CGS and Treasury indexed bonds. This is estimated using the 20-day average of both CGS and Treasury indexed bonds prior to the required date. The second approach is to take into account the expected inflation rate implied from the mid rate of the interest rate swaps using a 20-day average prior to the required date. Figure 27 below demonstrates the estimated expected inflation rate using both approaches.

Figure 27 Expected Inflation estimated from Treasury Indexed Bonds and Inflation Swaps



Source: Bloomberg, RBA and ERA analysis.

991. The divergence between the implied inflation rate of bonds and the zero-coupon swap rate is most evident during the period from December 2008 to July 2009, as presented in Figure 27. As the fixed inflation swap rate is determined by the market's inflation

583 Hurd,M. And Rellen, J. 2006, *Net information from inflation swaps and index-linked bonds,* Quarterly Bulletin, Bank of England, Spring, p. 29.

584 The Australian Treasury (August 2012) *Measuring market inflation expectations.*

expectations, this bias was not present in the implied inflation rate from zero-coupon inflation swaps. It is noted that the approach using observed yields on the Treasury index bonds was not adopted by Australian regulators to derive expected inflation during the above period due to concerns regarding illiquidity.

992. The rationale for utilising market based approaches is that market prices reflect the aggregation of diverse market participant's expectations. The forecasts of many different market participants is considered to contain more information and be more relevant than any one particular forecast model or limited set of models. There is some evidence that this is the case in the Australian markets.[585]

993. The Authority prefers the current Treasury index bonds implied inflation approach as adopted in the Final Decision on Western Power's proposed access arrangement in deriving an expected inflation. This is because this approach utilises both nominal and real risk-free rates which are directly observed from the market. As a consequence, these estimates will reflect the market's expectation of the expected inflation rate.

994. The Authority considers that the inflation swap approach contains a significant upward bias, which does not accurately reflect investor's inflation expectations. As Figure 27 demonstrates, the expected inflation rate derived from the inflation swap market is consistently higher than that of the implied inflation rate using the Treasury indexed bonds approach. The Authority is of the view that this upward bias is more prevalent in inflation swap markets due to hedgers paying a premium when entering into an inflation swap. This implies that they expect to pay a higher rate than the expected inflation rate. As such, using the implied inflation rate from the swap market is likely to overestimate the expected inflation rate.

15.2.2.2 Inflation forecast method

995. As mentioned in paragraph 9 above, an alternative inflation estimation approach used by the Authority and in previous decisions and by other regulators is the "Inflation forecast" method.

996. This approach estimates expected inflation rate by utilising the RBA Consumer Price Index (**CPI**) forecast from its most recent Statement on Monetary Policy for each period available. Where an explicit forecast is not available, the midpoint of the RBA's inflation target is utilised for the remaining periods.[586] The expected inflation rate over the regulatory period is estimated using the geometric mean of each of these expected inflation rates.

997. In its Final Decision for Western Power's proposed access arrangement, the Authority noted that using the RBA inflation forecast method resulted in a negative real risk-free rate when the Fisher equation is used.[587] The Authority considered that an expected negative real risk-free rate was incorrect, as 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. This negative expected real rate of return was a result of the RBA overestimating the expected inflation rate. Given the nominal risk-free rate observed from the market in conjunction with the inflation forecast from the RBA and

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585 Singh, R, 1993, *Response of Stock Prices to Money Supply Announcements: Australian Evidence*, Accounting & Finance, Vol 33, p. 51.

586 The RBA's current inflation target is within a 2-3 per cent band, resulting in a mid-point of 2.5 per cent.

587 Economic Regulation Authority (Western Australia), *Final decision on proposed revisions to the access arrangement for Western Power*, 2012 p. 328.

applying this to Fisher equation, resulted in a negative real risk risk-free rate.[588] The Authority noted that during this period, the liquidity of the Treasury indexed bond market had improved substantially. On this basis, the Authority was of the view that the expected inflation rate was best estimated using the observed yields of the CGS and the Treasury indexed bonds.

15.2.3 Conclusion

998. The Authority considers that estimating the expected inflation rate using the observed yields of CGS and of Treasury indexed bonds, then using the Fisher equation to estimate the implied inflation rate – the Treasury bond implied inflation approach – is the most robust measure of inflation expectations. However, given the issues that have occurred with this approach historically, the Authority may adopt the RBA's Inflation Forecast approach.

[588] 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, $\pi^e > i$.

Glossary

Acronym	Full text
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
bppa	Basis points per annum
DBP	Dampier Bunbury Pipeline (and DBNGP (WA) Transmission Pty Ltd)
DRP	Debt Risk Premium
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
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
RPP	Revenue and Pricing Principles (Section 24 of the NGL)
SFG	Strategic Finance Group Consulting
WACC	Weighted average cost of capital