Jemena Gas Networks (NSW) Ltd

2015-20 Access Arrangement

Response to the AER's draft decision and revised proposal

Updated Appendix 7.12 - CEG - Return on debt expert report

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Critique of the AER's JGN draft decision on the cost of debt

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Executive summary

1. Rule 87(3) of National Gas Rules (NGR)[1] defines the allowed rate of return objective (ARORO) as:

> *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).*

A benchmark debt management strategy must be defined

2. In our view, the requirements of Rule 87(3) and Rule 87[2] more generally suggest the need for a regulator to undertake two distinct steps when estimating the return on debt (cost of debt) for a 'benchmark efficient entity' (or any other entity):

   - Step 1: define a financing strategy for 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"; then
   - Step 2: estimate the "efficient financing costs" of implementing that strategy.

3. Step 1 is a necessary step given that, before we attempt to measure the cost of something, we must define what that 'something' is. In this case, the 'something' in question is the benchmark efficient debt management strategy that the benchmark efficient entity referred to in Rule 87(3) would undertake.

The AER's cost of debt transition does not define a feasible debt management strategy

4. The AER's methodology for setting the cost of debt does not comply with Rule 87(3) because the AER does not define a debt management strategy that, if followed, would give rise to a cost of debt consistent with that calculated under its methodology. Indeed, there is no debt management strategy (efficient or otherwise) that would give rise to a cost of debt consistent with the AER methodology.

5. The reason is that the AER debt transition results in a value for the return on debt that would not realistically be achieved under any debt management strategy. That

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1 Or equivalently under the National Electricity Rules (NER), 6.5.2(c). Throughout this report, references to the NGR and National Gas Law (NGL) can be read as also referring to the NER and the National Electricity Law (NEL).

2 Under the NER, 6.5.2.(c) and 6.5.2 more generally.

is, the cost of debt calculation undertaken by the AER is not replicable by a benchmark efficient business – either in practice or in theory.

6. The AER accepts that its methodology does not set an allowance that is based on the costs of a specific debt management strategy. This reflects the AER's interpretation that the NGR and National Gas Law (NGL) allow it to set the cost of debt allowance below efficient costs prospectively in order to offset the AER's retrospective view that past compensation was in excess of efficient costs.

7. This leads the AER to set a cost of debt allowance in a manner that is not replicable, where a replicable allowance is based on the costs of a debt management strategy that is actually implementable. In our view, the economic basis for the AER's interpretation of the NGR and NGL is not sound.

8. The previous 'on-the-day' approach to setting compensation for the cost of debt was flawed, including, in our view, being inconsistent with the newly formulated allowed rate of return objective. It did not reflect the costs of a viable debt management strategy and, every time a regulatory decision was made, a business and its customers were subject to what was, in effect, a roll of the dice.

9. All parties agree that a business' efficient debt costs are and were based, at least in part, on a trailing average of historical costs over a period of around 10 years. Yet, the regulatory allowance under the on-the-day approach, which was set for 5 years at a time, was based on a measurement of debt costs over a period of days (up to 40 days) prior to the start of the regulatory period. There was no reason for allowed debt costs under this methodology to align with efficient debt costs within a regulatory period and no reason for them to align across regulatory periods.

10. Over a period of hundreds of years, or many tens of regulatory periods, one might expect that the average compensation for cost of debt determined under the on-the-day approach provides a close match to the average costs incurred. However, this is a horizon that is simply beyond any reasonable horizon of concern to investors – particularly given recent technological developments and energy consumption patterns in the energy industry.

11. The adoption of a simple trailing average benchmark as the most appropriate basis, under the NGR and NGL[3], on which to compensate for the cost of debt was, in our view, correct. This would allow businesses to follow a debt management strategy that aligned their costs to the regulatory benchmark – removing an important source of discrepancy between actual costs and allowed revenues in regulatory decisions. Alternatively, another replicable debt management strategy is known as 'the hybrid' debt management strategy – which is in effect a simple trailing average debt issuance program with an interest rate swap overlay that has the effect of resetting base interest rates (but not risk premiums) at the beginning of each

3 And also under the NER and National Electricity Law (NEL).

regulatory period. Jemena Gas Networks (JGN) has stated that its practice under the on-the-day approach to determining the cost of debt was to adopt the hybrid debt management strategy. The AER has stated that it believes that this strategy was the uniquely efficient debt management strategy under the on-the-day approach.[4]

12. In our view, any transition that is consistent with the NGR and NGL must be a transition between one efficient (and, by definition, replicable) debt management strategy and another efficient debt management strategy. Therefore, if the AER is correct that the hybrid debt management strategy was the efficient debt management strategy in the past then this would form the starting point for a transition to a trailing average.

13. However, we do not believe that the AER is correct to define a uniquely efficient debt management strategy in the past. We consider that both the trailing average and the hybrid debt management strategy were efficient responses to the non-replicable nature of the on-the-day approach. As a consequence, it is not obvious that any transition is required given our view that the trailing average debt management strategy is efficient in both the past and the future.

14. However, to the extent that a network service provider's actual practice is relevant to selecting between past efficient debt management then this would add weight to the adoption of a transition from the hybrid to the trailing average for those businesses that used the hybrid debt management strategy in response to the on-the-day approach to setting the allowed cost of debt. Under this transition the cost of debt would be set equal to the trailing average debt risk premium (DRP) plus the cost of base interest rates utilised in the unwinding of the business's swap portfolio.[5]

15. By contrast, the transition imposed by the AER not only retains the worst aspects of the on-the-day approach – it intensifies these problems. This is because the weight given to the initial averaging period in the AER transition is higher than the weight given to the same period under a continuation of the on-the-day approach. The AER transition effectively rolls the on-the-day dice once more. In doing so, the AER creates uncertainty about, and instability, in prices faced by customers.

16. The AER's reasoning in defence of its proposed transition can be set out as follows:

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4 AER, Draft decision for Jemena Gas Networks, Attachment 3, p. 113. The AER states: "*We consider an efficient financing practice of the benchmark efficient entity under the on-the-day approach would have been to borrow long term and stagger the borrowing so that only a small proportion of the debt matured each year. We consider the benchmark efficient entity would have combined this practice with interest rate swap contracts to match the risk free rate component of its return on debt to the on-the-day rate.*"

5 In this report, unless otherwise stated, DRP refers to spreads between yields and swap interest rates, rather than spreads to yields on Commonwealth government securities.

a. Despite the simple trailing average being the most efficient strategy in the future (i.e., the one that it has chosen in its rate of return guideline as best), the AER argues that it was inefficient for a business to fund itself in this way in the past.

b. The AER instead argues that a "hybrid" debt management strategy was most efficient in the past. This strategy was essentially the trailing average debt management strategy with an interest rate swap overlay – the effect of which was that debt costs in the past were equal to the trailing average DRP plus the 5 year swap rate at the beginning of each regulatory period plus the transaction costs of swaps. The AER argues that this strategy was efficient because it provided the best hedge to the on-the-day allowance.

c. Notwithstanding that the AER states that the hybrid was the most efficient debt management strategy in the past and that the simple trailing average is the most efficient debt management strategy in the future, the AER does not propose a transition from the hybrid to the simple trailing average debt management strategy. Rather, the AER proposes a transition which, applied at the present time, will undercompensate all businesses – including both those that funded themselves with: i) a simple trailing average debt management strategy; and ii) the hybrid debt management strategy (that the AER argues was the uniquely efficient strategy in the past).

d. The AER's justification for its proposed transition rests on a belief that businesses received 'windfall gains' from the on-the-day approach in the last regulatory period. The AER believes that a regulator ought to impose offsetting 'windfall losses' over prospective regulatory periods.

17. In our view, each of the propositions a) to d) are flawed and are not consistent with the promotion of the allowed rate of return objective:

a. The properties of the simple trailing average strategy that make it an efficient debt management strategy in the future, namely the minimisation of transaction costs, also make it an efficient debt management strategy in the past.

b. The AER's argument that the hybrid debt management strategy was uniquely efficient is based on an unreasonable belief that it provides the best hedge to the on-the-day allowance.

c. Given the above, we do not consider that the AER has acted reasonably in concluding that a trailing average debt management strategy was inefficient and a hybrid strategy was uniquely efficient. However, given this is the AER's position, the only reasonable approach consistent with this would be for the AER to propose a transition from the hybrid to the trailing average debt management strategy. This is not what the AER's transition does.

d. The AER's only substantive reason for not doing so is to impose a prospective loss on businesses in order to offset what it argues are 'windfall gains' made from the application of the on-the-day approach. We do not consider that this is appropriate, because:

i. We consider that this reasoning is inconsistent with the ARORO, which is fundamentally forward looking. Attempting to reverse a perceived past error creates risk and uncertainty for investors and it does not promote investment incentives because investors can never be sure of whether the compensation they are paid today will be clawed back tomorrow.

ii. There are many unanswered questions about how the retrospective correction would actually be implemented if it was accepted as appropriate. How is the purported windfall gain measured? Over what period? Over how many dimensions should it be measured? For example, if the AER decides that the equity beta is lower than previously compensated should this be clawed back? If 'windfall gains' are to be clawed back, why would it not be done on a bespoke basis for each network business?

18. We also examine a range of other justifications the AER puts for its transition and find that these do not support its conclusions.

Estimating the trailing average DRP

19. In order to estimate the efficient cost of debt it is necessary to estimate the trailing average DRP over the last 10 years. This is true whether or not a transition from the hybrid debt management strategy is imposed. This is because under the hybrid debt management strategy, which the AER considers to be the efficient debt management strategy in response to an on-the-day cost of debt allowance, a business continues to pay a trailing average DRP.

20. For JGN, a 10 year trailing average must be measured over each of the years 2005/06 to 2014/15. We have estimated the DRP relative to swap rates over these years to average 2.35%.

21. The estimate cited above is based in part on DRP measured over the period from 19 January 2015 to 16 February 2015 (the "second averaging period"). Our previous report provided the estimate for 2 January 2015 to 30 January 2015 (the "first averaging period").

Estimating the cost of debt under a transition from hybrid to trailing average

22. Under a transition from the hybrid to the simple trailing average debt management strategy, the efficient cost of debt for the regulatory year 2015/16 is equal to:

- the trailing average of 10 year DRPs measured relative to swap rates over the period 2005/06 to 2014/15; plus

- the average of 1-10 year swap rates over the second averaging period; plus
- the costs of swap transactions required to effect the transition.

23. This reflects the fact that the hybrid strategy's use of a swap portfolio overlay allows base interest rates to be reset in the second averaging period. This allows the business to 'lock in' swap rates at that time that align to the maturity of its underlying bond portfolio. Given that the tenor of debt at issuance is assumed to be 10 years, then historical debt risk premiums continue to be paid on bonds that were issued up to 10 years ago (and which have remaining maturity). The historical DRP on each bond is matched with a swap rate, the tenor of which is equal to the bond's remaining maturity. Thus for a bond issued 9 years ago: the DRP on that bond reflects the DRP on a 10 year bond at that time; and this is matched with a 1 year swap rate.

24. This can be thought of as giving rise to a synthetic trailing average – where historical DRPs are matched with prevailing swap rates of the same remaining maturity. Once this is in place, the cost of debt will roll forward in the same way that a simple trailing average would.

25. For example, in 2015/2016 the oldest tranche of debt (assumed to have been issued in 2005/06) will mature and the DRP being paid on that debt will also cease. Similarly, the 1 year swap rate that was taken out in the second averaging period will also mature. These elements of the synthetic trailing average will be replaced by new debt issues occurring in 2015/16.

26. Based on the trailing average DRP reported above of 2.35% and the average of 1-10 year swap rates reported over the second averaging period of 2.57% we estimate that the semi-annual cost of debt associated with a transition from the hybrid to the trailing average is 4.92% during the regulatory year 2015/16. In addition, we consider that a conservative estimate of the transaction costs of swaps is 23 basis points – raising the total cost of debt to 5.15%, or 5.22% on an annualised basis.

Estimating the cost of debt under immediate adoption of simple trailing average

27. The efficient cost of debt under the immediate adoption of the trailing average is simply the trailing average of 10 year DRPs (2.35%) measured relative to swap rates plus the trailing average of 10 year swap rates measured contemporaneously over each of the 10 years rather than solely in the second averaging period of 5.27%. This results in an annualised cost of debt of 7.76%, not including transaction costs. For the trailing average cost of debt there is no need to express the cost of debt as a combination of DRP and base interest rate. However, given that the only difference between the hybrid and the trailing averages measures is the base interest rate this decomposition is nonetheless useful.

Other components of the cost of debt

28. This report addresses the cost of debt as measured from observations of prices in secondary market transactions. We also examine the costs of undertaking swaps transactions. We do not address the direct and indirect costs of engaging in debt raising in primary markets, such as debt raising costs and the new issue premium. However, these costs should also be considered in estimating the total cost of debt.

29. We have previously performed analysis on the new issue premium that estimates the yield on newly issued bonds to be 27 basis points higher than would otherwise be observed in secondary market trading.[6]

6 CEG, *The new issue premium*, October 2014.

1 Introduction

30. CEG has been engaged by Jemena Gas Networks (JGN) on behalf of itself and Jemena Electricity Networks to prepare an expert report[7] which provides:

    a. An assessment of the AER's draft decision on the cost of debt for JGN.

    b. Our opinion on whether the AER's proposed approach to the return on debt would result in the best estimate of the return on debt that contributes to the achievement of the allowed rate of return objective and meets the requirements of Rule 87.

    c. Our opinion on whether the return on debt estimate using the AER approach would produce a result consistent with the achievement of the NGO and the RPP.

    d. If we find that the AER's approach does not meet the requirements set out in points (ii) and (iii) above, a suggestion of an alternative method for estimating the cost of debt which should be used to produce the best estimate possible in the circumstances which complies with Rule 87 of the NGR,[8] and report on the estimate this method produces.

31. We were asked to provide the best estimate of the cost of debt for two averaging periods. Our previous report provided the estimate for the first averaging period (2 January 2015 to 30 January 2015). This report provides the estimate for the second averaging period (19 January 2015 to 16 February 2015).

32. Unless otherwise noted, the yields and spreads to swap quoted in this report are expressed in semi-annual terms, which is consistent with the Australian market convention for reporting these items and with the data that we have collected in this report. However, the cost of debt used by the AER in the context of its regulatory cost of capital should be expressed as an annual effective rate, consistent with the calculation of the WACC and the use of the WACC in the AER's regulatory modelling.

33. The remainder of this report is structured as follows:

    - **Section 2** discusses defining a debt management strategy consistent with the NGR and NGL. That is, it provides our economic interpretation of the legal context to determining the allowed cost of debt;
    - **Section 3** describes the mechanics of the trailing average and hybrid debt management strategies and also the mechanics of the transition from the hybrid to the trailing average debt management strategy;

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7 Terms of reference are provided at Appendix F.

8 Or equivalently under the NER, clause 6.5.2.

- **Section 4** provides an overview of the AER's justification for its proposed transition from the on-the-day approach to a trailing average debt management strategy and provides an assessment of the proposed transition;
- **Section 5** provides our best estimate of the DRP and cost of debt during the second averaging period. This is used as the basis for an estimate of the DRP/cost of debt in 2014/15 which forms part of the trailing average (i.e., on the basis that the benchmark entity refinances 10% of its debt portfolio in that period);
- **Section 6** provides our best estimate of the DRP and cost of debt over the 9-year period from 2005/06 to 2013/14, with that estimate informing the calculation of the cost of debt under the hybrid and trailing average approaches; and
- **Section 7** combines the relevant evidence to arrive at our best estimate of the cost of debt associated with the immediate adoption of a trailing average and a transition from the hybrid to a trailing average.

34. We acknowledge that we have read, understood and complied with the Federal Court of Australia's Practice Note CM 7, "Expert Witnesses in Proceedings in the Federal Court of Australia". We have made all inquiries that we believe are desirable and appropriate to answer the questions put to me. No matters of significance that we regard as relevant have to our knowledge been withheld. We have been provided with a copy of the Federal Court of Australia's Guidelines for Expert Witnesses in Proceeding in the Federal Court of Australia, and confirm that this report has been prepared in accordance with those Guidelines.

35. We have been assisted in the preparation of this report by Johanna Hansson, Annabel Wilton and Johnathan Wongsosaputro in CEG's Sydney office. However, the opinions set out in this report are our own.

Thomas Nicholas Hird

Daniel James Young

2 Defining a debt management strategy consistent with the NGR and NGL

36. This section provides our interpretation of the relevant economic content of the NGR and NGL as it pertains to setting an allowance for the cost of debt. In particular, we review Rules 87(3) (the allowed rate of return objective), 87(5) and 87(8)-(10). We also consider the National Gas Objective (NGO) and the revenue and pricing principles (RPP).

37. Based on the legislative context we consider that, in order to be consistent with the NGR and NGL, the cost of debt allowance must be:

- replicable in the sense that it is based on a well-defined debt management strategy;
- based on a debt management strategy which is efficient in the sense that it reflects a prudent strategy that minimises the expected (risk adjusted) costs of financing. In order to achieve this, the benchmark strategy should be based, as far as possible, on observed behaviour of regulated businesses (where it can reasonably be assumed that regulated business have an incentive to behave efficiently); and
- estimated based on the best available data.

2.1 Two steps in arriving at an estimate of the cost of debt

38. In our view, there are two distinct steps involved in estimating the allowed cost of debt for any entity – including the 'benchmark efficient entity' that the AER focuses on. The basis for this conclusion is a common-sense belief that, before one can embark on an estimation process, one must define what it is that is being estimated. To define what is being estimated, and consistent with the requirements of the NGR, it is necessary to:

- define a financing strategy for 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"; and
- estimate the *"efficient financing costs"* of implementing that strategy.

39. The second step cannot proceed without the first step.

40. Examples of elements of a benchmark efficient debt management strategy that may need to be defined in the first step include:

- the amount of debt issued;

- the term structure of the debt issued;
- the timing of debt issuance;
- the market into which debt is issued;
- the type of debt issued (e.g., callable vs non-callable debt);
- the extent to which derivative contracts, such as swap contracts, are used to manage the debt portfolio; and
- the perceived riskiness of the debt issued (e.g., proxied by a benchmark efficient credit rating). This needs to be consistent with the rest of the benchmark efficient debt management policy (e.g., higher assumed gearing should be associated with, other things equal, a lower credit rating).

41. There is general agreement between the AER and us that the efficient debt management strategy involves the issuance of 10 year debt on an evenly staggered basis.[9] There is similarly agreement that the benchmark credit rating falls within the BBB band.[10] We consider that, based on the actual practice of Australian businesses, including regulated energy businesses, the efficient strategy should include debt issued in foreign markets (and hedged back into Australian dollars).[11]

42. Once a benchmark efficient debt management strategy is defined, the next step is to estimate the financing costs associated with that strategy.

43. This step requires collection and analysis of financial market price/yield information relevant to determining the costs incurred in implementing the benchmark efficient financing strategy at the relevant times. This step focuses on data collection, interpretation and manipulation, to arrive at an estimate of the costs of implementing the benchmark efficient strategy defined in the first step. Relevant decisions that must be made are:

- whether and how to use third party estimates of the yields on broad categories of corporate debt – such as Bloomberg and the Reserve Bank of Australia (RBA) published estimates of the yields on bonds of particular maturities/credit ratings;

9 AER, JGN draft decision: Attachment 3 – Rate of Return, November 2014, pp. 111, 128-131

10 CEG has recently estimated that the credit metrics implied by the AER's draft decision for ActewAGL results in a credit rating of BB+ to BBB (depending upon the assumptions employed). See: CEG, *Efficient Debt Financing Costs*, January 2015, A report for AcetwAGL section 8. It is also the case that regulated energy businesses in Australia have credit ratings from BBB- to A- with an average over the last 10 years of between BBB and BBB+. The AER has proposed adopting a BBB+ credit rating but has expressed the view that because the available third party data series currently available from the RBA and Bloomberg are both broad BBB rated data series: "*adopting either a BBB+ or BBB benchmark credit rating is unlikely to have a practical impact on the estimation of the return on debt at this time*." AER, Draft Decision for Jemena Gas Networks, Attachment 3, p. 131.

11 As discussed in more detail in section 3.4

- whether and how to use estimates from market data providers of the yield on specific debt instruments (e.g., a specific bond issued company "X", another bond issued by company "Y", etc.); and
- what sources for these data should be used and what, if any, differential weighting should be applied to the data sources.

2.2 Rule 87(3): the allowed rate of return objective

44. Rule 87(3)[12] states:

> *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).*

45. This envisages that:

- it is possible to define 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";
- *"efficient financing costs"* for that entity can be estimated; and
- the service provider should receive compensation that is *"commensurate"* with this.

46. In the context of setting the allowed cost of debt, we consider that this requires:

- a benchmark efficient debt financing strategy to be defined;
- the costs of efficiently implementing that strategy to be estimated; and
- compensation commensurate with this to be provided to the service provider.

47. In our view, the definition of a benchmark efficient financing strategy must be such that it would be possible for a benchmark efficient entity to undertake that strategy. This does not necessarily mean that a specific regulated entity must actually or potentially be able to implement that strategy, nor that it must be the most efficient strategy for that entity. However, it must be conceivable that this strategy would be efficient for a benchmark entity facing the same or similar risks.

48. By way of example, if it is not possible to issue 100 year debt, or if it is known to be prohibitively expensive to attempt to do so, then issuing 100 year debt should not be included in the definition of a benchmark efficient debt financing strategy. To do so would be to attempt to arrive at a cost estimate that is associated with doing

12 The equivalent clause under the NER is 6.5.2(c)

something that is impossible/inefficient. Similarly, if it is impossible to trade certain derivative contracts, or if it is known to be prohibitively costly to do so or if they do not exist, then the trading of such derivative contracts should not be included in the definition of a benchmark efficient debt financing strategy.

49. The Australian Energy Market Commission's (AEMC) Final Rule Determination suggests that the AEMC envisaged its Rule change would require that the regulator clearly define a benchmark debt financing strategy and then estimate the costs of implementing that strategy:[13]

> *While the Commission considers that allowing the regulator to estimate the return on debt component of the rate of return using a broad range of methods represents an improvement to the current approach, it is a separate issue from that of benchmark specification and measurement.* ***A historical trailing average approach still requires the regulator to define a benchmark and use appropriate data sources to measure it. Arguably, it is even more important that the benchmark is defined very clearly and can be measured, because it needs to be estimated periodically in the future***. (Emphasis added)

50. Similarly, the AEMC clearly envisaged that the definition of an efficient benchmark entity would include a definition of that benchmark entity's efficient debt financing strategy:[14]

> *The first factor in the rule requires the regulator to have regard to the characteristics of a benchmark service provider and how this influences assumptions about* ***its efficient debt management strategy***. (Emphasis added)

51. The AER's draft decision for JGN proceeds on the basis that it is appropriate to define the efficient financing costs of a benchmark efficient entity on the assumption that they are regulated and as a function of the type of regulation that they are/have been subject to. For example, at page 3-115 of the JGN draft decision the AER states:

> *Based on the above, we consider a staggered debt portfolio with interest rate swaps was an efficient financing practice of the benchmark efficient entity* ***under the on-the-day approach***. (Emphasis added.)

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13 AEMC, *Rule Determination: National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012 and National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012*, November 2012, p. 90

14 Ibid, p. 84

52. It is not obvious that such a construction of the ARORO is necessarily correct. There is, inevitably, an element of circularity in this construction – with the efficient debt management strategy depending on the regulatory policy rather than the regulatory policy depending on the efficient debt management strategy.

53. Dr Hird has made this 'circularity' point previously. For example, in his February 2013 report for Ausgrid he stated:[15]

> *A 10 year trailing average approach would largely mimic the debt management strategy employed by infrastructure businesses (regulated and unregulated) around the world.*
>
> *In this regard, it is worth noting that it is also quite common for infrastructure businesses subject to "lighter-handed" forms of regulation to adopt the same strategy. This is important because regulated business financing activity may well be distorted by the particular way in which the relevant regulator compensates for the cost of debt. Examining similar infrastructure businesses that are only lightly regulated, such as Toll Roads and Airports, provides an insight into the way in which infrastructure businesses manage their debt absent incentives created by the regulatory regime.*

54. In short, if it is appropriate for efficient debt management practices of infrastructure owners in more competitive markets to inform the definition of a benchmark efficient debt management strategy then this would suggest that the trailing average debt management strategy should define the "efficient financing costs of a benchmark efficient entity". [16]

55. Nonetheless, we generally proceed in this report on the basis of the AER's construction, that is that the benchmark entity is a regulated entity, and more specifically, that the allowance for the return on debt for that entity was determined in the past on the basis of the "on the day" approach. We do this in order to consider the implications of the AER's construction (without accepting its validity).

2.2.1 Definition of "efficient" as used in 87(3) of the NGR

56. It is also necessary to define what is meant by the term "efficient" in the two places it is used in Rule 87(3). In our view, the correct interpretation is that the benchmark entity must engage in a financing strategy that gives rise to the lowest *expected* finance costs for an "entity with a similar degree of risk as that which applies to the service provider in respect of the provision of reference services".

15 CEG, Efficiency of staggered debt issuance, February 2013, pp. 30 to 31, paragraphs 97 and 98.

16 CEG, Efficiency of staggered debt issuance, February 2013, pp. 29 to 32.

57. In this context it is important to make two observations. First, Rule 87(3) is defined at the level of the weighted average rate of return on debt and equity. Thus, a financing strategy that results in the lowest expected cost of debt need not be efficient if undertaking that strategy raises the cost of equity by a more than offsetting amount. This could occur if undertaking that strategy results in a higher weighted average rate of return on debt and equity than could otherwise be expected to be achieved.

58. Second, financing strategies are designed without perfect knowledge of the future. This means that different financing strategies will give rise to different costs in different market circumstances. When we define an efficient financing strategy as one that gives rise to the lowest *expected* finance costs, we do not mean that it *always* gives rise to the lowest actual financing costs. Rather, we mean that it is a finance strategy that prudently takes into account future uncertainties and seeks to minimise the (actuarially weighted) expected financing costs under all possible future states of the world.

59. By way of illustration, a generally upward sloping yield curve for corporate debt suggests that issuing very short term debt (e.g., 3 month debt) might minimise interest costs in most circumstances (i.e., this strategy might be "most likely" to achieve cost minimisation given the range of future possible states of the world).[17] However, this strategy would involve refinancing 100% of debt every 3 months. Any future disruption to financial markets could have potentially disastrous consequences for an entity's debt and equity investors if the firm finds itself unable to refinance its debt.[18] This may cause the actuarially expected costs of financing solely with 3 month debt to be higher than the actuarially expected costs of funding using long term debt even if there is only a small probability of these disruptions occurring. Thus, even though short term funding might be 'most likely' to achieve cost minimisation, it may still have higher actuarially expected costs than long term debt funding because the practice magnifies investors' exposure to low probability but high cost events/risks.

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17 This is actually a doubtful proposition. The corporate yield curve is generally upward sloping at least in part because short term debt issued by a corporation is less risky than long term debt because it matures first. Consequently, a short term lender is less worried about default because they know the business has locked in funding from other debt providers that it does not need to repay in the short term. If all debt were short term debt then this advantage would disappear – and we would expect the cost of short term debt to rise.

18 For example, debt investors are defaulted on and equity investors have their rights challenged by debt investors in bankruptcy proceedings. In the process, part of the intrinsic value of the firm is destroyed due to constraints on its ability to operate without funds and in the midst of legal disputes between stakeholders.

2.3 Rule 87(5)

60. Rule 87(5)[19] sets out factors that must be had regard to when determining the allowed rate of return.

61. Rule 87(5)(a) requires that regard be had to *"relevant estimation methods, financial models, market data and other evidence"*. This has clear application to both steps, requiring that regard be had to all relevant evidence both when defining a financing strategy and when estimating the cost of that strategy.

62. Rule 87(5)(b) and Rule 87(5)(c) require that regard be had to the desirability of internal consistency between the estimates of the return on debt and return on equity. We consider that, amongst other things, this requires the definition of the benchmark efficient debt financing strategy to have regard to the debt management strategies of the companies used to infer an estimate of the benchmark efficient cost of equity funding.

2.4 Rule 87(8) to Rule 87(10)

63. Rule 87(8)[20] states that the return on debt should be estimated "such that it contributes to the achievement of the allowed rate of return objective".

64. Rule 87(9) [21] makes clear that the regulator may allow the return on debt to be constant across each year in an access arrangement period or that it may update the return on debt each year of the access arrangement period.

65. Rule 87(10)[22] is relevant to the first step of the estimation process (i.e., defining a benchmark efficient debt management strategy). Specifically, Rule 87(10) makes clear that, subject to it promoting the allowed rate of return objective and without limitation, the benchmark efficient financing strategy defined in the first step may be based on:

> *(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*

19 The equivalent clause under the NER is 6.5.2(e)

20 The equivalent clause under the NER is 6.5.2(h)

21 The equivalent clause under the NER is 6.5.2(i)

22 The equivalent clause under the NER is 6.5.2(j)

> *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).*

66. We believe that it is relevant that both 87(a) and 87(b) refer to the return that would be required by debt investors if the benchmark efficient entity raised its debt in a particular way. This is consistent with our view that it is necessary to define a benchmark efficient debt financing strategy before proceeding to estimate the costs of that strategy.

2.5 The national gas objective and the revenue and pricing principles

67. The NGO and the RPP in the NGL apply more broadly than to just the cost of debt and equity funding. However, in our view, the requirements set out in the NGL are consistent with our interpretation that the NGR requires an estimate of the allowed return on debt to be based on an estimate of the cost of following a benchmark efficient debt financing strategy.

68. In our view, if the allowance for the return on debt is based on a benchmark financing strategy consistent with that which a benchmark efficient entity would undertake, then the regulated entity will:

- have appropriate incentives to invest and maintain its assets in a manner that promotes the NGO;
- have "a reasonable opportunity to recover at least the efficient costs the service provider incurs in providing reference services" - consistent with (2)(a) of the RPP;
- be provided with effective incentives in order to promote economic efficiency – consistent with (3) of the RPP;
- have tariffs that allow for a return commensurate with the regulatory and commercial risks involved in providing the reference service – consistent with (5) of the RPP; and
- have appropriate incentives to invest in the network - consistent with (6) of the RPP.

69. Similarly, setting tariffs to reflect the cost of debt associated with a benchmark efficient debt financing strategy is consistent with promoting efficient utilisation of gas networks by customers. In fact, in our view, achieving the ARORO is an important foundation for achieving the NGO and the RPP.

70. Only if the cost of debt allowance is set consistent with a well-defined benchmark efficient debt management strategy can a business attempt to replicate that strategy

such that its own efficient costs are commensurate with the allowance. If a business cannot do this because the cost of debt allowance is not based on a well-defined debt management strategy, then a mismatch between the allowed and achievable cost of debt can be created. The effect of this mismatch can be to:

- weaken incentives for the business to invest and to maintain its assets in a manner that will promote the NGO;
- deny “a reasonable opportunity to recover at least the efficient costs [that] the service provider incurs in providing reference services” - inconsistent with (2)(a) of the RPP;
- weaken incentives for efficient investment and thereby fail to promote economic efficiency – inconsistent with (3) of the RPP;
- result in tariffs that do not allow for a return commensurate with the regulatory and commercial risks involved in providing the reference service – inconsistent with (5) of the RPP; and
- fail to provide appropriate incentives to invest in the network - inconsistent with (6) of the RPP.

3 Debt financing strategies

71. In order to understand many of the AER's positions in its draft decision in relation to the allowed cost of debt it is necessary to understand the difference between:

- a simple trailing average debt funding strategy; and
- a trailing average debt funding strategy with a swap overlay.

72. This section sets out the mechanics of these strategies separately from the arguments around the efficiency or otherwise of each strategy.

73. An understanding of the mechanics of each strategy is necessary to assess the AER's position that a swap overlay was efficient under its old practice of setting the cost of debt allowance based on the prevailing cost of debt during a relatively short averaging period.

74. As a matter of terminology we will refer to this past AER practice as the 'on the day' approach to setting compensation for the cost of debt. We will refer to the use of a trailing average plus swap portfolio overlay as the 'hybrid' debt management strategy. This is because, as will be seen below, the effect of the relevant swap overlay is that the business' actual cost of debt will be the sum of (i.e., a hybrid of) the trailing average DRP plus the prevailing 5 year swap rate plus swap transaction costs.

3.1 Mechanics of the trailing average approach

75. Under the simple trailing average strategy the business maintains a largely evenly staggered portfolio of 10 year debt. Consequently, its debt cost in any year is simply the trailing average of the interest rates on 10 year maturity corporate debt issued over the last 10 years.

76. Instead of immediately adopting a trailing average approach, the AER proposes a transition from the previous "on the day" approach to a cost of debt based on a trailing average.

77. The proposed transition initially gives 100% weight to the interest rates (and repayment of principle) observed in an initial averaging period for the first year of the regulatory period. This weight falls by 10% in each subsequent year until the first year cost of debt is given 10% weight in the tenth year and a full trailing average is achieved. The AER describes the mechanics of its transition to a trailing average as follows:[23]

[23] AER, *Jemena Gas Networks draft decision, Attachment 3: Rate of return*, November 2014, p.3-101.

> *We estimate the allowed return on debt of a benchmark efficient entity, rather than estimate the actual return on debt of any particular service provider. Our draft decision is to transition the benchmark efficient entity gradually into the new trailing average portfolio approach. We start by estimating the return on debt in a similar way to the previous regulatory approach, which was called the 'on the day' approach. This rate is applied to the first regulatory year, From there, we update 10 per cent of the return on debt each year based on the prevailing rate in that year over the service provider's averaging period. After the 10 year transition period is complete the allowed return on debt fully reflects a 10 year trailing average. The length of the transition period is determined by the benchmark term of debt, which is 10 years.*

3.2 Mechanics of the hybrid approach

78. Under the hybrid approach the entity is assumed to adopt the trailing average approach in the sense that it maintains an evenly staggered portfolio of 10 year bond issuance. However, it is assumed to overlay this with a set of swap contracts in order to:

- ensure that, in respect of the portion of the portfolio being hedged, the base rate of interest is 100% floating (i.e., continually reset at very short term intervals based on prevailing rates) at the beginning of each regulatory period;
- convert floating to fixed base interest rates over the period of the regulatory period – noting that in order to do this its base interest rate exposure, in respect of the portion of the portfolio being hedged, must be 100% floating at that time (i.e., the first dot point must be true); and
- ensure that base interest rate exposure, in respect of the hedged portion of the portfolio, reverts back to floating at the end of the regulatory period (in order to facilitate its ability to repeat the process in the first dot point for the next regulatory period).

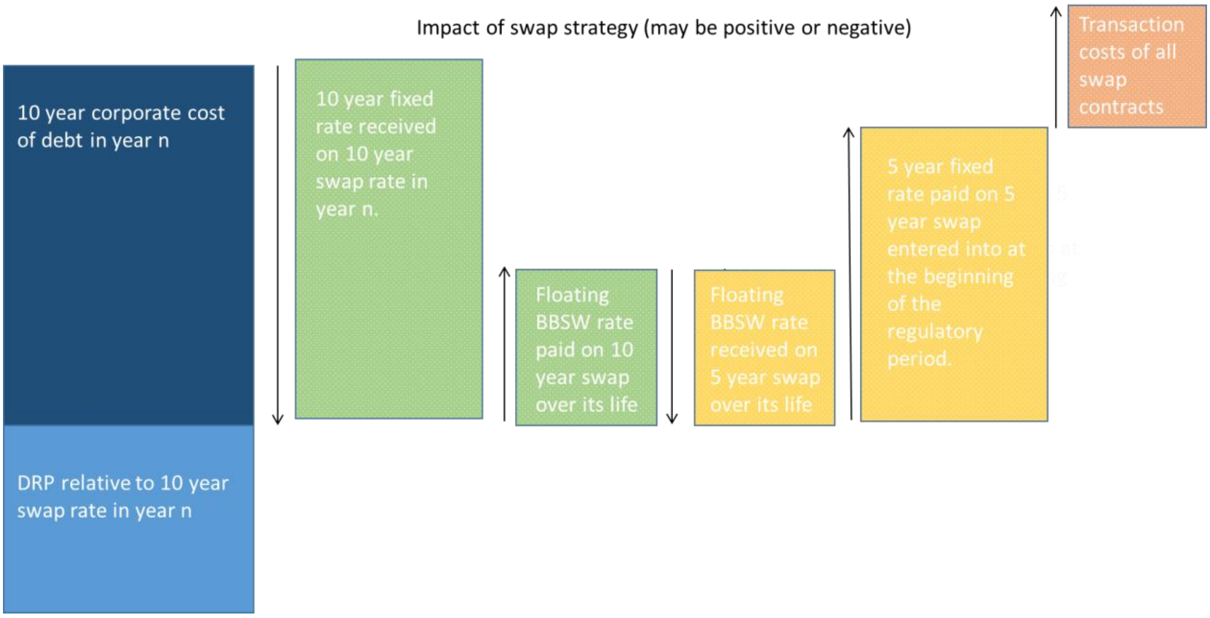
79. This strategy, once entered into, cannot be instantaneously unwound. In order to use swap rates to fix interest rates for a regulatory period - as set out in the second dot point above - a business must have arranged its affairs over the previous 10 years so that the relevant part of the base rate of interest will be floating (and not fixed) at the beginning of the regulatory period.[24]

---

[24] Swap transactions costs are distinct from debt raising costs. The former relate to the costs of entering into derivative contracts to change between fixed and floating exposure on coupon payments, whereas the latter relate to the costs incurred in primary debt raising.

80. The mechanics of this strategy are described in Figure 1 below and are summarised further at Figure 2. Both figures are simplified in that they do not consider other components of the cost of debt such as debt raising costs and new issue premiums.

Figure 1: Mechanics of swap strategy underpinning hybrid – example of the costs associated with a single bond issued in year "n"*



**Year "n" refers to the year in which fixed rate debt has been issued. For a firm that issued evenly staggered 10 year debt then "n" can refer to any one of the previous 10 years when debt has been issued and has not yet matured.*

81. Moving from left to right of Figure 1 describes the mechanics of the swap strategy underpinning the hybrid debt management strategy as it relates to the costs associated with a single bond issued in year "n":

- First, the firm issues a 10 year bond with a yield that is represented by the height of the first column (the sum of both the light and dark blue components of that column).
- Second, the firm immediately enters into a 10 year swap contract[25] (the components of which are the green coloured columns in the above figure) under which it:
  - is paid the 10 year fixed swap rate prevailing at that time (the business receives this same (fixed) rate over the 10 year life of the swap contract – which is also the life of the bond). The difference between the 10 year fixed

[25] This example is based on the assumption that the debt is issued in Australian dollars. If the debt is issued in a foreign currency then a cross-currency swap is used. However, the net impact is the same – with the borrower ending up with a floating rate exposure and DRP that are in Australian dollars.

swap rate and the yield on the corporate bond is, for future reference, how the light blue "DRP relative to 10 year swap rate in year n" is calculated; and

  - must pay its counterparty the floating 3/6 month bank bill swap rate (BBSW)[26] over the next 10 years. This is described as a 'floating rate' because the BBSW rate varies through time and the firm must make quarterly payments to the counterparty at a rate equal to whatever the prevailing 3/6 month BBSW rate is at that time.

- Third, the firm enters into a 5 year swap contract (the two components of which are coloured yellow in the above figure) at the beginning of the regulatory period under which it:
  - must pay the 5 year fixed swap rate prevailing at that time (the business pays this same (fixed) rate over the 5 year life of the swap contract – which is also the length of the regulatory period); and
  - is paid by its counterparty the floating 3/6 month BBSW over the next 5 years.
- The final (orange) column on the chart shows the impact of the transaction costs associated with two sets of swap contracts.

82. It is useful to make the following observations about the above mechanics:

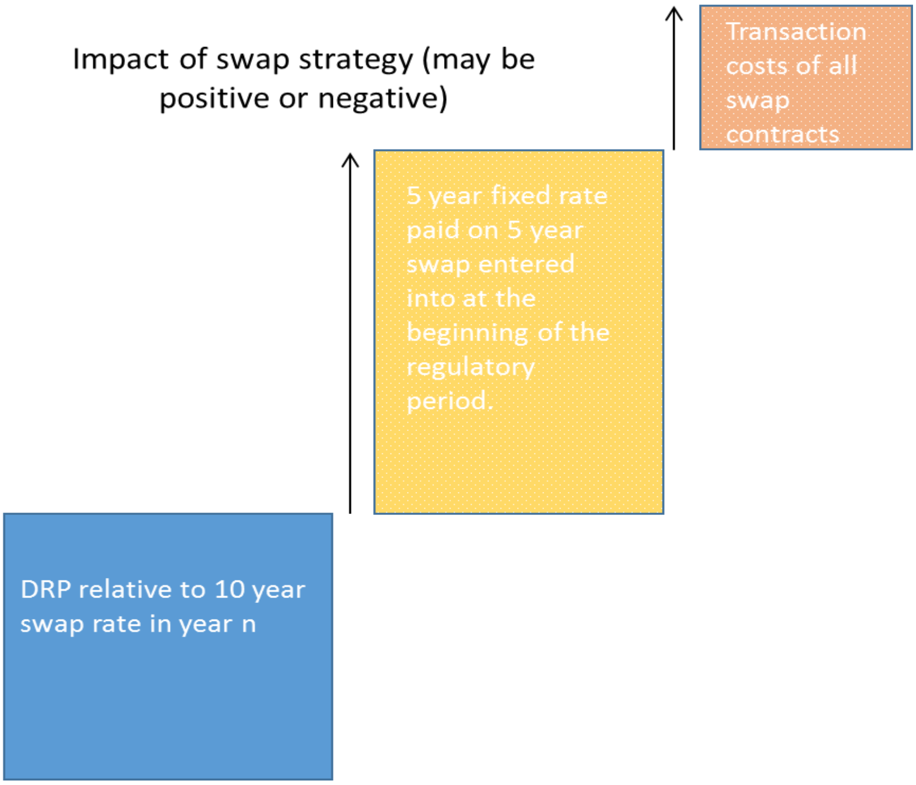
- The middle two green and yellow floating BBSW rate amounts 'cancel out', so these have no net effect on the costs of the strategy.
- The DRP on the bond at the time of issuance (measured relative to 10 year swap rates) is not altered and is payable every year over the life of the bond. It is, in some sense, the base fixed rate cost of the debt upon which the net effect of the swap contracts is added.
- The third step is undertaken to cancel out not just already existing bond/swap combinations created in steps 1 and 2, but also to cancel out bond/swap combinations expected to be created over the course of the regulatory period. Consider a 10 year bond issued at the end of the third year of a regulatory period - with the proceeds used to refinance a bond of equivalent value that is maturing at that time. At the beginning of the regulatory period the business will have entered into a 5 year (pay fixed/receive floating) swap that cancelled out:
  - the 3 years of floating rate exposure on the old (already existing) bond/swap combination maturing at the end of year 3; and
  - the 2 years of floating rate exposure on the new bond/swap combination that will be issued/entered into at the end of year 3.

[26] The BBSW is the rate at which banks lend to one another. It is also used as a market reference rate for other transactions, including interest rate swaps or in determining coupons for floating rate bonds.

- The impact of all of these steps may be to raise or lower the total cost of debt. The net impact will depend on the shape of swap yield curves, the movements in swap rates between bond issue date and the beginning of the regulatory period and also the level of transaction costs associated with the swaps.

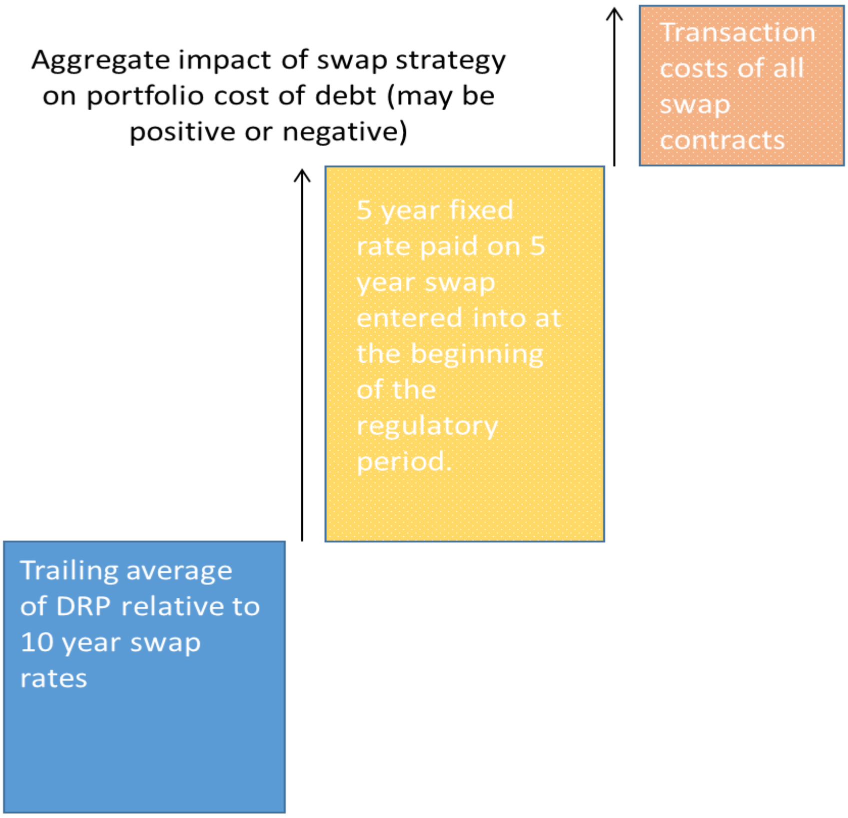
83. Figure 1 includes a number of elements that 'cancel out' across the entire strategy. In particular, the two floating rate payments underpinning each swap cancel out. In addition, the 10 year fixed swap rate received over the life of the bond effectively cancels out an equal amount of the 10 year yield on the bond. Figure 2 below shows a simplified version of Figure 1 with the elements that cancel out excluded.

Figure 2: Simplified mechanics of swap strategy underpinning hybrid



84. Figure 1 and Figure 2 depict the impact of the swap strategy on a single bond. However, the impact of the swap strategy applied to each bond in the staggered debt portfolio is simply the sum of these. The overall effect is illustrated in Figure 3 below. The difference between Figure 2 and Figure 3 is simply that a trailing average DRP replaces the DRP on the single bond in Figure 2.

Figure 3: Aggregate cost of debt under the hybrid approach



85. The purpose of the hedging strategy described under the hybrid approach is to align base interest costs with the base interest rate component of the cost of debt set under the 'on the day' approach. For the method to be effective at aligning actual and allowed base rates of interest, the fixed swap contracts must be undertaken in the same period that the regulator uses to set the cost of debt allowance and must only last for as long as that cost of debt allowance will be paid (in the past AER practice this period has been the 5 year regulatory period). Only then will the business' interest rate exposure on that portion of the portfolio being hedged return to floating at the beginning of the next regulatory period – enabling it to once more enter into 5 year fixed swaps to turn that floating rate exposure into a fixed rate exposure in the same market conditions that the regulator uses to determine the fixed cost of debt.

86. Of course, this strategy, even if implemented perfectly and for 100% of the portfolio, does not align the business' total cost of debt with the AER's total allowance for the cost of debt under the on-the-day approach. The business will still be paying a trailing average DRP on its actual costs and the on-the-day approach will compensate based on the prevailing DRP, which may move in the opposite direction

to the prevailing swap rate, rather than the trailing average DRP. In addition, the business will incur the transaction costs associated with the swap contracts.

87. For these reasons it cannot be assumed that using swap contracts in an attempt to align base rates of interest to the on-the-day allowance will actually align the total cost of debt to the on the day allowance. These issues are discussed further in section 4.2 below.

3.3 Mechanics of a transition from the hybrid to a trailing average

88. If the hybrid debt management strategy is the assumed starting point then it is possible to define a transition to the trailing average debt management strategy from that starting point.

89. If a business has been employing the hybrid debt management strategy in the past then the 5 year swaps that it entered in to in the previous access arrangement period will have expired, leaving the business with a fully floating exposure. The relevant transition must therefore reflect how a benchmark efficient entity with base interest costs that are completely floating at the beginning of the regulatory period would transition to a trailing average exposure. A simple way to do so would be to set an allowance based on an assumed strategy of entering into 10 different fixed rate swap contracts:

- 10% of the overall portfolio value fixed at one year maturity;
- 10% at two year maturity;
- …
- 10% at 10 year maturity (or, equivalently, just issue 10 year fixed rate debt (which has embedded in it the 10 year swap rate)).

90. Entering into these swap contracts, one for each year maturity, results in the maturity profile of the entity's swap exposure being aligned with the maturity profile of the entity's DRP exposure, given the assumption that the business has followed the hybrid debt management strategy in the past.

91. Having done this the firm would have effectively created a synthetic trailing average cost of debt that is equal to the average of:

- The DRP on 10 year debt (measured relative to 10 year swap rates) from 9 years ago plus the one year swap rate today.
- The DRP on 10 year debt from 8 years ago plus the 2 year swap rate today;
- …

- The DRP on 10 year debt from the most recent year (year "zero") plus the 10 year swap rate today (or, equivalently, the 10 year fixed rate today).

92. The transaction costs associated with swaps would need to be added to this.

93. This portfolio approach could then be rolled forward in precisely the same way that a trailing average return on debt would – dropping the debt instruments from the earliest year of the trailing average because those debt instruments are maturing soonest and replacing the earlier debt with the costs associated with issuing debt in the most recent year.

3.4 Transaction costs of swap strategy

94. As noted above, maintaining a swap portfolio will lead to transaction costs. Recent regulatory debate on the cost of debt in Australia has focussed on the achievability of the cost of debt benchmark. As part of this, there have been two recent expert reports on the expected cost of entering into swap contracts. These are:

- a report by Evans and Peck for the Queensland Competition Authority estimating the costs of conducting interest rate swaps; and
- reports by UBS for TransGrid and the NSW electricity distribution businesses estimating on a bottom up basis the cost of hedging the interest rates of the New South Wales electricity businesses over the previous regulatory period.

3.4.1 Evans and Peck report

95. The Evans and Peck report estimates the cost of interest rate swaps as consisting of:[27]

- an execution spread that increases with the maturity of a bond; and
- a credit spread that increases with the maturity of a bond and is also higher for bonds with lower credit ratings.

96. Following the methodology set out in the Evans and Peck report, for a debt term of 10 years and a regulatory period of 5 years, the costs for a BBB entity would be:

- execution spread of 4.0 basis points and a credit spread of 5.5 basis points for the 10 year fixed-to-floating leg; and
- execution spread of 3.0 basis points and a credit spread of 3.5 basis points for the 5 year floating-to-fixed leg.

97. The total cost of swap transactions for this purpose is 16 basis points per annum.

27 Evans and Peck, *SEQ Retail Water Price Review*, 4 February 2013

98. We note for clarity that this estimate does not capture the transactions costs associated with entering into cross-currency swaps on debt issued in foreign currency. However, these costs are considered in the context of the UBS report on the transaction costs of using swaps.

3.4.2 UBS report

99. The UBS report identifies four components of hedging for a BBB+ entity over 10 years being:[28]

- 5 basis points for credit, capital and execution costs;
- 18 basis points for cross-currency credit, capital and execution costs (on the basis that the most efficient debt management strategy would be to raise large volumes of debt offshore and convert this back to floating rate AUD dollar denominated exposure);
- 9 basis points for tracking risk, to hedge for differences in the movement of the benchmark swap rate and the fair value estimates over the averaging period; and
- 6 basis points for deferral risk, to account for hedging occurring in advance of the start of the regulatory period.

100. That is, UBS estimates a total hedging cost of 38 basis points for a BBB+ entity. However, only 23bp of this estimate are actual fees paid to banks (the first two dot points of the explanation above). The remaining 15bp are a quantification of risks associated with an inability to fully hedge to the regulatory allowance even when using swaps. In this report we focus on the 23bp as a measure of the direct transaction costs.

3.4.3 Estimated transaction costs

101. We note that both the UBS and the Evans and Peck estimates of swap transaction costs are prevailing estimates. However, under the hybrid debt management strategy, the firm is required to enter into a historical series of interest rate swaps at the same time that debt has been issued. Therefore, a trailing average of transaction costs is a relevant cost for the business (just as a trailing average DRP is a relevant cost).

102. However, it is likely that the trailing average of swap transaction costs is materially greater than the prevailing estimate. This is because in periods of financial sector dislocation, such as those which have dominated the last 10 years, the fees that banks charge for credit, capital and execution costs will have been elevated (in much

28 UBS, *Analysis of Liquidity of Interest Rate Swaps*, January 2015

the same way as corporate debt risk premiums have been). UBS makes this point when it states: [29]

> *With no domestic debt issuance in the Australian debt capital markets in the period immediately after the averaging period over the remainder of 2008 and only $2.4b of issuance in 2009, it is reasonable to assume that liquidity and appetite to take and hold corporate risk was constrained at that time. Given the liquidity and credit risk constraints at the time, we are not able to accurately quantify the cost of hedging some $18,263m of notional debt (total notional debt amount for all service providers subject to determination in 2009).*

103. Consistent with this it is reasonable to treat the UBS and Evans and Peck estimates as lower bound estimates of the actual transaction costs associated with swaps that still form part of the benchmark efficient entity's portfolio (assuming that one accepts the AER's position that the hybrid debt management strategy is the uniquely efficient debt management strategy).

104. Similarly, the UBS and Evans and Peck estimates will likely underestimate the transaction costs of swap portfolios because they do not include the impact on the traded prices in swap markets as a result of an attempt to transact the large volumes of interest rate swaps that are necessary under the hybrid approach.

105. In the context of the above, it is reasonable to adopt the upper end of the range defined by these two estimates of the transaction costs associated with swaps.

106. We note that UBS assumes that debt is issued overseas because of the low ability that it attributes to the Australian domestic market to fund 10 year BBB+ debt – especially over the last 10 years. [30] The RBA (and the AER[31]) has made similar observations:[32]

> *US dollar denominated securities account for an even larger share of the outstanding BBB-rated bonds. Almost all of the BBB-rated bonds outstanding with residual maturities above 7 years are denominated in US dollars. Australian dollar-denominated BBB-rated bonds are slightly less than 20 per cent of the total outstanding at this rating, and are skewed heavily towards shorter residual maturities. Over time, the value*

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29 UBS, *Analysis of Liquidity of Interest Rate Swaps, a report for TransGrid*, January 2015, p. 6.

30 UBS, *Financeability – debt issuance and capital structure,* a report prepared for Networks NSW, January 2015, pp. 8-9.

31 The AER acknowledged the use of foreign currency debt issued by its network businesses it regulates, See: AER, Explanatory Statement to the rate of return guideline, pp. 136, 142, 143.

32 RBA, New Measures of Australian Corporate Credit Spreads, RBA Bulletin | DECEMBER Quarter 2013, pp.16-17

and number of outstanding Australian NFC bonds with longer residual maturities has increased significantly, especially in the 7 to 10 year range.

107. We note that the RBA curve construction does include the market price for cross-currency basis swaps.[33] The costs of a basis swap can sometimes be positive and sometimes negative depending on expected exchange rate movements (although they have most commonly been positive when swapping from USD to AUD). However, these should not be confused with the 23bp of fees estimated by UBS which are estimates of bank fees rather than market rates for cross-currency basis swaps.

108. This is a further reason to give more weight to the UBS estimate (which includes the transaction costs of issuing debt internationally). However, it is an open question as to what the benchmark efficient proportion of foreign and domestically issued debt will be going forward. As noted by the RBA, there has been an increase in domestic issuance in recent years – although foreign issuance still dominates.

109. An extreme estimate of the minimum possible level of swap transaction costs can be derived by assuming that the benchmark firm issued all debt domestically and that historical average swap transaction costs were the same as prevailing swap transaction costs (10bp[34] according to UBS or 16bp according to Evans and Peck).

110. This range of estimates is supported by the QCA, which has stated that:[35]

Interest-rate swap contract transactions costs are typically around 15-20 basis points per annum, whereas the prevailing spread (11/8/2014) between 1-year and 10-year CGS bonds is around 90 basis points per annum (RBA Statistical Table F16).

3.4.4 Swap transactions costs over time

111. If it is assumed that future debt is issued internationally then swap transaction costs will continue to be incurred in proportion to the share of debt that is issued overseas – even once the transition to a trailing average is completed. This is because cross-currency swaps will still need to be entered into. However, if it is assumed that fixed rate domestic issuance dominates future issuance then swap transaction costs will fall over time as old interest rate swap contracts end and are not renewed.

33 RBA, New Measures of Australian Corporate Credit Spreads, RBA Bulletin | DECEMBER Quarter 2013, Appendix A.

34 This is twice UBS's 5bp estimate for the cost of a single leg of a domestic swap transaction (noting that two legs of a swap transaction are required under the hybrid debt management approach).

35 QCA, *Position paper: Long-term framework for SEQ water retailers – weighted average cost of capital (WACC)*, August 2014, p. 29.

112. If it is assumed that, prospectively, the benchmark firm issues only domestic debt, then the transactions costs of swaps are likely to fall over time. For example, adopting our estimate of 23bp of swap transaction costs in the first year, if the firm is assumed to issue domestic fixed rate debt in each subsequent year then the transaction costs of swaps would fall to 20.7bp (90% of 23bp) in that year and to 18.4bp (80% of 23bp) in the subsequent year and so on. By the tenth year the transaction costs of swaps would be zero.

113. Alternatively, if the Evans and Peck, or any other estimate, is adopted as the best estimate of transaction costs on interest rate swaps not yet matured, then this estimate will fall according to the same pattern if it is assumed that only domestic fixed rate debt is issued prospectively.

4 AER's justification for transition

4.1 Overview

114. The AER has a number of different, sometimes inconsistent, rationales for why it proposes to transition to, rather than immediately compensate, the regulated business for the costs associated with a trailing average cost of debt. In our view, these rationales can be reasonably summarised as follows:

a. Under the previous on-the-day approach, the AER considers that an efficient business would have adopted the hybrid debt management strategy (described in section 3.2 of this report). This is a reason for not compensating based on a simple trailing average (without a swap overlay) now. (As discussed in section 2.2, this rationale for a transition depends on a construction of the ARORO that allows efficient financing costs of the benchmark efficient entity to be determined in the context of, and as a response to, a specific regulatory practice.)

b. Notwithstanding the above, the AER does not propose to compensate for the costs associated with the hybrid debt management strategy, or the costs for a transition from the hybrid debt management strategy to a trailing average. This is because the AER believes that, under the on-the-day approach, many regulated businesses earned windfall gains on the DRP during the global financial crisis and the AER believes that its transition is likely to reverse these gains in the next regulatory period. The AER sees this as a desirable outcome.

c. In addition the AER believes that its transition:

   i. will avoid practical problems with the use of historical data;

   ii. is consistent with investor/consumer expectations while reducing future price volatility;

   iii. is consistent with the AER's adoption of a single benchmark efficient entity definition; and

   iv. reduces the potential for opportunistic behaviour from stakeholders.

115. The AER provides a reasonably clear statement of the above positions:[36]

> *We adopt the same transitional arrangements for both the risk free rate and debt risk premium components of the return on debt. However, our reasons for adopting transitional arrangements differ for these two components.*

[36] AER, *Jemena Gas Networks draft decision, Attachment 3: Rate of return*, p. 3-112.

> *We have adopted a transition on the risk free rate component because a transition minimises the potential mismatch between the allowed return on debt and the actual return on debt of the benchmark efficient entity, as it transitions its financing practices. The benchmark term of debt is 10 years. It would therefore take 10 years before all of the existing debt of the benchmark efficient entity matured, and its financing practices are fully transitioned. Accordingly, this reason for the transition on the risk free rate component also informs our draft decision on the length of the transition period, which is 10 years.*
>
> *We have adopted a transition on the debt risk premium component of the return on debt because a transition:*
>
> - *Avoids potential windfall gains or losses to service providers or consumers from changing the regulatory regime*
> - *Avoids practical problems with the use of historical data*
>
> *We have also adopted a transition on both the risk free rate and debt risk premium components because a transition:*
>
> - *Maintains the same average price level while decreasing price volatility over time*
> - *Reduces the potential for opportunistic behaviour from stakeholders*
>
> *Further, adopting the same transitional arrangements for all service providers is consistent with our adoption of a single benchmark efficient entity definition. These reasons are discussed in the following sections.*

4.2 Efficient practice under the on-the-day approach

116. We do not consider that it is reasonable to conclude that the hybrid debt management strategy was uniquely efficient under the on-the-day approach. Our reasoning for this conclusion is set out in detail in section 4 of our most recent report for ActewAGL.[37] In summary:

   a. The properties of the simple trailing average strategy that make it an efficient debt management strategy in the future, namely the minimisation of transaction costs, also make it an efficient debt management strategy in the past.

   b. The AER's argument that the hybrid debt management strategy, which it implicitly assumes to have been associated with hedging 100% of the base rate of

37 CEG, *Efficient debt financing costs:a report for ActewAGL*, January 2015.

interest exposure, was uniquely efficient in the past is based on an unreasonable belief that it provided the best hedge to the on-the-day allowance.

117. Given the above, we do not consider that the AER has acted reasonably in concluding that a trailing average debt management strategy was inefficient and that a hybrid strategy was uniquely efficient. However, given this is the AER's position, the only reasonable approach consistent with this would be for the AER to propose a transition from the hybrid to the trailing average debt management strategy. This is not what the AER transition does.

4.3 Reversing past windfall gains

4.3.1 AER's views

118. The AER's views on why it believes its transition is required to avoid windfall gains accruing to regulated businesses are set out on pages 3-115 to 3-119 of JGN's draft decision. Further clarification of the AER's reasoning is also provided in the Ausgrid draft decision. It is difficult to extract a short precise statement of the AER's reasoning. Consequently, we summarise our interpretation of the AER's reasoning below:

a. The AER assumes that the 'efficient' base rates of interest were accurately compensated for all businesses under the on-the-day approach. In doing so, the AER relies on the assumption that the benchmark efficient debt management strategy was the hybrid debt management strategy.[38]

b. On this basis, the AER considers that any windfall gain or loss should be measured by reference to the difference between:

   i. the prevailing DRP in the averaging period at the start of the regulatory period and used to set compensation for the DRP during the regulatory period; and

   ii. the historical average DRP that a business would actually be paying on its historical debt portfolio[39] (noting that the DRP cannot be hedged).

c. The prevailing DRP can rise above the historical average DRP and this did happen during the early part of the global financial crisis. This is because the trailing average DRP rises (and falls) more slowly than the prevailing DRP since the latter is only a small influence on the former. This means that, under the on-the-day approach, any businesses which had their DRP set during such a period

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38 See fourth full paragraph on page 3-117 of the Jemena Gas Networks draft decision beginning "*As discussed in the previous section, with respect to the risk free rate component, …*"

39 See first two paragraphs on page 3-299 of the Ausgrid draft decision beginning "The NSW service providers did not take hedging into account, …"

will have received a windfall gain relative to a cost of debt proxied by historical average DRP. However, as the prevailing DRP falls back to more 'normal' levels, the prevailing DRP can be expected to fall below the trailing average DRP – imposing a windfall loss on businesses whose averaging periods fall in such periods (regulatory DRP equal to prevailing DRP which is less than historical average DRP).[40]

d. These windfall gains and losses that accrue under the 'on the day' approach can be expected to be broadly offsetting in the long run.[41]

e. Adopting a trailing average DRP immediately would help ensure that there was no future windfall loss (or gain).[42] However, avoiding future windfall losses is undesirable because the AER will 'lock in' past windfall gains – which a future windfall loss would otherwise offset (and vice versa). Therefore, it is appropriate that the AER impose a transition that has the effect of retaining the properties of the 'on the day' approach for at least one more regulatory period.[43]

f. Empirical analysis performed by Associate Professor Martin Lally, and reproduced by the AER in Table 3-26 suggests that, in the last set of regulatory decisions, across the last six years, the industry as a whole will be overcompensated by 1.3% of its debt costs but would be overcompensated by 3.4% without any transition.[44]

119. The AER's justification for a transition, as set out above, is fundamentally that it is appropriate and desirable to design a transition that:

- compensates businesses at less than their prospectively incurred efficient costs; because
- the regime that existed in the past led to them being overcompensated relative to their efficiently incurred costs in the past.

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40 AER, *Ausgrid draft decision*, November 2014, pp. 3-300 to 3-302

41 Ibid, p. 3-301

42 Ibid, p. 3-302

43 See Ibid, p. 3-301, reproduced here:

> *A consistent application of the on-the-day approach over a long term would tend to balance out these positive and negative effects. However, if the regulatory approach changes and is implemented immediately (without transition), depending on the time in the above process where the switch occurs, it would create the potential for windfall gains and losses. This is because the accumulated effects would be locked-in once the switch of regime occurs.* (Emphasis added)

44 AER, *ActewAGL draft decision*, November 2014, p. 3-120

120. The clearest justification for this is, in our view, not found in the AER decision but in Professor Lally's report. Lally states:[45]

> *It might be argued that the transitional process would involve 'clawing back' past gains. I think that 'clawing back' relates to a situation in which gains have arisen from a past event, that past event will not give rise to future consequences that will naturally erode those gains, and the transitional process does erode the gains. However, in the present situation, the gains have arisen from a DRP spike and the natural reversion in the DRP back to its earlier level would erode these gains back to zero. Switching to a trailing average in mid-stream without a transitional regime locks in the accumulated gains up to that point. So, the use of a transitional regime to prevent this does not constitute a claw back. It instead constitutes a process that mimics the erosion in the gains for the businesses that would have occurred naturally under the earlier regime.*

121. In this passage Lally is putting forward a premise that the errors (i.e., differences between allowed cost of debt and actual cost of debt) associated with the 'on the day' approach tend to move in cycles – with under-compensation in one regulatory period followed by over-compensation in the next followed by under-compensation etc. A new approach (such as the trailing average approach) can remove this source of over or under-compensation and set compensation equal to efficient costs. However, in Lally's view, if this source of error is removed at a given point in time, it may be that:

- the accumulated level of past over-compensation is materially positive; and
- this would have been offset by prospective under-compensation without the change in regulatory approach.

122. Lally is arguing that the regulator should adopt a transition "that mimics the erosion in the gains for the businesses that would have occurred naturally under the earlier regime".[46]

123. In our view there are a number of errors in this analysis and conclusion that are both logical and empirical. We set these out below.

4.3.2 Justification under the rules

124. Professor Lally does not ground his conclusions in the context of the requirements of the NGR or the NGL, which are effectively the same with regard to setting the

45 Lally, M., Transitional Arrangements for the Cost of Debt, 24 November 2014, pp. 21-22.

46 Martin Lally, Transitional Arrangements for the Cost of Debt, 24 November 2014, p. 22.

cost of debt. The only discussion is of the NER in the form of the following sentence, which is repeated, with minor word changes, five times in his report:[47]

> *Furthermore, the adoption of this transitional process is consistent with the requirement under clause 6.5.2 of the NER to have regard to the impact on a benchmark efficient entity of a change in methodology.*

125. The AER, similarly, does not explain in any detail its justification for the transitional arrangements in the context of the NGR. It is not obvious that it is possible to read into the NGR and the NGL that it is appropriate to set future compensation in a manner that attempts to reverse past over or under compensation, to the extent that the consequences of the on-the-day approach that arise in respect of past regulatory periods may be considered errors or consequences that can or should be adjusted for. In any event, neither the AER nor Professor Lally has provided such a justification.

126. In its discussion of the "windfall gain" justification for the transition arrangements the AER only appears to rely on NGR 87(11)(d).[48] This clause states that the AER must have regard to:

> *…any impacts (including in relation to the costs of servicing debt across regulatory control 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 regulatory control period to the next.*

127. The AER (and Lally) appear to be interpreting this in a manner that:

- fixing an error in the cost of debt methodology would eliminate a prospective windfall loss to the benchmark efficient entity (i.e., it would eliminate future under-compensation). However, this would occur at a time when the business has earned a windfall gain in the past;
- this creates a positive "impact" on the benchmark efficient entity (by virtue of avoiding that prospective loss, and, in so doing, not eroding a past windfall gain); and
- having regard to this positive impact it is appropriate for the AER to put in place a transition that mitigates the positive impact (i.e., that reinstates the windfall loss that the AER considers would otherwise have accrued to the business).

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47 Martin Lally, Transitional Arrangements for the Cost of Debt, 24 November 2014, pp. 4, 13, 22, 25, 38.

48 Referred to at AER, *Jemena Gas Networks draft decision*, pp. 3-111 to 3-112. The equivalent clause in the NER is 6.5.2(k)(4).

128. Without commenting on the legal interpretation of Rule 87(11)(d), our plain economic reading of this clause is that the AER must have regard to the extent to which a change in methodology will cause prospective compensation to be different from efficient prospective costs – given the financing strategy that the benchmark efficient entity (efficiently) adopted under the old regime. There is nothing in this rule that leads me to interpret it as suggesting that the AER could design a new cost of debt methodology (inclusive of transition or not) with the express purpose of imposing a prospective loss on the benchmark efficient entity in order to offset what it considers to be a past gain by that entity.

129. Rule 87(11)(d) does not, in our opinion, provide grounds for the AER to simply alternate between two mutually exclusive debt management strategies without transition. An example of this would be for the AER to determine that a simple trailing average methodology (with no swap overlay) is efficient in one regulatory period and then to determine that a hybrid debt management methodology (trailing average methodology with swap overlay) is efficient at the beginning of the next regulatory period. This would be at odds with Rule 87(11)(d) because a benchmark efficient entity that had adopted a simple trailing average debt management strategy in the first regulatory period would not be in a position to align its costs with a hybrid debt management strategy for the second.[49]

130. In this context, a transition would be appropriate in order to set prospective compensation in a manner that was consistent with prospective costs of the benchmark efficient entity transitioning from one strategy to another. However, that logic applies only to prospective alignment of compensation and costs – it does not suggest any role for intentionally misaligning or creating a mismatch between prospective compensation and costs in order to offset any perceived past misalignment of compensation and costs.

131. In our view the ARORO is an important context here. The ARORO is defined as:

> *... the rate of return for a Distribution Network 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 Distribution Network Service Provider in respect of the provision of standard control services (the allowed rate of return objective).*

132. We read this objective as being prospective in nature. If this is correct then our interpretation of Rule 87(11)(d) is consistent with this. However, if the AER's interpretation of Rule 87(11)(d) is correct then either Rule 87(11)(d) is in conflict with the ARORO or *"commensurate with the efficient financing costs of a benchmark efficient entity"* must be read such that these costs, and the allowed rate

49 Their allowance under the hybrid would be either higher/lower than their actual trailing average costs if base interest rates were higher/lower at the beginning of the second regulatory period than the trailing average of base interest costs.

of return, must be measured over both future and past regulatory periods in order to test whether the ARORO is satisfied.

133. The AER draft decision states, in relation to the ARORO, that:[50]

> *Commencing the trailing average with a period of transition contributes towards the achievement of the rate of return objective because it minimises the potential mismatch between the allowed and actual return on debt of the benchmark efficient entity, while also avoiding windfall gains or losses to service providers or consumers from changing the regulatory approach to the return on debt. For these reasons, it also provides service providers with a reasonable opportunity to recover at least their efficient debt financing costs.*

134. The only way this statement can be internally consistent is if the AER is interpreting the ARORO as requiring "commensurate" to be interpreted over the sum of both future and past regulatory periods. On the AER's own terms, and on Lally's advice to the AER, the transition creates (by preventing the elimination of) a prospective mismatch between the allowed and actual DRP of a benchmark efficient entity.

135. We do not consider that this is an appropriate interpretation of the ARORO, and we consider that this interpretation would make the application of the NGR unworkable and would be inconsistent with the NGO. Under this interpretation of the ARORO the regulator can identify retrospectively that its past decisions have allowed a benchmark efficient entity to be overcompensated in the past and can use that as a basis to undercompensate it in the future. In our view, this would distort incentives because a business could never be certain that the allowed revenues that it has been allowed will not be deemed to be overcompensation and then be removed at some later date. This would not provide appropriate incentives for a business to seek to minimise its cost of debt

136. Putting aside this serious concern, even if one were to accept that the rules did allow this retrospective reversal of past decisions, the AER justification for its transition would still be flawed in that it applies the same transition to all businesses – even if doing so imposes a loss greater than any estimated past over-compensation. On Lally's own estimates, reproduced by the AER in Table 3-26, just such a net loss is imposed on businesses with regulatory cycles beginning in 2007, 2010 and 2011.

137. If the ARORO and Rule 87(11)(d) of the NGR could be interpreted in the manner that the AER and Lally have done, then we do not understand why each business could not have a bespoke transition where the level of prospective windfall loss applied to each business would be commensurate with the level of windfall gain the AER determines that they earned retrospectively. That is, it is illogical to motivate a methodology by a concern about windfall gains where the AER has not performed

50 AER Jemena Gas Networks draft decision, p. 3-112

sufficient analysis to inform whether its concerns would be resolved by its proposed transition. In particular it has not assessed:

- what these windfall gains amount to – and for many businesses they may be windfall losses; and
- how much of these windfall gains are expected to be clawed back under its proposed transition to a trailing average.

138. The draft decision is internally inconsistent when it argues that:[51]

> *This approach means a single benchmark should apply for the purpose of estimating the return on debt and return on equity. For the return on debt estimation, it also means applying a single benchmark definition for the purpose of implementing transitional arrangements.*

139. If the AER's rationale for its transition is accepted then it should be designed consistently with that rationale. However, the magnitude of the alleged windfall gain differs depending on the timing of each regulatory cycle being applied to the benchmark efficient entity. Therefore, a different transition, which results in losses commensurate to past gains, would be required to be applied to each cycle that the benchmark efficient entity operates in. The AER's transition has not been designed with this in mind.

140. Moreover, the AER's and Lally's analysis of alleged windfall gains (which they argue must be offset by prospective windfall losses) extends only back to the single immediate past regulatory decision. If past windfall gains are relevant then it is not obvious analysis of these gains would be limited to examining only the immediate past.

4.3.3 NPV principle

141. The draft decision argues that its transition is justified by application of the "NPV principle". The following passage reflects these relevant views:[52]

> ***When the methodology for estimating the return on debt changes during the life of a regulated asset, the NPV principle is unlikely to be met automatically. Any pre-existing differences between the allowed return on debt and the actual return on debt of a benchmark efficient entity remain.*** *The service provider will receive a return on debt that is different from the benchmark efficient entity and consumers will pay prices that reflect this difference.*

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[51] AER, *Jemena Gas Networks draft decision*, November 2014, p. 3-123

[52] AER, *Jemena Gas Networks draft decision*, November 2014 p. 3-117.

> *In these circumstances, departures from the NPV principle are not the result of changes in efficiency. Rather, they are a consequence of changing the estimation methodology. Therefore, in our opinion, the resulting benefits or detriments are windfall gains or losses that the regulatory regime should avoid. In other words, regardless of who obtains the benefit or detriment, an immediate change from one methodology to another has the potential undesirable consequences. Also, this should be a concern for both the benchmark efficient entity and for consumers as, ex ante, they could not know for certain whether they would obtain a benefit or detriment.* (Emphasis added)

142. In our opinion, the above views are disordered. In the highlighted part of the passage, the AER is positing the existence of a pre-existing accumulated difference between the allowed and efficient cost of debt under the old approaches to determining the cost of debt – where the old approach is the on-the-day approach in the current context. This difference can only exist if the on-the-day estimate of the cost of debt did not accurately assess efficient costs in the past.

143. This is a reason for wanting to change the on-the-day approach to a methodology that more accurately estimates efficient costs. If a new regime is introduced that does not have any errors (or has much smaller errors) then the errors from the pre-existing regime will not be added to or subtracted from by future errors. A natural interpretation of this result is that it would promote the NPV principle in that future costs would be aligned with future compensation.

144. However, the AER appears to view the introduction of a more accurate regime as creating the errors that already existed. That is, the new 'low error' methodology causes the errors that existed under the old regime 'to remain' and, therefore the AER concludes that the immediate introduction of the new regime is inconsistent with the NPV principle.

145. In our view this is illogical. The errors that existed under the old regime cannot be attributed to the new 'low error' methodology. The NPV principle cannot be served by maintaining a methodology, or aspects of a methodology, that is known to violate the NPV principle. This, after all, is why it is possible for "pre-existing differences between the allowed return on debt and the actual return on debt of a benchmark efficient entity" to exist under that methodology.

146. Rather, it is our view that past errors are precisely that – past violations of the NPV principle. Prospectively, the NPV principle requires the AER to attempt to minimise errors – not make offsetting errors of similar magnitude to past errors. Moreover, as noted elsewhere in this report, the AER's proposed transition cannot be relied on to create such offsetting errors in any event.

4.4 Other rationales for AER transition

4.4.1 Practical problems with the use of historical data

147. The AER also argues that it would be difficult to estimate the cost of debt historically because:[53]

> *There is no third party data series that is available for the full 10 year historical period, meaning a mixture of data series for different time periods would be required.*
>
> *There has been considerable variation in the results of the different data series, which complicates the choice and materiality of choosing between or combining different data series for different time periods.*
>
> *It is not clear to us if each data series is of comparable or varied quality, and whether this changed over time. For example, during the first several years of the RBA data series the sample size was small, whereas it has increased in more recent years.*

148. We do not consider that these are actual or material barriers to establishing a trailing average estimate.

149. First, the AER/ACCC and other regulators have been estimating the cost of debt over this entire period and all of the relevant data that was available then is available now. In fact, more data is available now in the form of a new RBA series for the corporate cost of debt that extends back to January 2005. There is no materially greater difficulty in estimating the cost of debt for previous years than there was when the AER in fact did so.

150. Second, the available data series do have some material differences over some periods, in particular parts of the GFC. However, the same will almost certainly be true prospectively. In our view, the AER is without basis in concluding as follows about the reliability of its estimates of the return on debt in prospective averaging periods because, as a consequence of the prospective nature of those averaging periods, the AER cannot know what the available data will look like in those periods.[54]

> *In contrast, adopting transitional arrangements avoids these practical problems with the use of historical data. This is because our transitional arrangements do not use any data from before 2014.* ***We have been able to conduct a detailed assessment of the data series which***

53 AER, *Jemena Gas Networks draft decision*, November 2014, p. 3-120.

54 AER, *Jemena Gas Networks draft decision*, November 2014, p. 3-121.

> ***are currently available, and also considered carefully how those data series should be combined. Accordingly, we have a degree of confidence in the reliability of the return on debt resulting in our combination of those data series****. We would not have the same degree of confidence in the reliability of a historical return on debt, for the reasons outlined above.* [Emphasis added.]

151. Here the AER appears to be determining that it can be confident in the reliability of data that does not yet exist. Indeed, the AER goes further and is arguing that data that does actually already exist, and which it has previously used to make regulatory decisions, can be presumed to be less reliable than data that does not yet exist. I do not consider that this is reasonable.

152. Estimating the cost of debt historically does not create a problem in terms of weighting different data sources that will not exist prospectively. The AER has proposed a simple mechanism to deal with prospective differences and that is to give equal weight to the two currently available third party estimates (Bloomberg and RBA). The same method could easily be applied historically.

153. In our view, any problems associated with differences between the estimates from data providers are much more severe with the AER's transition. This is because the AER transition gives 100% weight to yields estimated during the initial, short, averaging period and this estimate dominates the AER cost of debt estimate over the transition (it still has 60% weight in the last year of the next regulatory period). The choice/weighting between data provider's estimates in this period is, therefore, critical to outcomes over the transition. If an estimate provided by a data provider is problematic over the month (or few months) of the AER's initial transitional averaging period then this will materially affect the AER's allowance over the entirety of the transition.

154. By contrast, instead of giving 100% weight to the month (or few months) of the second averaging period, estimating a trailing average cost of debt over the last 10 years results in less than 1% weight being given to each available month. Consequently, there is little or no prospect of an 'unusual' estimate from one data provider distorting regulatory outcomes.

155. Consistent with this we estimate that the trailing average DRP is not sensitive to the third party data provider chosen or to the extrapolation method used. This is explored in detail in section 6 below. By contrast, the prevailing Bloomberg and RBA estimates using the AER's extrapolation methodology are very different in the first averaging period. Using the AER's extrapolation technique, the RBA BBB DRP (spread to 10 year swap) is 1.58% while the Bloomberg BVAL estimate is 1.18%. That is, the RBA estimate is almost one third higher than the Bloomberg estimate. Giving the current estimates such significant weight in the AER's transition creates much more serious issues in choosing between data service providers than using a historical average.

156. Finally, we note that much of the justification for the AER's transition is based on the use of historical data by Professor Lally to provide evidence of past over-compensation. It is difficult to reconcile the use of historical data in support of the adoption of its transition with the AER's view that the use of historical data is a barrier to an immediate transition of the DRP or cost of debt.

4.4.2 Maintains average price level while decreasing price volatility over time

157. The AER's draft decision cites controlling price volatility in support of its proposed transitional arrangements:[55]

> *However, changing between regulatory approaches without transitional arrangements may lead to a different average return on debt, and therefore a different average price level, than would result from either approach being applied consistently over time. Specifically, moving from the on-the-day approach to the trailing average portfolio approach when:*
>
> - *prevailing interest rates are below the historical average—would result in a higher average return on debt, and therefore higher average price level, than if either approach was applied consistently over time, and*
> - *prevailing interests are above the historical average—would result in a lower average return on debt, and therefore a lower average price level, than if either approach was applied consistently over time.*

158. In part, the AER appears to be making a factual statement that, if the historical average cost of debt is different to the prevailing cost of debt, then immediate adoption of a trailing average will result in different levels of compensation than staying with the "on the day" approach. This is obviously correct.

159. The AER does not explain, in this paragraph or elsewhere in the same section, why this provides a justification for its proposed transition. Indeed, the AER's concern does not specifically seem to be about price volatility since its proposed approach would result in the greatest immediate change in the cost of debt out of all the options that we discuss in this report.

160. Rather, the AER is arguing that it is desirable to retain the same price outcome that would have resulted from one more "roll of the dice" using the on-the-day methodology. The AER's transition certainly does this. However, other than the windfall gain argument which the AER treats as a separate justification, no other

55 AER, *Jemena Gas Networks draft decision, Attachment 3: Rate of return*, November 2014, p. 3-121 to 3-122

justification is provided for why this is a desirable property. That is, no justification is provided for why retaining the potential for a prospective error is desirable.

161. It is certainly not true that this approach provides for price stability. It does not. The trailing average (either of the DRP only or of the entire cost of debt) is more stable than the "on the day" estimate. By retaining the "on the day" estimate for both the DRP and the base rate of interest, the AER transition makes prices less stable not more stable because a spot rate (such as the "on the day" rate) is inherently more volatile than a trailing average.

162. In our view, the argument put forward here is, in reality, the same as the windfall gain/loss arguments that we deal with above.

4.4.3 Reduces the potential for opportunistic behaviour from stakeholders

163. The AER also states that the application of transitional arrangements is likely to minimise the potential for opportunistic behaviour.[56] We have addressed these arguments before and concluded that there is no substance to these arguments.[57]

164. To the extent that adopting a new benchmark efficient debt management strategy will, if implemented immediately and without transition, raise (or lower) compensation then some stakeholders will have an incentive to propose a change in the benchmark efficient debt management strategy in order to benefit from the associated change in compensation. In this circumstance, a transition can be designed that will eliminate any such incentive. However, the design must be such that it is a transition:

- from the current benchmark efficient debt management strategy (call this "A");
- to the new benchmark efficient debt management strategy (call this "B"); and
- must be defined in a manner that is consistent with how the benchmark efficient entity would transition its debt portfolio from "A" to "B").

165. Such a transition path between the old ("A") and new ("B") benchmark efficient debt management strategies allows the benchmark efficient entity to actually replicate the costs being allowed during the transition. That is, not only would the old and new benchmark efficient debt management strategies be able to be followed (be replicable) but so would the pathway (transition) between them.

166. If this is not the case then precisely the same 'gaming' incentives exist in relation to proposing a transition that will benefit one set of stakeholders over another. If the

56 AER, *Jemena Gas Networks draft decision, Attachment 3: Rate of return*, November 2014, p. 3-122

57 CEG, *Debt transition consistent with the NER and NEL*, A report prepared for the NSW DNSPs, May 2014, p. 29 paragraphs 105-106. Equally, although this report refers to the NER and NEL its conclusions apply equally to the NGR and NGL.

transition does not start from "A" and transition to "B" on the same path that the benchmark efficient entity would transition,[58] then the benchmark efficient entity will, depending on the nature of the departure from this path, either be over or under-compensated. Equally, there will be no benefit to the benchmark efficient entity as a result of a change in the benchmark efficient debt management strategy is adopted with a transition of the form described above.

167. Indeed, Rule 87(11)(d) requires a regulator to take into account the impact, if any, on a benchmark efficient entity when moving from compensating for one benchmark efficient debt management strategy to another benchmark efficient debt management strategy. This recognises that the benchmark efficient entity will not, in general, be able to simply adopt the newly determined benchmark efficient debt management strategy 'overnight' and may need to take time to adjust their debt portfolio and any associated hedging contracts.

168. The AER considers that the benchmark efficient debt management strategy was previously the use of a staggered portfolio of 10 year debt with an interest rate swap overlay for 100% of the base rate of interest. If this is accepted as correct, then it would be permissible to design a transition from this strategy to a trailing average. However, such a transition would apply only to the base rate of interest because the DRP component cannot be hedged. Therefore, the benchmark efficient entity's efficient financing costs, associated with what the AER regards as the previously efficient debt management strategy, is already based a trailing average DRP.

169. If we accept the AER's contention regarding the previously efficient debt management strategy, the AER's adoption of a trailing average cost of debt methodology amounts to, in part, a correction of an error under the old methodology; which compensated for the 'on the day' DRP despite the benchmark efficient entity's efficient financing costs reflecting the trailing average DRP. In our view, the Rules do not allow a transition to be imposed to the extent that the change in regulatory methodology is designed to correct an error that existed under the old regulatory methodology (as opposed to the redefining a new benchmark efficient debt management strategy). Applying the AER's transition to the DRP amounts to making the same error again – and allowing the impact of that error to affect the cost of debt estimate for the next nine years.

58 For example, if the AER determined that the benchmark efficient entity issued 10 year debt and, at some subsequent date, determined that issuing 5 year debt would be more efficient then, at that time, the benchmark efficient entity will still have 10 year debt from the last 10 years on its books. The benchmark efficient entity could not 'go back in time' and issue 5 year debt instead of 10 year debt. The relevant transition path is one that mimics how the benchmark efficient entity would actually transition between the old and new debt management benchmarks. In this case, this would involve a transition path that assumed new debt would be issued at a 5 year maturity while recognising that costs of the existing 10 year debt would still need to be compensated for until it matured.

170. In the terminology used above, the AER is not proposing a transition from "A" (the benchmark efficient entity's current efficient financing costs which the AER regards as being consistent with the hybrid debt management strategy) to "B" (the trailing average cost of debt). Rather, the AER is beginning its transition at "C"; where "C" is the "one the day" DRP which the AER accepts does not reflect the efficient financing costs of the benchmark efficient entity. In proposing a transition that is divorced from the benchmark efficient entity's debt management practice, the AER is creating a framework where precisely the opportunistic behaviour it is concerned about can exist.

4.4.4 Consistent with the AER's adoption of a single benchmark efficient entity definition

171. The AER argues[59] in favour of its transition on the basis that it is the same for all businesses and, therefore, consistent with the assumption of a single benchmark efficient firm and (implicitly) a single benchmark efficient debt management strategy.

172. We make two observations in response to this. First, even if one accepts the AER's proposition that there was a single efficient debt management strategy (the hybrid strategy) then this is an argument for a single approach to transition. It is not an argument for the AER's transition.

173. As we have already set out, if the hybrid debt management strategy was uniquely efficient in the past then the transition should be derived based on transitioning from the hybrid debt management strategy. A description of how this transition would work is set out in section 3.3 above. However, a critical feature of this is that the DRP would be based on the 10 year trailing average DRP – not the prevailing DRP.

174. Second, it is, in our view, simply unreasonable to assume that a unique debt management strategy was efficient under the old regime. As we state in our May 2014 report[60]:

> *The previous regulatory benchmark was based on an inefficient (and ultimately un-implementable) debt management strategy. The introduction of the new Rules, most relevantly the ARORO, meant that this benchmark had to change. That is, the old practice was inconsistent with the ARORO and had to change. In my view, this means that it is not possible to define a unique benchmark efficient debt management strategy that existed under the previous regulatory practice of setting the cost of debt 'as if' all debt was raised 'on the day'.*

59 AER, *Jemena Gas Networks draft decision, Attachment 3: Rate of return*, November 2014, p. 3-123

60 CEG, *Debt transition consistent with the NER and NEL*, May 2014, p. 15.

175. This is consistent with the analysis that we have presented in this section which demonstrates that the AER has no reasonable basis for concluding that the trailing average was not efficient in the past.

5 Best estimate of the cost of debt for the second averaging period

5.1 Overview of update

176. This section is an update of the results presented in our February 2015 report which relied on data over the period 2 January to 30 January 2015. This section follows the same basic structure but now analyses data over the period 19 January to 16 February (the "second" averaging period).

177. The results of this analysis are very similar to those presented in our February 2015 report – which is to be expected given the overlapping periods from which data has been drawn. It is still the case that the SAPN extrapolation provides the best fit to the full bond sample for the Bloomberg and RBA third party fair value estimates.

178. The average of these extrapolated estimates has fallen by 16bp from 4.77% to 4.61%. This can be decomposed into a 10bp fall in 10 year swap rates over the later averaging period and a 6bp fall in spreads to swap.

179. The remainder of this section examines third party estimates of the cost of debt. We present analysis that uses a wide dataset of bonds to inform the selection between these third party estimates. We also assess how the bond data informs the extrapolation of the third party estimates to 10 years maturity.

180. We examine the following estimates of the cost of debt:

- RBA BBB corporate bond yields;
- Bloomberg BVAL BBB fair value yield curve; and
- an average of the RBA and Bloomberg yield data.

181. We also test two methodologies for extrapolating these fair value curves to 10 year maturity – the method proposed by the AER in its draft decision for JGN and the method proposed by South Australian Power Networks (SAPN).

182. We collect a wide dataset of bonds issued by Australian domiciled firms with a broad BBB rating (BBB-, BBB or BBB+) from Standard and Poor's. We collect data from Bloomberg to estimate option adjusted spreads to swap (OAS) on these bonds over the nominated averaging period. Our methodology for estimating bond spreads closely follows that used by the RBA in the estimation of its published bond yield and spread estimates.[61]

[61] Details of the RBA methodology can be found at Arsov,, I., Brooks, M. and Kosev, M. "New Measures of Australian Corporate Credit Spreads", RBA Bulletin, December 2013, p. 17. Appendix A below sets out a

183. We look at which estimates and extrapolation methods best reflect the data by performing goodness of fit tests based on the methodology proposed by JGN,[62] Nelson-Siegel analysis and bond-pair analysis. This analysis is set out in the current section and supports the use of the SAPN methodology to extrapolate the third party fair value curves. The best estimate for the 10 year cost of debt based on this methodology is, expressed in semi-annual terms, 4.65%/4.58% for the RBA/Bloomberg fair value sources. The difference between these estimates is small (7 bp) such that it is not, in our view, necessary to adopt a single estimate as best, The average of these is 4.61% or, expressed on an annualised basis 4.67%. This is the estimate that would determine the cost of debt allowance in the first year of the AER transition. By contrast, as described in subsequent sections,[63] the cost of debt based on transitioning from the hybrid to the trailing average would be 5.10% annualised excluding swap transaction costs (and 5.22% including swap transaction costs) and would be 7.76% for immediate adoption of the trailing average.

5.2 Context for testing third party estimates

184. Determining the third party estimate that best captures the information provided by the bond data is particularly important at the present time since the AER's proposed approach to transitioning to the trailing average places such significant weight upon the cost of debt arising from the averaging period for the initial year of the regulatory period. As described above, 100% weight is placed upon this value in the first year, and this reduces by 10% in each subsequent year. This means that this initial estimate receives weight of:

- 80% on average across the five years of the regulatory period from 2015/16 to 2019/20; and
- 30% on average across the five years of the regulatory period from 2020/21 to 2024/25.

185. The initial estimate of the cost of debt remains an input under the hybrid approach, the trailing average approach and the transition from the hybrid to the trailing average. However, since under these approaches it receives only 10% weight in each of the next 10 years, its importance to the overall compensation for the cost of debt is much diminished.

cross-check of our modelling against the results of the RBA's estimates of yields for non-financial corporations for December 2014 and January 2015. The closeness of the overall estimates suggests that there is no fundamental flaw in our updated calculations.

62 See JGN, *2015-20 Access Arrangement Information Appendix 9.10: Return on debt proposal*, 30 June 2014, pp. 24-26

63 See section 7 for costs excluding swap transaction costs and section 3.4 for swap transaction costs.

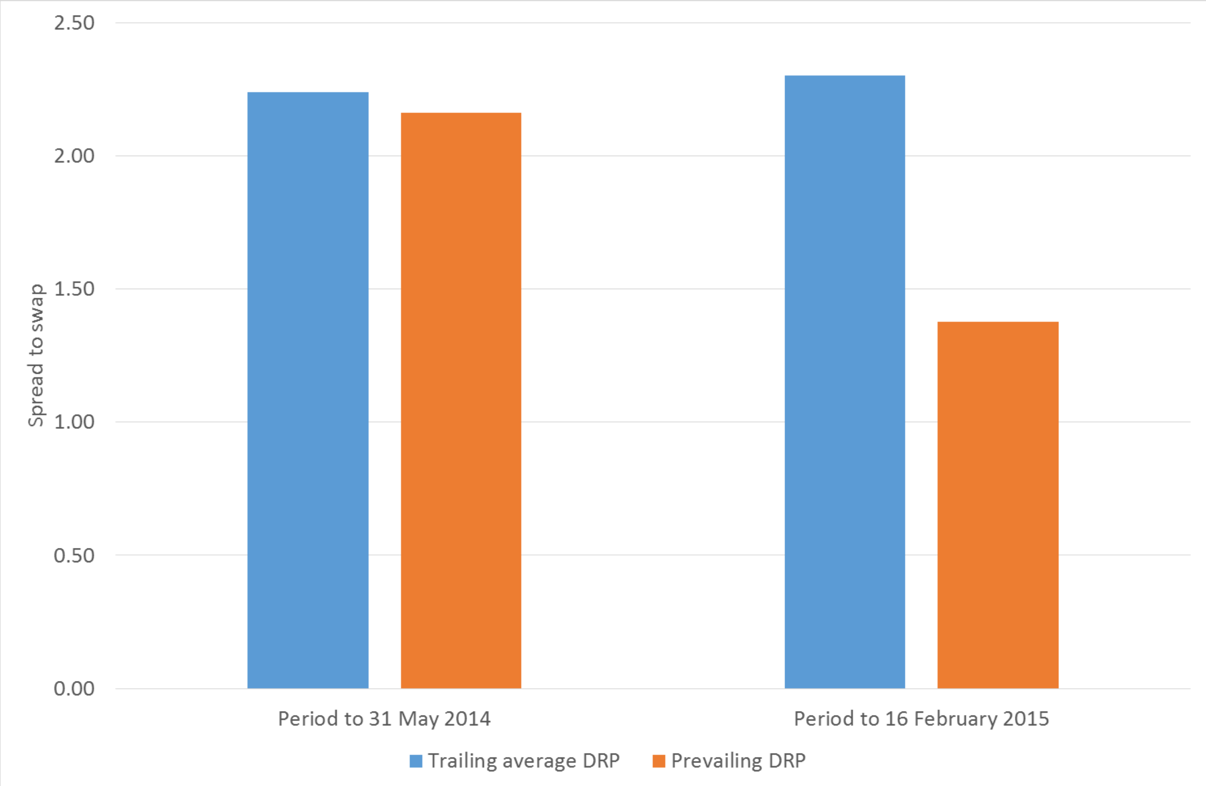
186. At the time JGN's lodged its regulatory proposal, there was not a significant divergence between the prevailing DRP (which the AER proposes to apply) and the trailing average DRP that would be determined under the hybrid approach (which the AER considers to be an efficient debt management response to the on-the-day approach to determining the cost of debt allowance). Nor was it clear whether there would be a significant divergence by the time of JGN's actual averaging period. However, since that time a substantial divergence has emerged between these two measures.

187. JGN's proposal was submitted on 30 June 2014. At that time, the most recent set of RBA information available to inform application of the AER's proposed extrapolation methodology would have been the May 2014 figures. Figure 4 below shows how the comparison between the trailing average and prevailing DRPs (measured against swap) have changed since that time. We compare:

- the prevailing DRP estimated over the 40 days to 30 May 2014 (2.16%) against the 10 year trailing average DRP estimated to 30 May 2014 (2.25%); and
- the prevailing DRP estimated over the 20 days t0 16 February 2015 (1.38%) against the 10 year trailing average DRP estimated to 16 February 2015 (2.30%).

188. These figures have been calculated using the average of RBA and Bloomberg 10 year estimates, extrapolated using the AER's proposed extrapolation methodology. They are also expressed on a semi-annual basis. A further difference from the figures presented later in this report is that we use the 10 years to 16 February 2015, whereas, in section 7 below, we calculate a trailing average with 90% weight given to a 9 year average and 10% weight given to JGN's proposed averaging period. These alternative assumptions promote comparability on a like-for-like basis between estimates over time and do not reflect a view on the best estimate of the cost of debt in each of these periods.

Figure 4: Comparison of trailing average and prevailing DRP



Source: Bloomberg, CEG analysis

5.3 Extrapolation

189. In this report we consider two methodologies for extrapolating the RBA and Bloomberg BVAL yield estimates to a tenor of 10 years. We call these methods the AER method and the SAPN method. We discuss these methods further below.

5.3.1 AER extrapolation method

190. In its draft decision for JGN, the AER proposed a new method for extrapolating the BVAL curve from 7 to 10 years, based on the shape of the RBA curve.

191. The AER proposes to extrapolate the RBA yield curve from its 10 year 'target' tenor to a 10 year 'effective' tenor based on the slope of the spreads to swap estimates at the 7 and 10 year target tenors. The AER's proposed formula is:

$$Yield_{10}{}^{E} = Yield_{10} + (10 - Tenor_{10})\frac{(Spread_{10} - Spread_{7})}{(Tenor_{10} - Tenor_{7})}$$

Where:

- $Yield_{10}{}^{E}$ is the extrapolated yield at 10 years maturity;
- $Yield_{10}$ is the RBA's estimated yield at the target maturity of 10 years;
- $Spread_{10}$ is the RBA's estimated spread to swap at the target 10 year maturity;
- $Spread_{7}$ is the RBA's estimated spread to swap at the target 7 year maturity;
- $Tenor_{10}$ is the effective tenor associated with the RBA's estimated spread to swap at the target 10 year maturity; and
- $Tenor_{7}$ is the effective tenor associated with the RBA's estimated spread to swap at the target 7 year maturity.

192. A similar formula is used to interpolate a yield for 7 years effective maturity:

$$Yield_{7}{}^{E} = Yield_{7} + (7 - Tenor_{10}) * \frac{(Spread_{10} - Spread_{7})}{(Tenor_{10} - Tenor_{7})}$$

Where:

- $Yield_{7}{}^{E}$ is the extrapolated yield at 7 years maturity; and
- $Yield_{7}$ is the RBA's estimated yield at the target maturity of 7 years.

193. Application of this method to the RBA yield estimates over the period from 19 January 2015 to 16 February 2015 gives rise to a yield of 4.43% in semi-annual terms or 4.48% in annualised terms. This is consistent with a semi-annual spread to swap of 157.91 basis points.

194. The AER's draft decision methodology extrapolates the Bloomberg BVAL curve from 7 years to 10 years using the difference between the 10 year extrapolated and 7 year interpolated RBA estimates for 10 and 7 year 'effective' tenors. That is, the AER assumes that the Bloomberg BVAL curve runs parallel to the extrapolated RBA curve between 7 and 10 years. Further details on our implementation of the AER extrapolation method can be found in Appendix B.

195. The implementation of the AER's methodology to the Bloomberg BVAL BBB yield curve over the period from 19 January 2015 to 16 February 2015 gives rise to a yield of 4.03% in semi-annual terms, or 4.07% in annualised terms. This is consistent with a semi-annual spread to swap of 117.75 basis points.

196. In December 2014 and January 2015 the RBA spread to swap estimates at a 10 year target are lower than those at a 7 year target. Consequently, the AER's methodology results in a negative slope to extrapolation during the 19 January 2015 to 16 February 2015 averaging period. Over this period, the slope of the extrapolation to 10 years was -10.5 bppa on spreads to swap for the RBA curve and -10.1 bppa on spreads to swap for the BVAL curve.

5.3.2 SAPN extrapolation method

197. The SAPN extrapolation method was proposed by SAPN in the context of its regulatory proposal to the AER.[64] The method extrapolates both the RBA and the Bloomberg BVAL curve by:

- estimating the slope coefficient of the spread to swap estimates against effective tenor (for tenors of at least 1 year) using simple least squares regression; and
- estimating a 10 year spread to swap as the spread to swap for the longest available maturity, extrapolated from its tenor to 10 years assuming a straight line with the slope calculated in the prior step.

198. Details on SAPN extrapolation of the RBA and BVAL curves can be found in Appendix B.

199. Application of this methodology to the RBA and BVAL curves give rise to semi-annual yield estimates of 4.65% and 4.58% on average over the period from 19 January 2015 to 16 February 2015. These are equivalent to yields of 4.70% and 4.63% respectively in annual terms, and semi-annual spreads to swap of 179.2 and 172.6 basis points – with an average of 175.9 basis points. The resulting difference of 6.6 basis points is small.

200. Despite the fact that the RBA spread to swap estimates are negatively sloped between 7 and 10 year target maturities, they are on average positively sloped between 3 and 10 years. The slope of the spreads to swap extrapolation of the RBA curve to 10 years is +3.9 bppa. The extrapolation of the implied BVAL spreads to swap, based on the slope of the implied spreads between 1 and 7 years, is +8.2 bppa.

5.4 Bond population

201. We consider that it is desirable to form as broad a dataset of bonds as possible in order to inform the best estimate of the cost of debt, as long as the bonds collected retain comparability to the benchmark bond or the differences can be controlled for. JGN's return on debt proposal introduces criteria for determining a relevant sample of bonds that are broad – generally considerably broader than those applied by the RBA.[65] Consistent with these criteria, we form a sample of bonds that:

- are issued by entities domiciled in Australia;
- are issued in Australian dollars, United States dollars, Euros or British pounds;

64 SAPN, *Regulatory Proposal 2015-2020*, December 2014, p. 339

65 JGN, *2015-20 Access Arrangement Information Appendix 9.10: Return on debt proposal*, 30 June 2014, pp. 24-26

- are issued by corporations an any industry, excluding governments or government bodies;
- have a credit rating issued by Standard & Poor's of BBB-, BBB or BBB+ on the final day of the averaging period.[66]

202. Over the period from 19 January 2015 to 16 February 2015, we have identified 158 bonds that meet these general criteria and report option adjusted spreads (OAS) to swap in this period. Table 1 below describes the breakdown of this population by credit rating, maturity and currency. Further we note that 104 of the bonds are issued by non-financial corporations, while a further 54 are issued by financial corporations.

Table 1: Description of bonds in population

Credit rating	# bonds	Maturity	# bonds	Currency	# bonds
BBB-	25	**0-4 years**	59	**AUD**	96
BBB	73	**4-6 years**	40	**USD**	43
BBB+	60	**6-8 years**	28	**EUR**	13
		8-12 years	23	**GBP**	6
		12+ years	8		
	158		158		158

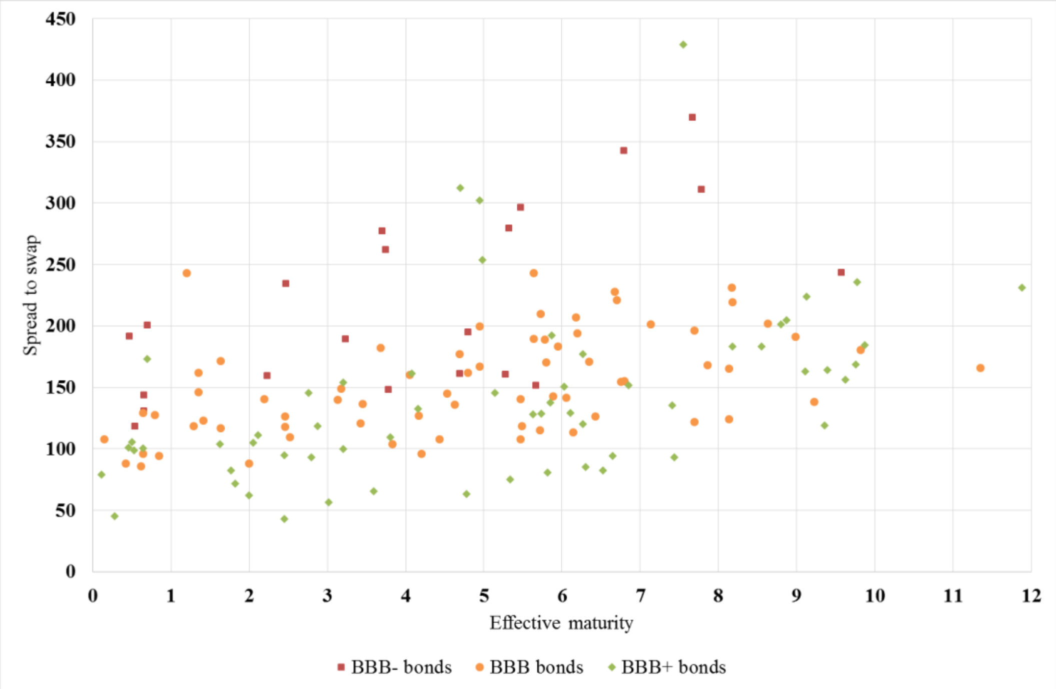
Source: Bloomberg, CEG analysis

203. It is also helpful to visualise the bonds in this sample. The charts below show details of this dataset of semi-annual spreads to swap by reference to:

- the credit rating of the bonds;
- the currency that the bonds are issued in;
- the coupon type of the bonds; and
- whether the bond is issued by firms operating in the finance and banking sectors.

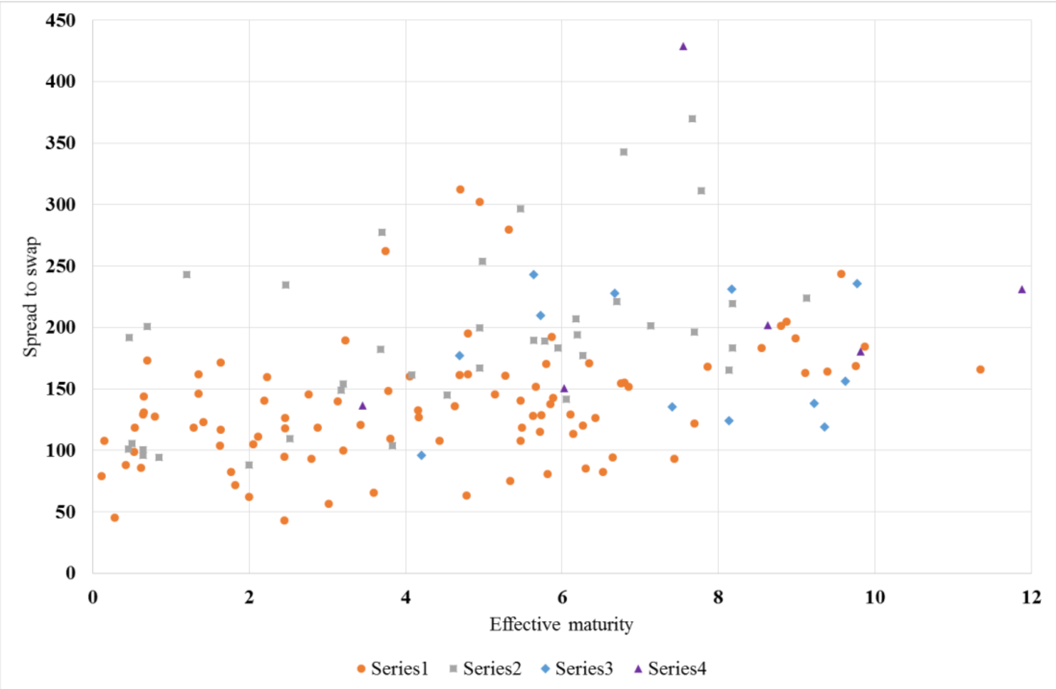
66 We note that JGN's criteria are narrower than the RBA's only in this respect, since the RBA also includes bonds that do not have a rating if the issuer has a rating from Standard & Poor's in the relevant range.

Figure 5: Full bond sample OAS by credit rating



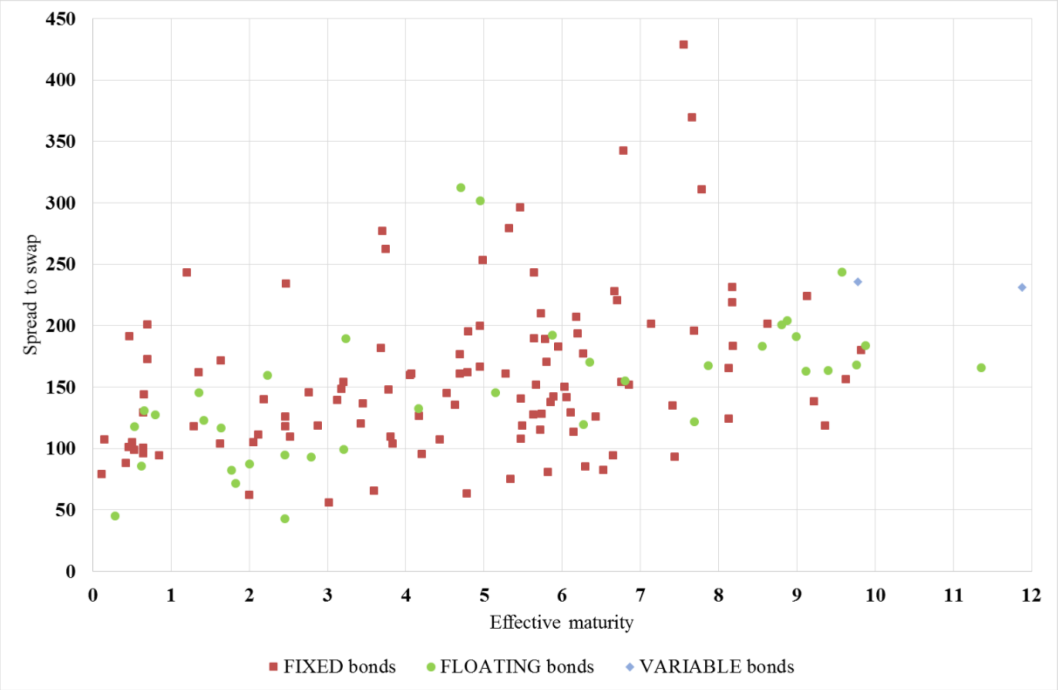
Source: Bloomberg, CEG analysis

Figure 6: Full bond sample OAS by currency of issue



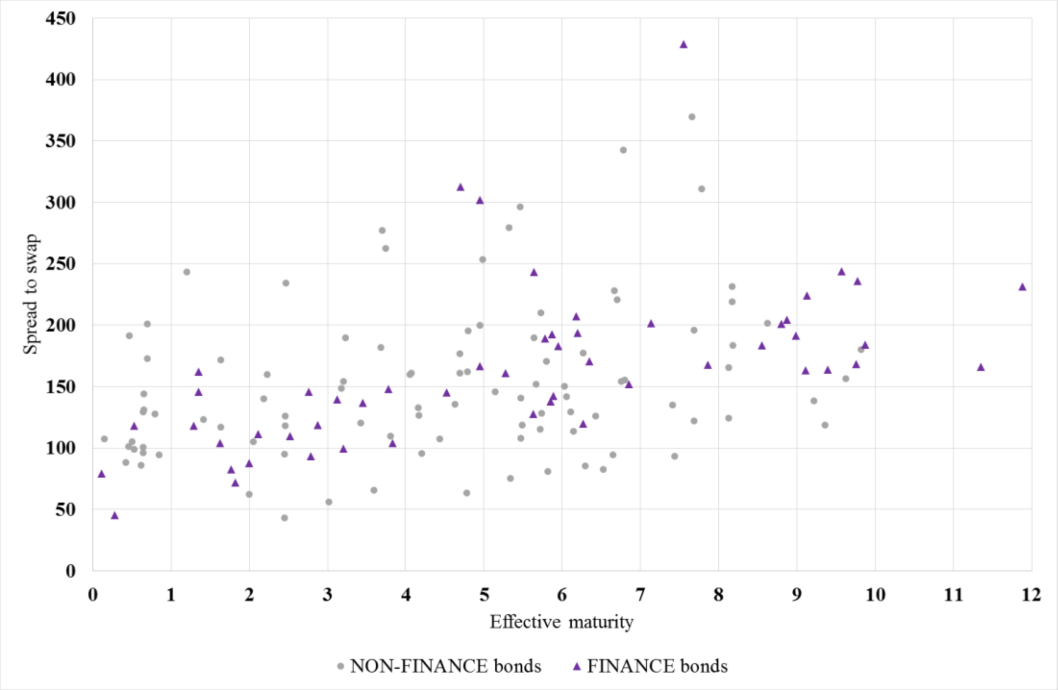
Source: Bloomberg, CEG analysis

Figure 7: Full bond sample OAS by coupon type



Source: Bloomberg, CEG analysis

Figure 8: Full bond sample OAS by sector



Source: Bloomberg, CEG analysis

5.5 Goodness of fit test of extrapolated fair value curves

204. We test the goodness of fit of the different measures of the spread to swap at 10 years to maturity using the method set out in JGN's return on debt proposal.[67] This proposal determines the best fit curve as the curve that has the lowest sum of squared errors from observed bond data. This requires calculating the sum of squared errors for each curve as:

- the weighted sum of squared differences between each bond spread to swap observation and the spread to swap for that maturity for each of the RBA, Bloomberg BVAL and the average of the two; where
- weightings are estimated as a Gaussian kernel with a mean of 10 years and a standard deviation of 1.5 years.

205. As discussed in this section, we have used extrapolation assumptions to extend both the RBA and Bloomberg BVAL yields to 10 years. However, this methodology is not assumed to give results for greater than 10 years, and the RBA yields are not reported for bonds with maturities of less than about 3 years.

206. In this report we apply the testing methodology by allowing linear extrapolation both backwards for maturities less than the shortest maturity yield estimate and forwards to maturities greater than the longest maturity yield estimate assuming a straight line between the two nearest defined yield observations. We do not consider that our results will be greatly affected by sensitivities to this assumption because:

- almost all bonds with maturities of close to 10 years have maturities of less than 10 years. The choice of extrapolation for spread to swap beyond 10 years is unlikely to be critical to the results of most tests; and
- the weight given under the Gaussian kernel method to bonds with maturities of 3 years or less is, in essence, negligible. Excluding these bonds would not be expected to make any important difference to the results of the tests.

5.5.1 Full bond sample

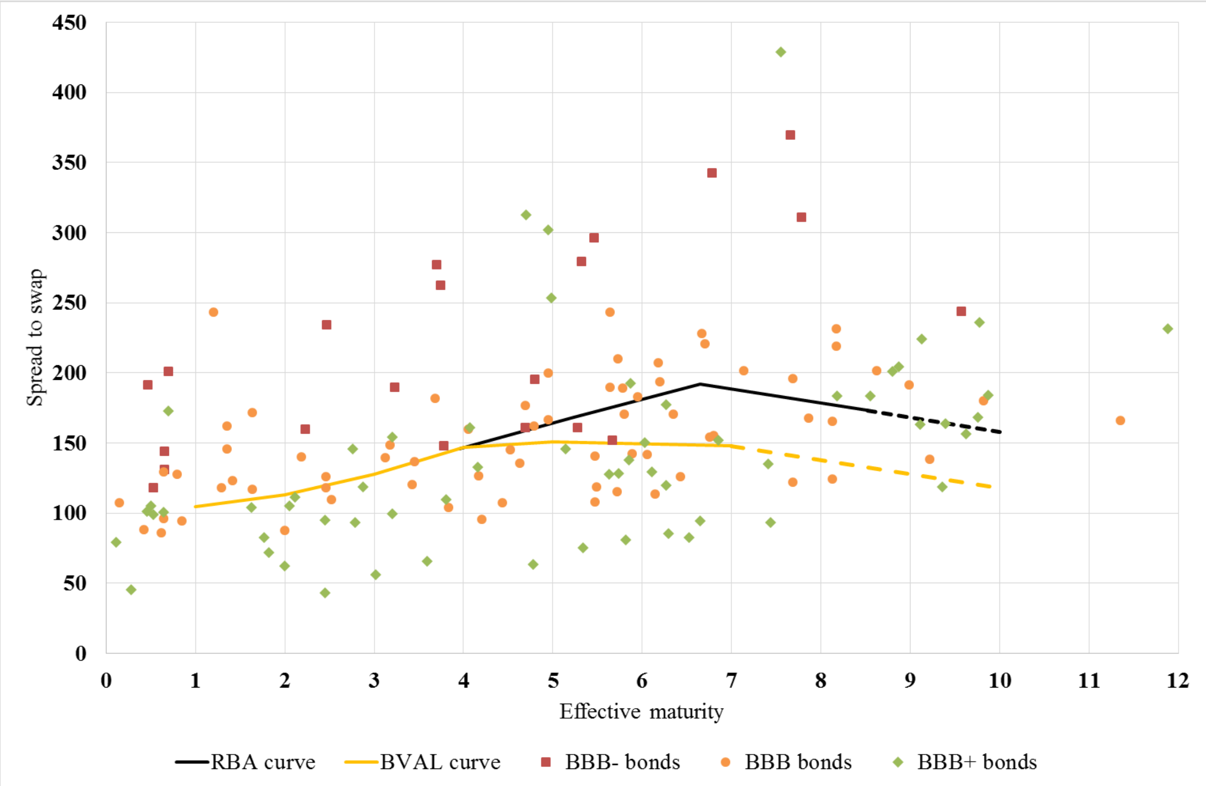
207. Figure 9 and Figure 10 below show the OAS estimates for the full bond sample defined above. Figure 9 presents the AER's extrapolation method for both the RBA and the Bloomberg BVAL yield estimates, while Figure 10 presents the SAPN extrapolation method for both.

208. From a visual perspective the SAPN methodology appears to provide a better fit to the data. The AER's extrapolation methodology results in a continued downward slope to both the RBA and Bloomberg BVAL spread to swap estimates which results

[67] JGN, *2015-20 Access Arrangement Information Appendix 9.10: Return on debt proposal*, 30 June 2014, pp. 24-26

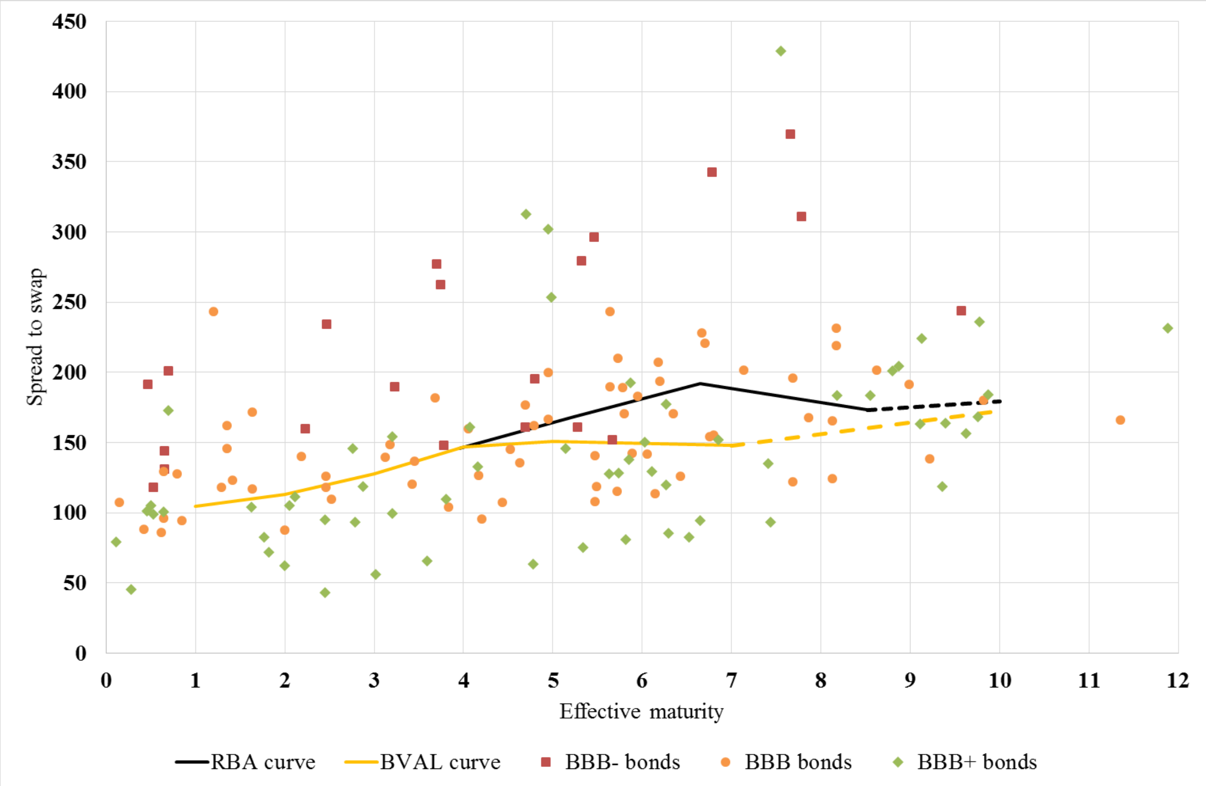
in the estimates at 10 years being below the majority of bonds with maturities at or close to 10 years. By contrast the SAPN methodology sets an upwards slope for both the RBA and the Bloomberg BVAL spread to swap estimates over this range. The result is that the extrapolated 10 year spread to swap appears to be consistent with empirical observations at similar maturities.

Figure 9: Full sample OAS estimates by credit rating, AER extrapolation



Source: RBA, Bloomberg, CEG

Figure 10: Full sample OAS estimates by credit rating, SAPN extrapolation



Source: RBA, Bloomberg, CEG

209. Table 2 below shows the results of the goodness of fit tests applied to the cost of debt sources over the full sample. Specifically, it shows the weighted sum of squared errors (SSE) calculated against the bond data for the RBA estimates, the Bloomberg BVAL estimates and the average of these estimates. We assess the results using both the AER's preferred extrapolation methodology and the SAPN extrapolation method. The curve with the best fit to the data under the test has the lowest SSE.

210. The results in Table 2 confirm the *a priori* expectations developed by visual inspection of Figure 9 and Figure 10 above. In particular, the results suggest that:

- the RBA spread to swap estimates provide a closer fit to the data around 10 years maturity than the average, which is in turn a closer fit than the Bloomberg BVAL estimates. In both charts we observe a large cluster of bonds between 7 and 10 years to maturity above the curves, supporting the higher of the two curves, whereas only a few bonds lie below the curves; and
- using the SAPN extrapolation methodology improves the goodness of fit for all measures, such that the best spread to swap estimates are those produced by the RBA with the SAPN extrapolation.

Table 2: Goodness of fit tests applied to full sample, weighted SSE

	AER extrapolation	SAPN extrapolation
RBA estimates	3,360	2,999
Average estimates	4,587	3,247
Bloomberg BVAL estimates	6,642	3,646

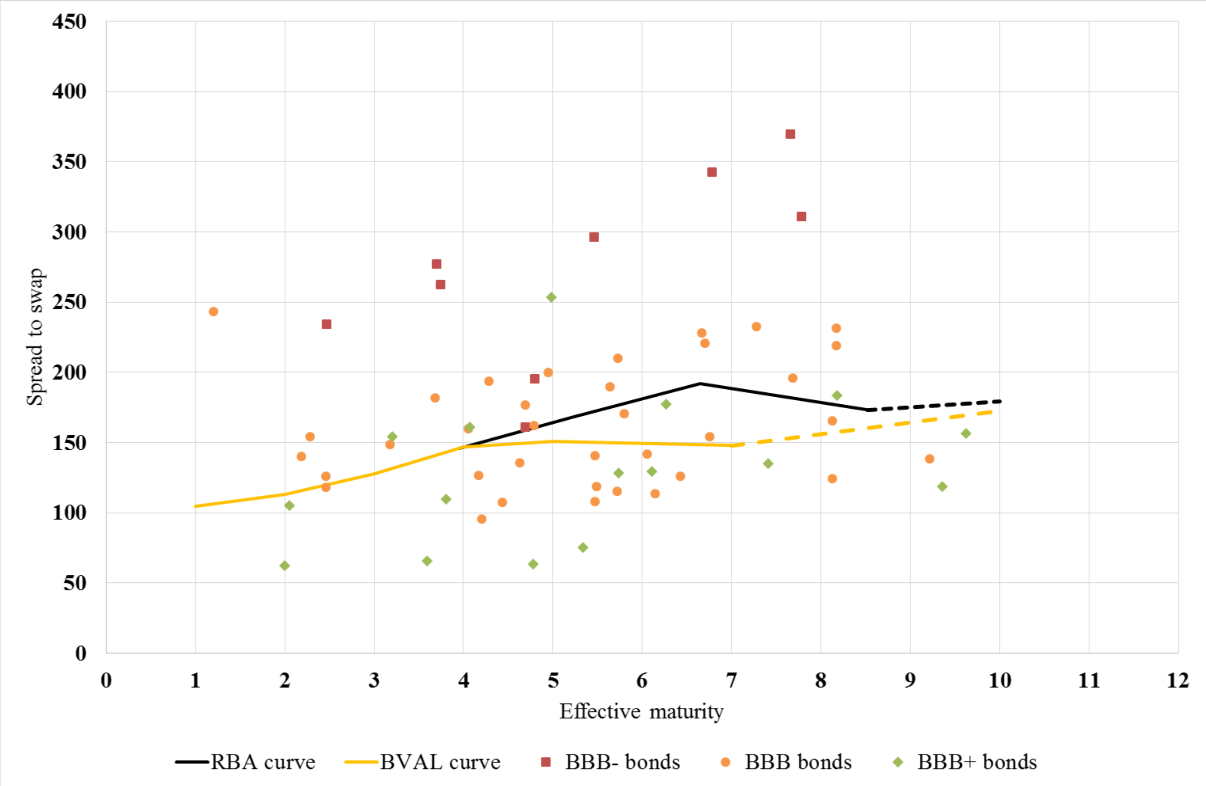
Source: CEG

5.5.2 RBA bond sample

211. Figure 11 below shows the RBA curve and Bloomberg curve (extrapolated using the SAPN methodology) against the sample of bonds that we obtain by replicating the RBA's selection criteria. That is, bonds that:

- are issued by businesses that are domiciled in Australia;
- are issued in Australian dollars, United States dollars or Euros;
- are not issued by businesses in the financial or government sectors;
- have a minimum maturity of one year;
- have an issue amount of more than A$100 million or the same in foreign currency equivalent; and
- are rated BBB-, BBB or BBB+ with Standard & Poor's, or the issuer's credit rating is in this range if the bond does not have a rating.

Figure 11: RBA sample OAS estimates by credit rating, SAPN extrapolation



Source: RBA, Bloomberg, CEG

212. *A priori*, we would expect that applying the goodness of fit testing methodology to this dataset would result in a preference for the RBA estimates, since the testing methodology mirrors quite closely the method used to derive the RBA yields.

213. Table 3 below shows the results of the goodness of fit tests applied to the sample of bonds replicating the RBA's criteria. As might be expected, the methodology based on the RBA sample indicates that the RBA spread to swap estimates provide the closer fit to the data.

214. However, the test conducted on the RBA sample produces mixed results for the extrapolation methodology, preferring the AER method for the RBA estimates but the SAPN method for the Bloomberg BVAL estimates. This likely reflects the lack of information on spreads for floating rate notes and finance sector bonds that provide more information in the higher 7-10 year maturity range beyond the bond sample used by the RBA.[68]

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68 See Figure 7 and Figure 8 above for more details.

Table 3: Goodness of fit tests applied to RBA sample, weighted SSE

	AER extrapolation	SAPN extrapolation
RBA estimates	3,769	4,063
Average estimates	4,507	4,530
Bloomberg BVAL estimates	6,055	5,231

Source: CEG

5.6 Nelson-Siegel analysis

215. In this section we estimate Nelson-Siegel curves on the yield estimates obtained for the samples of bonds analysed at section 5.5.1 and 5.5.2 above.

5.6.1 Nelson-Siegel curves

216. The Nelson-Siegel model is a highly flexible functional form that allows for a variety of shapes one would expect a curve might take but which also limits the amount of computing power required to estimate the relevant parameters. We provide more background discussion of the Nelson-Siegel model at Appendix C to this report.

217. In this report we implement two versions of the Nelson-Siegel model. We estimate a model that fits a single curve through a sample of observed spread to swap estimates over the 19 January 2015 to 16 February 2015 averaging period. The functional form for this implementation is:

$$Yield(t) = \beta_1 + (\beta_2 + \beta_3)\frac{1 - e^{-\left(\frac{t}{\beta_0}\right)}}{\left(\frac{t}{\beta_0}\right)} - \beta_3 e^{-\left(\frac{t}{\beta_0}\right)}$$

218. We also estimate a second form of Nelson-Siegel that includes dummy variables that capture the effect of credit rating on the estimated spread to swap. On the samples that we apply it to, which include bonds rated BBB-, BBB and BBB+, this methodology generates three parallel curves. The functional form for this implementation is:

$$Yield(t, rating) = \beta_{1,rating} + (\beta_2 + \beta_3)\frac{1 - e^{-\left(\frac{t}{\beta_0}\right)}}{\left(\frac{t}{\beta_0}\right)} - \beta_3 e^{-\left(\frac{t}{\beta_0}\right)}$$

219. We have excluded bonds with more than 20 years maturity from the sample that we fit Nelson-Siegel curves to. These bonds may be very influential in determining the shape of Nelson-Siegel yield curve, whereas they do not contribute materially to the result of the tests conducted in section 5.5 above due to the weighting system of the Gaussian kernel.

220. Of the 7 bonds with maturities above 20 years there are some significant outliers, with one issued by Santos having a maturity of 56 years, a yield of 10.7% and a spread to swap of 743 basis points.[69] A bond issued by Ancora at 21 years to maturity reports a yield of 3.5% and a spread of 35 basis points.

221. Given the unusual observed spreads to swap on these bonds, and because we consider that the estimated spread to swap at 10 years should be determined by bonds with maturities similar to 10 years and not by outlying bonds at much greater maturities, these 7 bonds are excluded in the Nelson-Siegel analysis presented in this section.

5.6.2 Nelson-Siegel 10 year estimates

222. Nelson-Siegel curves provide another estimate of 10 year spreads based on the broadest sample and the RBA sample. Since it is based on a different methodology to the extrapolated third party estimates, it provides a 10 year spread to swap estimate which we can use to inform the choice of estimates and extrapolation methods.

223. Table 4 below shows the 10 year yield estimates from Nelson-Siegel curve-fitting and the associated spreads to swap, calculated from yield estimates using ADSWAP rates. We fit Nelson-Siegel curves to both the broad sample and the RBA sample. 'Single curve' estimates result from fitting a single curve through all bond data points. 'Multiple curve' estimates result from fitting three parallel curves through the data – one for each credit rating. The 'multiple curve' estimates below reflect the estimates on the BBB curves.

224. The spreads to swap calculated from Nelson-Siegel estimates of 10 year yields based on the broadest sample are 197.83 and 201.52 basis points for single and multiple curve-fitting, respectively. Spread to swap estimates based on the RBA sample are similar – 198.06and 198.02. All Nelson-Siegel estimates are higher than the estimates from the AER-extrapolated fair value curves (see Table 5). The estimates are also higher than those from SAPN-extrapolated curves. At 179.17, the SAPN-extrapolated RBA estimate is closest to the Nelson-Siegel estimates. We note, however, that the difference between the 10 year spreads implied by the BVAL and RBA curves, when both are extrapolated using the SAPN methodology, is small. The Nelson-Siegel curves therefore support the choice of the SAPN-extrapolated curves.

[69] This estimate likely reflects the limitations of extrapolating an estimate of the swap curve to 56 years.

Table 4 Nelson-Siegel - 10 year spreads

	Broadest Sample		RBA sample	
	Single curve	Multiple curve	Single curve	Multiple curve
Yield	4.83%	4.87%	4.83%	4.83%
Spread (bp)	197.83	201.52	198.06	198.02

Source: Bloomberg and RBA data, CEG analysis

Table 5 Extrapolated fair value curves – 10 year spreads (bp)

	AER	SAPN
BVAL	117.75	172.57
RBA	157.91	179.17

Source: Bloomberg and RBA data, CEG analysis

5.6.3 Nelson-Siegel implied extrapolation

225. The BVAL curve is extrapolated from 7 to 10 years whereas the RBA curve is extrapolated from an effective tenor of 8.52 years to an effective tenor of 10 years. The slopes of the spreads to swap associated with our estimated Nelson-Siegel yield curves between 7 and 10 years and 8.52 and 10 years can be used to inform the appropriate extrapolation between these tenors.

226. Table 6 below shows the slopes between spread estimates implied by single and multiple curve-fitting through the broadest sample and the RBA sample. Table 7 shows the slopes used to extrapolate the BVAL and RBA curves according to the AER and SAPN methodologies.

Table 6 Nelson-Siegel implied extrapolations (bppa)

	Broadest Sample		RBA sample	
	Single curve	Multiple curve	Single curve	Multiple curve
7 to 10 year slope	7.390	9.273	4.697	7.273
8.55 to 10 year slope	6.298	8.278	3.074	5.388

Source: Bloomberg and RBA data, CEG analysis

Table 7 AER and SAPN extrapolations (bppa)

	AER	SAPN
BVAL - 7 to 10 years	-10.074	8.200
RBA - 8.55 to 10 years	-10.489	3.886

Source: Bloomberg and RBA data, CEG analysis

227. The 7 to 10 year spread to swap slopes implied by the Nelson-Siegel curves range from 4.679 bppa to 9.273 bppa. The slopes used to extrapolate the BVAL curve from 7 to 10 years are -10.074 bppa and 8.200 bppa according to the AER and SAPN extrapolation methodologies respectively. It is clear that the Nelson-Siegel curves are consistent with a positive extrapolation between 7 and 10 years' maturity and support the SAPN extrapolation of the BVAL curve.

228. The slopes between 8.52 and 10 years' maturity on the Nelson-Siegel curves range from 3.074 bppa to 8.278 bppa. The slopes used to extrapolate the RBA curve from between effective maturities of 8.52 and 10 years are -10.489 bppa and 3.886 bppa according to the AER and SAPN extrapolation methodologies respectively. Once again, the Nelson-Siegel curves support the positive extrapolation resulting from the SAPN extrapolation methodology.

229. We consider that the Nelson-Siegel curves support the choice of the SAPN extrapolation methodology in preference to the AER extrapolation methodology over the averaging period.

5.7 Bond-pairing analysis

230. Bond pair analysis involves using pairs or groups of bonds issued by the same firm in order to make inferences about the shape of the yield or spread to swap curves without having to take into account differences in credit quality of bond issues. Bond pair analysis has previously been used by the AER to extrapolate the Bloomberg BBB fair value curve to 10 years.[70]

231. We perform an analysis aimed at identifying a wide set of potential bond pairs. In this exercise, we take an inclusive approach to identifying bond pairs. Where the analysis identifies more than two bonds that meet our criteria, we summarise the result using the slope from a simple linear regression of the spread to swap for the bonds against the maturity in years.

232. For the purpose of identifying bond pairs or groups, we restrict the sample of bonds to those that:

- were denominated in Australian dollars;
- were issued by a company domiciled in Australia;
- had a credit rating of between BBB- and A-;
- had between 5 and 12 years to maturity; and
- were not callable.

[70] JGN's access arrangement proposal includes a report by Incenta on this issue. See Incenta, *Methodology for extrapolating the debt risk premium*, June 2014.

233. We manually identify bond pairs for extrapolation purposes, where pairs must:

- be issued by the same entity;
- have the same bond credit rating;
- have the same coupon type; and
- have spread to swap data available.

234. The above approach identifies 7 sets of bond pairs over the 19 January 2015 to 16 February 2015 period, as shown in Table 8 below. We obtained the slope of the bond pairs using a simple linear regression of the individual spreads-to-swap against their respective times to maturity.

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Table 8: List of bond pairings identified

	Issuer	Bloomberg ID	Issue date	Maturity date	Maturity type	Credit rating	Coupon type	Time to maturity	Spread-to-swap	Yield
1	Coca-Cola Amatil Ltd	EJ689924 Corp	4/06/2013	4/06/2020	At Maturity	BBB+	Fixed	5.34	75.21	3.29
	Slope: 8.98	EJ922576 Corp	25/11/2013	25/11/2020	At Maturity	BBB+	Fixed	5.81	81.03	3.38
		EK262202 Corp	21/05/2014	21/05/2021	At Maturity	BBB+	Fixed	6.30	85.47	3.47
		EK415237 Corp	12/08/2014	12/08/2021	At Maturity	BBB+	Fixed	6.53	82.61	3.46
		EI814473 Corp	27/09/2011	27/09/2021	At Maturity	BBB+	Fixed	6.65	94.27	3.58
		EJ271436 Corp	11/07/2012	11/07/2022	At Maturity	BBB+	Fixed	7.44	93.39	3.63
2	AusNet Services Holdings	EJ542415 Corp	14/02/2013	14/02/2020	At Maturity	A-	Fixed	5.03	119.94	3.71
	Slope: 7.36	EI626314 Corp	1/04/2011	1/04/2021	At Maturity	A-	Fixed	6.16	122.81	3.83
		EJ251235 Corp	28/06/2012	29/08/2024	At Maturity	A-	Fixed	7.40	132.12	4.01
		EJ251460 Corp	28/06/2012	28/06/2022	At Maturity	A-	Fixed	7.40	149.85	4.19
		EK348922 Corp	2/07/2014	2/07/2024	At Maturity	A-	Fixed	9.41	149.04	4.31
3	Perth Airport Pty Ltd	EJ758820 Corp	23/07/2013	23/07/2020	At Maturity	BBB	Fixed	5.47	108.07	3.63
	Slope: 8.24	EK130688 Corp	25/03/2014	25/03/2021	At Maturity	BBB	Fixed	6.14	113.59	3.74
4	General Property Trust	EK475088 Corp	11/09/2014	11/09/2020	At Maturity	A-	Fixed	5.61	106.75	3.62
	Slope: 9.04	EJ320261 Corp	16/08/2012	16/08/2022	At Maturity	A-	Fixed	7.54	124.17	3.94
5	QPH Finance Co Pty Ltd	EJ764636 Corp	29/07/2013	29/07/2020	At Maturity	BBB	Fixed	5.49	118.63	3.73
	Slope: 8.02	EK355413 Corp	7/07/2014	7/07/2021	At Maturity	BBB	Fixed	6.43	126.17	3.88
6	Sydney Airport Finance	EG064076 Corp	8/12/2006	20/11/2021	At Maturity	BBB	Floating	6.80	155.18	4.20

	Issuer	Bloomberg ID	Issue date	Maturity date	Maturity type	Credit rating	Coupon type	Time to maturity	Spread-to-swap	Yield
	Slope: -37.39	EG021985 Corp	15/12/2006	11/10/2022	At Maturity	BBB	Floating	7.69	121.92	3.93
7	DBCT Finance Pty Ltd	EF462422 Corp	9/06/2006	9/06/2021	At Maturity	BBB	Floating	6.35	170.90	4.32
	Slope: -0.91	EG022210 Corp	12/12/2006	12/12/2022	At Maturity	BBB	Floating	7.86	167.87	4.40
		EF462446 Corp	9/06/2006	9/06/2026	At Maturity	BBB	Floating	11.35	165.99	4.57

Source: Bloomberg, CEG analysis

235. Table 8 above indicates seven slope estimates under these criteria. Of these, five are positive and one is slightly below zero. The remaining estimate is based on the bonds issued by Sydney Airport, which suggests a highly negative extrapolation of -37 basis points per annum. We regard this observation as an outlier.

236. Setting aside this outlying estimate, the results range from -0.91 bppa for DBCT to 9.04 bppa for General Property Trust. Five of the seven results are between 7.36 bppa and 9.04 bppa. These results appear broadly consistent with those derived from the SAPN extrapolation methodology applied to the RBA and Bloomberg BVAL curves, shown in Table 7 above. However, the AER methodology gives rise to a material negative extrapolation which does not appear consistent with the majority of the bond pair results.

5.8 Best estimate

237. In this section, we have considered RBA BBB corporate bond spreads, the Bloomberg BVAL BBB fair value curve and the average of the two, extrapolated according to the AER's and SAPN extrapolation methodologies. We have performed goodness of fit tests, Nelson-Siegel analysis and bond-pairing analysis to inform our choice of cost of debt estimate and extrapolation method.

238. Based on the goodness of fit tests presented in section 5.5, we find that the RBA curve extrapolated according to the SAPN methodology best fits the broadest dataset over the averaging period. (However, we note that there is a small difference in levels between the RBA curve and the BVAL curve where both are extrapolated using the SAPN methodology.) Similarly, the SAPN extrapolation of the BVAL curve provides the best fit to the narrower RBA sample. The only exception is the RBA curves is a slightly better fit to the RBA sample when using the AER extrapolation.

239. The Nelson Siegel analysis in section 5.6 supports:

- the 10 year spread to swap estimate from the RBA and Bloomberg curves extrapolated according to the SAPN methodology as they[71] are the closest estimate to the Nelson-Siegel curves at 10 years; and
- the use of the SAPN extrapolation methodology in preference to the AER methodology on the basis that, unlike the AER extrapolation, the slope of the Nelson-Siegel curves between 7 and 10 years is consistently positive and is broadly consistent with the slope of the SAPN extrapolation during the averaging period.

[71] Noting that they are only slightly different.

240. Bond pair analysis, presented in section 5.7, shows that the negative extrapolation implied by the AER extrapolation method is inconsistent with the slope between spreads to swap of bond pairs or groups. On the other hand, the SAPN extrapolation methodology applied to the RBA and Bloomberg is broadly consistent with the majority of the bond pairing results.

241. Based on this analysis, we conclude that over the period from 19 January 2015 to 16 February 2015, the best method of extrapolation of the third party estimates to 10 year spread to swap is the SAPN method. When this is done, the BVAL and RBA estimates at 10 years are very similar. The average of these two estimates is 175.9 basis points in semi-annual terms, when added to the prevailing 10 year swap rate of 2.85%, corresponds to a 10 year cost of debt 4.61% in semi-annual terms, or an annualised yield of 4.67%.

6 Best estimate of the 9 year average DRP for the trailing average

242. In order to estimate a 10 year trailing average DRP for JGN we need to estimate the DRP for the 10 years from 2005/06 to 2014/15. In this section, we provide our best estimate of the trailing average DRP for the 9 years from 2005/06 to 2013/14. This will be combined with the 2014/15 estimate derived in section 5 above to give an estimate 10 year trailing average DRP.[72]

243. We have not attempted to carry out monthly analysis of the kind undertaken in section 5 throughout the relevant 9 year history. Such an exercise would require the collection of a very large dataset comprising all BBB rated bonds on issue at some point in time since 2005/06. Our analysis shows that this exercise would be of little utility, because the average difference between third party estimates and across different extrapolation methodologies over this period is very small.

244. Our analysis indicates a range from the single lowest to the single highest estimate of the 9 year trailing average DRP from 2.32% to 2.47%, or 15bp. The single lowest estimate of 2.32% is derived by giving 100% weight to the Bloomberg curve extrapolated to 10 years using the contemporaneous extrapolation method proposed by the AER (i.e., in the preceding regulatory determination to the date in question). The single highest estimate of 2.47% is based on giving 100% weight to the RBA curve extrapolated to 10 years applying the methodology proposed by the AER in the JGN draft decision to all historical dates.

245. Our best estimate of the 9 year trailing average DRP is 2.41%, which sits in the middle of the single lowest and highest values. Our best estimate is derived by giving equal weight to the Bloomberg and RBA curves, and using the AER draft decision extrapolation methodology for the years 2005/06 to 2013/14.

6.1 Three different data sources

246. There are three potential third party data providers which publish – or have published in the past – fair value curves for BBB rated debt: Bloomberg, the Reserve Bank of Australia (RBA) and/or CBASpectrum. The AER has relied on all of these third party data providers to inform its prevailing DRP estimates in its regulatory decisions in the past.

247. Not all of these third party data providers have published relevant fair value curves for the entire 10 years preceding the present time. The RBA introduced its fair value

72 This methodology could be applied at a future point in time to periods that start and end later than the period examined in this report.

curves in late 2013, however it backdated its estimates to January 2005. CBASpectrum published its fair value curves for a range of credit ratings including BBB from July 1998 to August 2010.

248. Bloomberg has published two different AUD BBB fair value curves since 2001, estimated using different methodologies: The Bloomberg Fair Value curve (BFV) and the BVAL curve. These fair value curves are available from December 2001 until 1 May 2014 and from October 2009 until the present respectively.

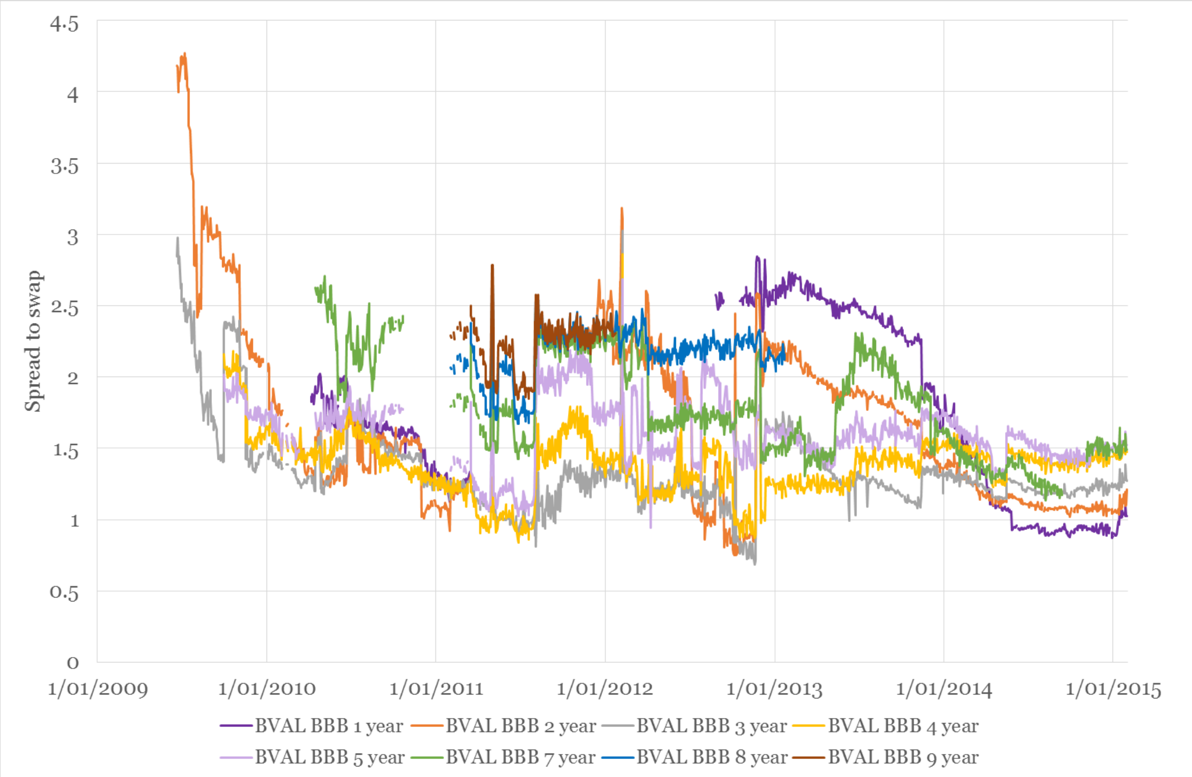
6.1.1 Bloomberg's fair value curves

249. Bloomberg's BFV curve dates back to 2001. In 2013 and 2014, Bloomberg developed a new approach to estimating fair value curves, called BVAL. The AUD BBB BVAL curve became available on the Bloomberg terminal in early 2014 but was backdated as far as 2009 for some maturities. The BFV curve was discontinued on 1 May 2014, and since then only the BVAL curve has been available.

250. The BVAL information from before the 1 May 2014 is intermittent, as is illustrated in Figure 12. In addition, prior to that date the BVAL curve provides results that are inconsistent with standard finance theory and the empirical regularity that the risk premium on bonds tend to increase with the maturity of the bonds – especially between one and seven years. However, the BVAL one year spread to swap is substantially higher than the 7 year spread to swap from late 2012 until late 2013. In fact, the one and two year curves are only below curves of longer maturities from the beginning of May 2014, which is the time at which Bloomberg first introduced the BVAL curve and discontinued the BFV curve.

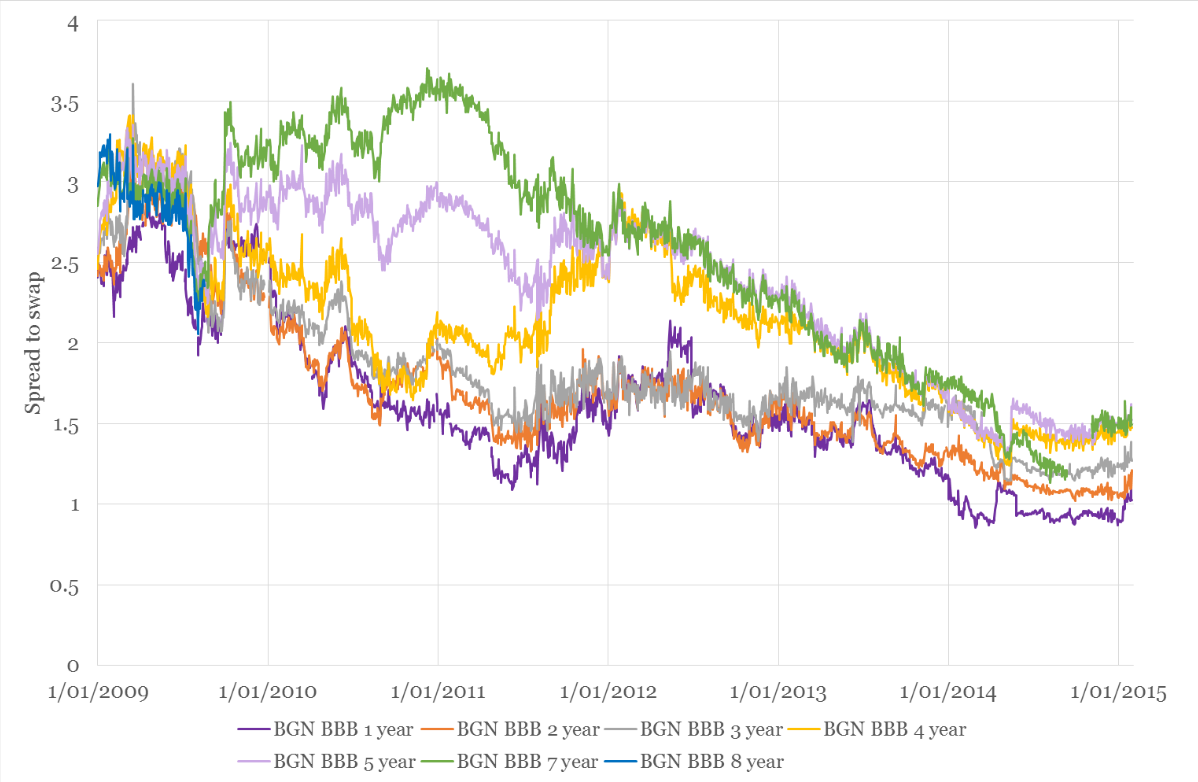
251. The corresponding information from the BFV fair value curve is much more consistently available, and broadly exhibits a conventional pattern. This is illustrated in Figure 13.

Figure 12: BVAL curves at different maturities



Source: Bloomberg, CEG analysis

Figure 13: BFV curves at different maturities



Source: Bloomberg, CEG analysis

252. A comparison of Figure 13 and Figure 12 clearly indicates that, prior to May 2014, the BVAL curve was not behaving in a manner that is consistent with either expectations or the BFV curve. Beyond 2014 this problem has been rectified.

253. Consistent with this, we consider that the appropriate time to move from the BFV curve to the BVAL curve is in May 2014. This also coincides with the point in time when Bloomberg decided to discontinue the BFV curve. Given this, from here, "Bloomberg", refers to the BFV curve until the 1 May 2014, and then BVAL.

6.2 Three different extrapolation methods

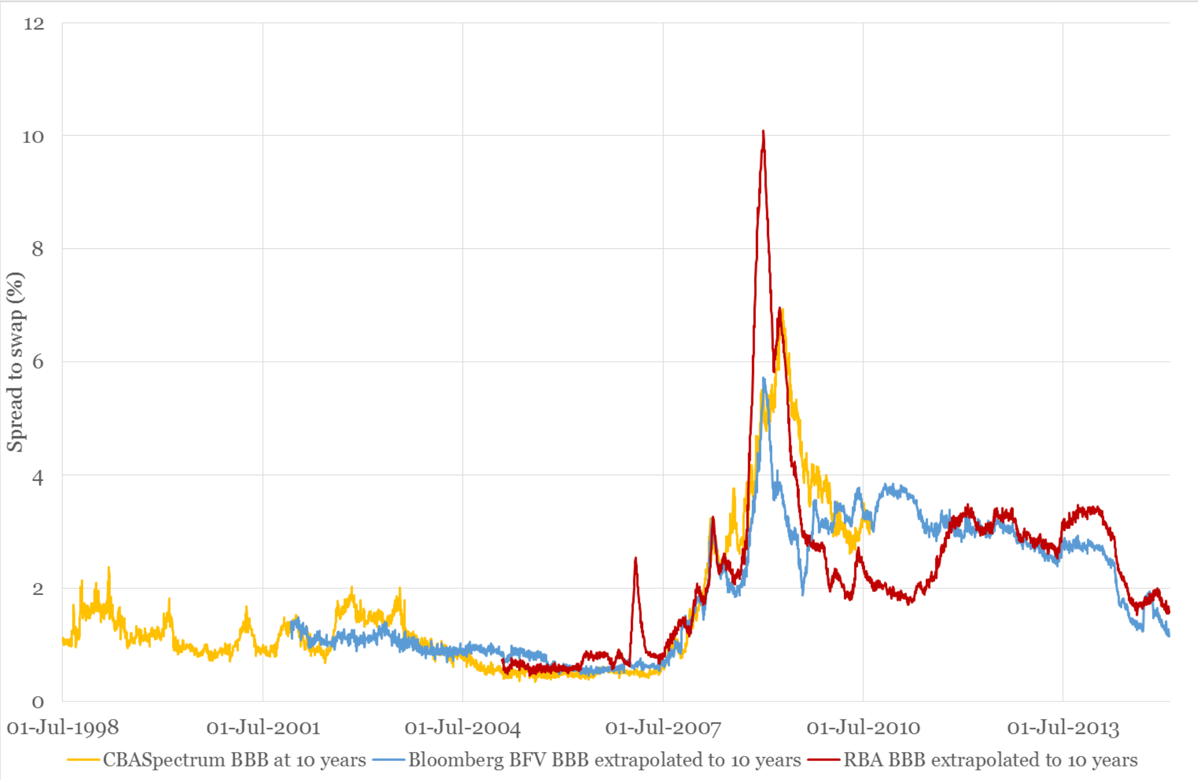
254. Only the CBASpectrum fair value curve is available at 10 years. Both the Bloomberg and the RBA curves need to be extrapolated to 10 years. We consider three different methods of extrapolation: the AER draft decision methodology, the SAPN method and a "regulatory precedent" methodology. The first two extrapolation methods are described in detail in section 5.3 above. The last 'regulatory precedent' methodology reflects the methodology applied historically by the AER at a given point in time, and applies only to the Bloomberg curve (given that was the only curve historically extrapolated by the AER).

255. In history the AER used the shape of other contemporaneous Bloomberg corporate fair value curves (e.g., the A or AAA curve) to extrapolate the Bloomberg BBB curve to 10 years. From 23 June 2010 no Bloomberg corporate fair value curve reported yields at 10 years and the AER used the increase in DRP to CGS from the AAA curve for the 20 days to 22 June 2010 to extrapolate the BBB curve from 7 to 10 years. After 15 March 2013, the AER used bond pairing analysis to extrapolate the Bloomberg curve. However, bond pairing is practically difficult to retrospectively implement on a daily basis. For this reason we have relied on the draft determination extrapolation methodology from 15 March 2013 to 30 June 2014.[73]

6.3 Results

256. Figure 14 to Figure 16 graphically illustrate the DRP associated with each of the three different data sources and extrapolation methods.

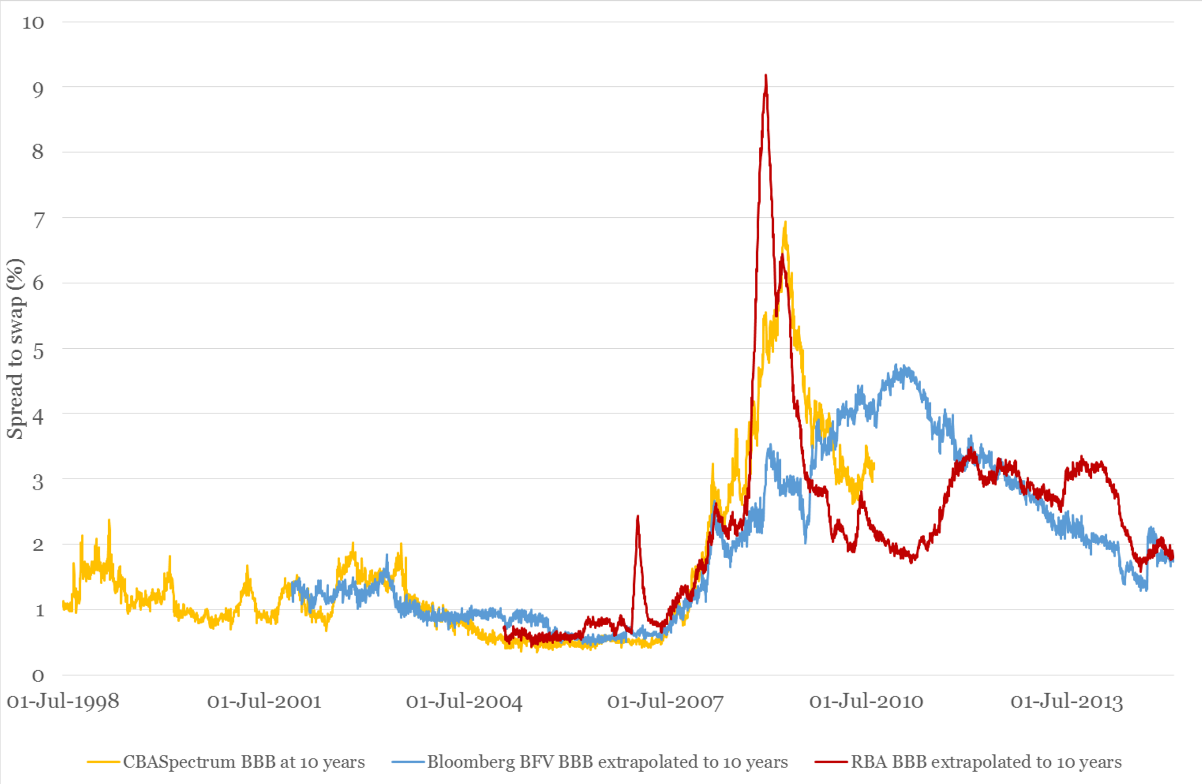
Figure 14: Draft decision extrapolation method



Source: Bloomberg, RBA, CBASpectrum and CEG analysis

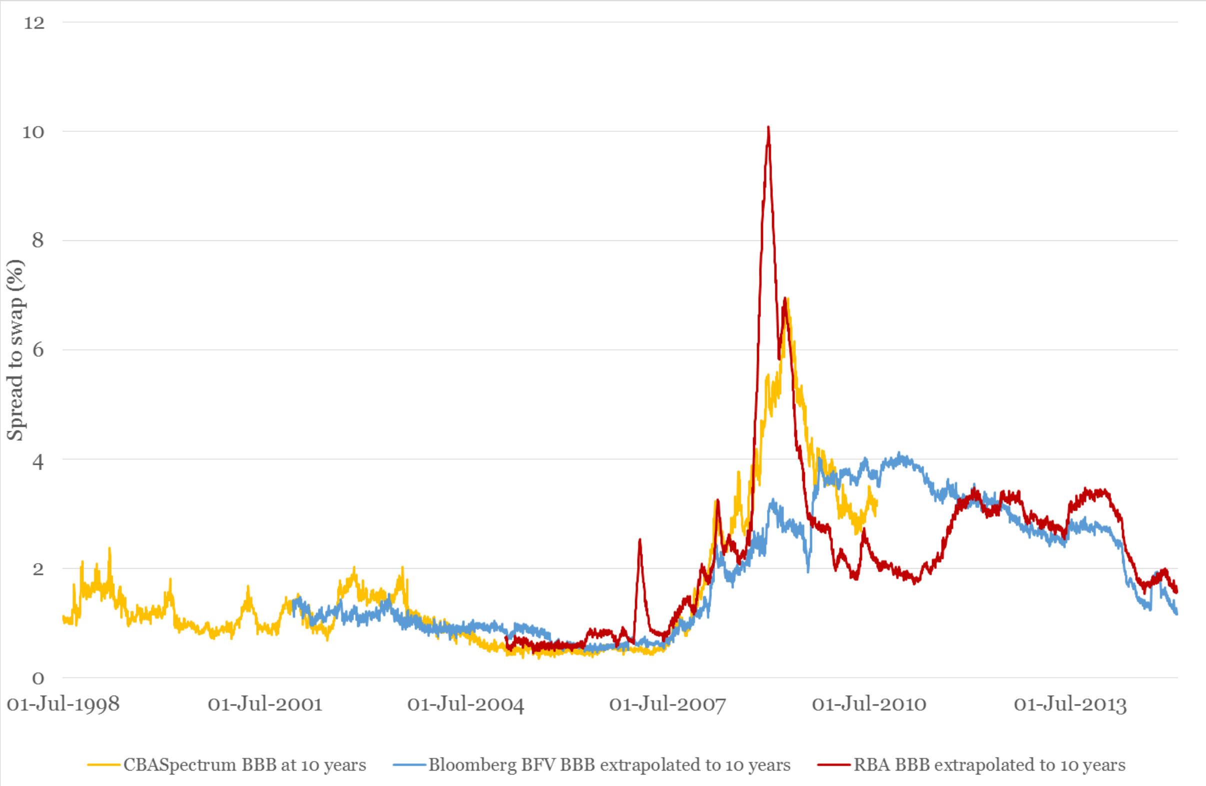
73 These statements come from review of a wide range of AER decisions, such as those cited at 277 to this report.

Figure 15: SAPN extrapolation method



Source: Bloomberg, RBA, CBASpectrum and CEG analysis

Figure 16: Regulatory precedent extrapolation method



Source: Bloomberg, AER, CEG analysis

Note: The RBA curve is extrapolated using the draft determination methodology in this chart

257. It can be seen that the AER draft decision extrapolation methodology (Figure 14) tends to result in a minimisation of the difference between the Bloomberg fair value curve and the other two fair value curves over the relevant period. This is a desirable property of this methodology, given that each curve is attempting to estimate the same underlying value (the cost of BBB rated corporate debt).

258. It is also the case that the Bloomberg fair value curve behaves in a manner that is more consistent with expectations when the AER extrapolation technique is applied to it. Using the SAPN or the regulatory precedent extrapolation method the Bloomberg fair value curve reaches a peak in January 2011 – well after the accepted height of the global financial crisis in 2008/09. Moreover, its value in mid to late 2010 is above the values estimated by CBASpectrum and the RBA.

259. The RBA has noted that the Bloomberg (un-extrapolated) curve did not behave as expected over this period:[74]

[74] RBA (2013), *New Measures of Australian Corporate Spreads*, p. 24

> *The Bloomberg Australian dollar fair value curve appears to be overly smooth between early 2009 and late 2010. These measures did not increase as much as could be expected in early 2009, given that the global financial crisis was at its most severe at that time, and as was observed in other measures of Australian and foreign corporate bond spreads. Moreover, the Bloomberg spread measures remained elevated for an extended period of time between early 2009 and 2010, while credit spreads globally declined sharply following the introduction of extraordinary policy measures; this was especially true of BBB-rated bond spreads.*

260. By contrast, when the AER extrapolation methodology is used the Bloomberg fair value curve does reach a higher peak in 2008/09 and is lower in 2010 and more consistent with the other curves (compare Figure 14 with Figure 15 and Figure 16).

261. For these reasons, we consider that the AER draft decision extrapolation methodology is the most appropriate over the 9 years from 2005/06 to 2013/14. Over this period, the 9 year trailing average DRPs of the RBA and Bloomberg curves extrapolated using this method are 2.47% and 2.35% respectively (a difference of only 12bp). In this context, we consider that the best estimate of the 9 year trailing average DRP is 2.41%. This is derived by given equal weight to the RBA and the Bloomberg curves.

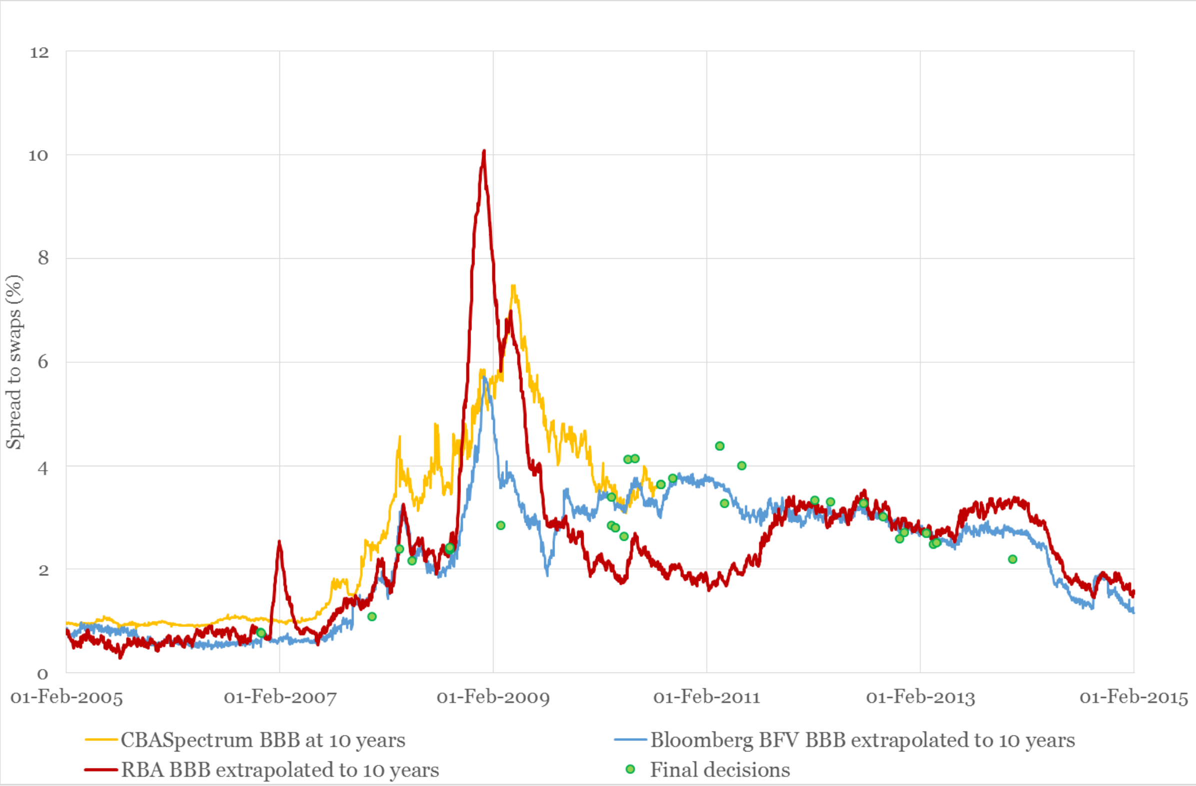
262. We note that our best estimate is not sensitive to the assumptions used to derive it. In particular:

- including CBASpectrum in the average (over the dates it was also published) would give rise to an estimate of 2.43% (i.e. add 2bp to our best estimate);
- using the SAPN extrapolation methodology would result in a 2.39% DRP (i.e. subtract 2bp from our best estimate); and
- using extrapolation based on regulatory precedent would result in a DRP of 2.39% (i.e., subtract 2bp from our best estimate).

263. Further, we note that the regulatory precedent in terms of actual decisions made in the past is consistent with adoption of the average of RBA and Bloomberg in most periods.

264. Figure 17 shows the final decisions made by the AER and the Australian Competition Tribunal in regards to the DRP, together with the three fair value curves. The Bloomberg and RBA fair value curves are extrapolated to 10 years using the draft decision extrapolation methodology in this figure. The derivation of the decision estimates used in Figure 17 is explained in Appendix D below.

Figure 17: Fair value curves compared to past regulatory decisions



Source: Bloomberg, RBA, CBASpectrum, AER, Competition Tribunal, CEG analysis

265. The figure shows that the regulatory decisions are generally consistent with both the RBA and the Bloomberg fair value curves, with the exception of the period from mid-2010 to mid-2011 when it is clearly more consistent with the Bloomberg fair value curve. In this period, the Bloomberg curve is higher than the RBA curve. This means that our best estimate, which gives equal weight to Bloomberg and RBA, is, if anything, conservative relative to regulatory precedent.

266. The only notable exception where a decision is not very close to either the Bloomberg or the RBA curve is the ActewAGL decision in early 2009. However, we note that the ActewAGL decision was the only decision out of five made at the same time which was not appealed to the Australian Competition Tribunal. The other four decisions (for NSW electricity businesses) had their averaging period moved back in time to September 2008 by the Competition Tribunal, where they align closely with both the RBA and the Bloomberg curve.

267. The following tables show the trailing average DRP when giving equal weighting to all time periods and equal weighting to the sources listed. Note that these numbers have not been annualised.

Table 9: Draft decision extrapolation methodology

Financial year	RBA only	BB only	RBA & BB	RBA & BB & CBA	RBA & CBA
2005/06	0.62	0.63	0.63	0.58	0.55
2006/07	0.97	0.61	0.79	0.70	0.75
2007/08	1.78	1.66	1.72	1.71	1.74
2008/09	5.40	3.32	4.36	4.45	5.01
2009/10	2.51	3.11	2.81	3.06	3.03
2010/11	1.99	3.49	2.74	2.74	1.99
2011/12	2.98	3.07	3.03	3.03	2.98
2012/13	2.97	2.81	2.89	2.89	2.97
2013/14	3.00	2.49	2.75	2.75	3.00
Average	**2.47**	**2.35**	**2.41**	**2.43**	**2.45**
Highest-lowest spread	**4.78**	**2.88**	**3.73**	**3.87**	**4.55**

Source: Bloomberg, RBA, CBASpectrum, CEG analysis

Table 10: SAPN extrapolation methodology

Financial year	RBA only	BB only	RBA & BB	RBA & BB & CBA	RBA & CBA
2005/06	0.62	0.64	0.63	0.58	0.55
2006/07	0.96	0.61	0.79	0.70	0.74
2007/08	1.64	1.43	1.54	1.59	1.67
2008/09	5.12	2.65	3.89	4.13	4.88
2009/10	2.58	3.57	3.07	3.23	3.06
2010/11	2.01	4.34	3.18	3.18	2.01
2011/12	2.97	3.44	3.21	3.21	2.97
2012/13	2.90	2.69	2.80	2.80	2.90
2013/14	2.89	1.99	2.44	2.44	2.89
Average	**2.41**	**2.37**	**2.39**	**2.43**	**2.41**
Highest-lowest spread	**4.50**	**3.73**	**3.26**	**3.55**	**4.33**

Source: Bloomberg, RBA, CBASpectrum, CEG analysis

Table 11: Regulatory precedent extrapolation methodology (applies only to Bloomberg)

Financial year	BB only	RBA & BB	RBA & BB & CBA
2005/06	0.63	0.63	0.58
2006/07	0.61	0.79	0.70
2007/08	1.36	1.57	1.61
2008/09	2.56	3.98	4.20
2009/10	3.47	2.99	3.18
2010/11	3.87	2.93	2.93
2011/12	3.19	3.09	3.09
2012/13	2.66	2.81	2.81
2013/14	2.49	2.75	2.75
Average	**2.32**	**2.39**	**2.43**

Source: Bloomberg, AER, CEG analysis

7 Best estimate of cost of debt

268. Based on the analysis in sections 5 and 6 the best estimate of the DRP in each of the last 10 years is provided below.

Table 12: Best estimate of trailing average DRP

Financial year	DRP
2005/06	0.628
2006/07	0.793
2007/08	1.719
2008/09	4.359
2009/10	2.810
2010/11	2.737
2011/12	3.025
2012/13	2.886
2013/14	2.746
2 January 2015 to 30 January 2015	1.759
Average (10 years)	**2.35**

Source: Bloomberg, RBA, CBASpectrum, CEG analysis

269. This 2.35% DRP can be used to estimate the cost of debt associated with:

- a transition from the hybrid debt management strategy to the trailing average debt management strategy by adding the average of 1 to 10 year swap rates during JGN's second averaging period (2.57%). This results in a semi-annual yield estimate of 4.92% which is equivalent to an annualised estimate of 4.98%.
- an immediate adoption of the trailing average methodology by adding the trailing average of 10 year swap rates (5.27% measured contemporaneously over each of the 10 years rather than solely in the second averaging period). This results in a semi-annual yield estimate of 7.61% which is equivalent to an annualised estimate of 7.76%.

270. These estimates do not include the additional costs associated with swap transactions and the new issue premium.

271. If one accepts the AER's view that the benchmark efficient debt management strategy is uniquely the hybrid debt management strategy, then the lower of these numbers is appropriate. However, we do not consider that the AER has reached this conclusion on a sound basis for the reasons described in a separate report for the NSW electricity distributors.[75] To the extent that a unique benchmark efficient

[75] CEG, Efficient debt financing costs, February 2015 – see in particular sections 4.3, 4.5 and 4.6.

debt management strategy must be defined for the entire industry then a strong case can be made that this the trailing average should be adopted. This is because, as described in the report for the NSW DNSPs, the hybrid debt management was simply not viable for these businesses. [76] Under neither scenario is the adoption of the AER's proposed transition consistent with a benchmark efficient debt management strategy.

[76] CEG, Efficient debt financing costs, February 2015 – see in particular section 4.3.

Appendix A RBA replication

272. A cross-check on our updated modelling is whether it is able to replicate the results of the RBA's estimates of yields for non-financial corporations. We show below the results of testing the model in this way for December 2014 and January 2015.

273. Following the RBA's specification, we use a Gaussian kernel, weighted by issue amount, with sigma of 1.5 calculated on spreads for bonds that:

- are issued by businesses that are domiciled in Australia;
- are issued in Australian dollars, United States dollars or Euros;
- are not issued by businesses in the financial or government sectors;
- have a minimum maturity of one year;
- have an issue amount of more than A$100 million or the same in foreign currency equivalent; and
- are rated BBB-, BBB or BBB+ with Standard & Poor's in respect of the BBB estimates, and A-, A or A+ with Standard & Poor's in respect of the A estimates, or the issuer's credit rating is in this range if the bond does not have a rating.

274. Table 13 below shows that for the BBB yield estimates, the replication is very close in both December and January, with differences between our replication of the RBA estimates not exceeding 3 basis points. Similarly, Table 14 shows a close replication of the effective maturity estimated by the RBA.

Table 13: Replication of RBA spread to swap

	Spread to swap – 3 years	Spread to swap – 5 years	Spread to swap – 7 years	Spread to swap – 10 years
December 2014				
RBA BBB	149.82	163.57	188.35	176.26
CEG replication	148.38	162.22	187.67	174.47
RBA A	72.69	89.85	101.59	111.80
CEG replication	67.68	85.44	97.33	113.06
January 2015				
RBA BBB	159.59	173.96	195.93	174.13
CEG replication	161.99	176.20	195.40	171.37
RBA A	74.00	92.42	105.19	112.74
CEG replication	69.74	88.34	100.62	115.28

Source: RBA, CEG

Table 14: Replication of RBA effective maturity

	Effective maturity – 3 years	Effective maturity – 5 years	Effective maturity – 7 years	Effective maturity – 10 years
December 2014				
RBA BBB	3.98	5.26	6.68	8.57
CEG replication	3.95	5.27	6.68	8.57
RBA A	3.18	4.93	6.58	8.86
CEG replication	3.20	4.95	6.58	8.93
January 2015				
RBA BBB	3.94	5.24	6.66	8.53
CEG replication	3.95	5.24	6.63	8.52
RBA A	3.17	4.92	6.55	8.84
CEG replication	3.19	4.94	6.55	8.91

Source: RBA, CEG

275. Table 15 indicates that the RBA has in general captured slightly more bonds in its sample than we have in December 2014 and January 2015. This is particularly the case for short dated A rated bonds. We have captured more BBB bonds with 12+ years to maturity than the RBA, but we note that most of these bonds have more than 20 years to maturity and would not affect the Gaussian kernel estimate at 10 years.

Table 15: Replication of RBA bond sample

	Number of bonds 1-4 years	Number of bonds 4-6 years	Number of bonds 6-8 years	Number of bonds 8-12 years	Number of bonds 12+ years
December 2014					
RBA BBB	16	25	16	8	2
CEG replication	15	23	14	8	4
RBA A	46	19	15	9	7
CEG replication	40	19	15	10	8
January 2015					
RBA BBB	16	25	16	8	2
CEG replication	15	24	14	8	4
RBA A	46	20	15	9	7
CEG replication	40	20	15	10	8

Source: RBA, CEG

276. While the comparison of our results to the RBA’s shows that there remain some differences that will be the subject of further review, the closeness of the overall estimates suggests that there is no fundamental flaw in our updated calculations.

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Appendix B Implementation of extrapolation methodologies

277. This appendix describes the implementation of the AER and the SAPN extrapolation methodologies, both for:

- estimating daily 10 year spreads to swap associated with extrapolating RBA yields and the Bloomberg BVAL fair value curve; and
- estimating daily spreads for all tenors associated with RBA spreads and the Bloomberg BVAL fair values, extrapolated under either methodology, for the purpose of conducting tests of the fair value curves over the averaging period.

278. This appendix describes the calculation of a daily series. In each case, to generate an estimate for a proposed averaging period (such as the second averaging period) the final step is to calculate a simple average of the daily observations of spread over the days covered by the averaging period.

279. Where we refer to effective tenors associated with published RBA spreads or yields we refer to the effective tenors published by the RBA associated with BBB yield and spread estimates.

B.1 Implementation of AER[77] extrapolation methodology

B.1.1 Extrapolation of the RBA curve

280. The RBA BBB spread curve for target tenors up to 10 years is calculated based on bond data sourced from the final working day on each month ("month-end date"). At each month-end date, the RBA yield at an effective tenor of 10 years is calculated as:

$$Yield_{10}^{RBA\ AER} = Yield_{10}^{RBA} + (10 - Tenor_{10}) * \frac{(Spread_{10} - Spread_7)}{(Tenor_{10} - Tenor_7)} \text{ (Eqn. A)}$$

Where:

- $Yield_{10}^{RBA\ AER}$ is the extrapolated yield at the effective 10 year tenor using the AER methodology;
- $Yield_{10}^{RBA}$ is the RBA's estimated yield at target 10 year tenor;
- $Spread_{10}$ is the RBA's estimated spread to swap at the target 10 year tenor;

77 AER (November 2014) Draft decision Jemena Gas Networks (NSW) Ltd Access arrangement 2015-20, Attachment 3: Rate of return, pp. 3-319 to 3-320.

- $Spread_7$ is the RBA's estimated spread to swap at the target 7 year tenor;
- $Tenor_{10}$ is the effective tenor associated with the RBA's estimated spread to swap at the target 10 year tenor; and
- $Tenor_7$ is the effective tenor associated with the RBA's estimated spread to swap at the target 7 year tenor.

281. Calculate a daily series of RBA 10 year yields between month-end dates by:

 i. Calculating spreads to CGS at each month-end date as ${Yield_{10}}^{RBA\ AER}$ less interpolated CGS yields at 10 years' term to maturity.

 ii. Calculate a daily series of spreads to CGS between month-end date spreads to CGS using the following formula:

$$Spread\ to\ CGS_d = Spread\ to\ CGS_{D_1} + (d - D_1) * \frac{(Spread\ to\ CGS_{D_2} - Spread\ to\ CGS_{D_1})}{(D_2 - D_1)}$$

(Eqn. B)

Where:

 a. d is the date for which the spread to CGS is being calculated;

 b. D_1 is the month-end date immediately prior to date d; and

 c. D_2 is the month-end date immediately subsequent to date d; and

 iii. Calculate a daily series for ${Yield_{10}}^{RBA\ AER}$ as the daily spread to CGS calculated in step ii above plus a daily series of interpolated 10 year yields on CGS.

282. Finally, we calculate a daily series for ${Spread\ to\ swap_{10}}^{RBA\ AER}$ as the daily yield series calculated in step iii above less a daily series of 10 year interest rate swap yields sourced from Bloomberg using ticker code ADSWAP10 Curncy.

B.1.2 Construction of the RBA curve

283. Section B.1.1 describes the calculation of a daily series for a 10 year RBA yields using the AER's extrapolation methodology. However, an entire RBA daily spread to swap curve must be calculated in order to estimate the weighted sum of squared differences between this curve and observed bond data. The RBA only reports yield and spread to swap data at month-end dates.

284. Consistent with the methodology described in section B.1.1, we estimate daily series of the spread to swap from the yield reported by the RBA at each target tenor t by:

i. Calculating month-end spreads to CGS for each target tenor t as the RBA's published yield at that target tenor less CGS yields interpolated to the effective tenors associated with that target tenor t.

ii. Calculating daily spreads to CGS for each target tenor t by linearly interpolating between month-end spreads to CGS calculated in step i above using equation B.

iii. Calculating daily estimates of the effective tenor for each target tenor t by linearly interpolating between month-end effective tenors reported by the RBA;

iv. Calculating a daily yield series for each target tenor t as the daily spreads to CGS calculated in step ii above plus a daily series of CGS yields interpolated to the effective tenor associated with that target tenor t (as calculated on a daily basis in step iii above).

v. Calculating a daily series of spreads to swap for each target tenor t as the daily yield series calculated in iv above less the Bloomberg estimate of swap rates for that target tenor t, using ADSWAP3 Curncy, ADSWAP5 Curncy, ADSWAP7 Curncy and ADSWAP10 Curncy or otherwise estimates of swap sourced from Bloomberg consistent with the target tenor t.

B.1.3 Extrapolation of the BVAL curve

285. Bloomberg's BVAL fair value curve does not currently report yields at a tenor of 10 years. The AER's proposed method for extrapolating the Bloomberg BVAL curve from its longest tenor T years to 10 years is:

$$Yield_{10}^{BVAL\,AER} = Yield_T^{BVAL} + \left(Yield_{10}^{RBA\,AER} - Yield_T^{RBA\,AER}\right)$$

Where:

- T is the longest available tenor of 10 years or less at which the Bloomberg BVAL curve reports fair value yields. Over JGN's second averaging period T is equal to 7;
- $Yield_T^{BVAL}$ is the Bloomberg BVAL fair value yield for tenor T; and
- $Yield_T^{RBA\,AER}$ is the RBA BBB yield estimate for effective tenor T consistent with the AER's approach to extrapolating RBA yields to 10 years.

286. Section B.1.1 describes the AER's methodology for calculating a daily series of extrapolated 10 year RBA yield and spread to swap estimates. $Yield_T^{RBA\,AER}$ is calculated at each month-end using the following formula to extrapolate or interpolate an RBA yield at effective tenor T:

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$$Yield_T^{RBA\,AER} = Yield_T^{RBA} + (T - Tenor_T) * \frac{\left(Spread_{T_{high}} - Spread_{T_{low}}\right)}{\left(Tenor_{T_{high}} - Tenor_{T_{low}}\right)}$$

(Eqn. C)

Where:

- T is the longest available tenor of 10 years or less at which the Bloomberg BVAL curve reports fair value yields. Over JGN's second averaging period T is equal to 7;
- T_{low} is the target tenor associated with the highest effective tenor available from RBA data that is lower than T. If no effective tenor is lower than T then T_{low} is the lowest target tenor from RBA data. Notwithstanding this, if T is greater than all RBA effective tenors then T_{low} is equal to the second highest effective tenor available from RBA data;
- T_{high} is the target tenor associated with the lowest effective tenor available for RBA data that is higher than T. If no effective tenor is higher than T then T_{high} is equal to the highest target tenor from RBA data. Notwithstanding this, if T is less than all RBA effective tenors then T_{high} is equal to the second lowest effective tenor available from RBA data;
- $Yield_T^{RBA}$ is the yield reported by the RBA for target tenor T;[78]
- $Tenor_T$ is the effective tenor associated with target tenor T;
- $Spread_{T_{high}}$ is the RBA's estimated spread to swap at target tenor T_{high};
- $Spread_{T_{low}}$ is the RBA's estimated spread to swap at target tenor T_{low};
- $Tenor_{T_{high}}$ is the effective tenor associated with target tenor T_{high}; and
- $Tenor_{T_{low}}$ is the effective tenor associated with target tenor T_{low}.

287. We estimate the increase in yield that extrapolates the Bloomberg BVAL curve from T years to 10 years at each month-end date based on the slope of the RBA curve as:

[78] Over JGN's second averaging period, the longest available tenor of 10 years or less at which the Bloomberg BVAL curve reports fair value yields, T , is equal to 7 therefore the RBA publishes yield and spread estimates for a T year target tenor. If, during another period, T is a target tenor for which the RBA does not publish yield and spread estimates, use the following formula in the place of Equation C:

$$Yield_T^{RBA\,AER} = Swap_T + Spread_{T_{low}}{}^{RBA} + \left(T - Tenor_{T_{low}}\right) * \frac{(Spread_{T_{high}} - Spread_{T_{low}})}{(Tenor_{T_{high}} - Tenor_{T_{low}})}$$

Where terms are defined as in step 286 and:

- $Swap_T$ is the T year swap rate sourced from Bloomberg using ADSWAP Curncy; and
- $Spread_{T_{low}}{}^{RBA}$ is the spread reported by the RBA for target tenor T_{low}.

$$Yield_{10}{}^{RBA\,AER} - Yield_{T}{}^{RBA\,AER}$$

288. A daily series for this increase in yield is calculated by using linear interpolation between $Yield_{10}{}^{RBA\,AER} - Yield_{T}{}^{RBA\,AER}$ calculated at each month-end, consistent with the interpolation methodology for spreads shown at equation B above.

289. We estimate a daily series for the Bloomberg BVAL 10 year extrapolated yield as the Bloomberg BVAL yield at T years plus the daily series of increases in yields calculated at step 287 above.

B.1.4 Construction of the BVAL curve

290. An entire BVAL BBB fair value curve must be used to estimate the weighted sum of squared differences between this curve and observed bond data. This curve is constructed as:

- the BVAL BBB fair value yields for maturities from 1 year to T years; and
- the extrapolated BVAL BBB fair value yield for 10 years as calculated above.

291. We calculate a daily series for the Bloomberg BVAL BBB fair value spreads to swap as the yield estimates calculated above less swap yields sourced from Bloomberg using the ADSWAP ticker series (ie, ADSWAP1 Curncy, ADSWAP2 Curncy, etc).

B.2 Implementation of SAPN extrapolation methodology

B.2.1 Extrapolation of the RBA curve

292. The 10 year extrapolated yield for the RBA curves on each publication date is estimated as:

$$Yield_{10}{}^{RBA\,SAPN} = Yield_{10}{}^{RBA} + (10 - Tenor_{10}) * Slope \qquad \text{(Eqn. D)}$$

Where:

- $Yield_{10}{}^{RBA}$ is the RBA's estimated yield at target 10 year tenor;
- $Slope$ is the slope coefficient of the RBA's spread to swap estimates against the associated estimates of effective tenor using simple least squares regression; and
- $Tenor_{10}$ is the effective tenor associated with the RBA's estimated spread to swap at the target 10 year tenor.

293. In order to derive a daily series for yields and spreads to swap based on the SAPN extrapolation methodology follow the process described in step 280, step 281 and step 282 above substituting $Yield_{10}{}^{RBA\,SAPN}$ where $Yield_{10}{}^{RBA\,AER}$ is mentioned.

B.2.2 Extrapolation of the BVAL curve

294. A BVAL spread to swap curve is calculated as BVAL yields less Bloomberg estimates of swap rates sourced using ADSWAP Curncy.

295. The BVAL curve is extrapolated from its longest available tenor of 10 years or less, T, to 10 years using the following formula:

$$Spread_{10}{}^{BVAL\,SAPN} = Spread_T + (10 - T) * Slope \quad \text{(Eqn. E)}$$

Where:

- $Spread_{10}{}^{BVAL\,SAPN}$ is the 10 year extrapolated BVAL spread using the SAPN methodology;
- T is the longest available tenor of 10 years or less at which the Bloomberg BVAL curve reports fair value yields. Over JGN's second averaging period T is equal to 7;
- $Spread_T$ is the T year spread to swap calculated in step 294 above; and
- $Slope$ is the slope coefficient of the Bloomberg BVAL spread to swap estimates against tenor using simple least squares regression, where:
  - Spreads to swap are calculated as described in step 294 above; and
  - Regression is applied to estimates at tenors of one year or greater for which the BVAL curve is published.

Appendix C Nelson-Siegel analysis

296. We have applied a yield curve functional form based on the method introduced by Nelson and Siegel. Nelson and Siegel first used their technique to approximate yield curves for US Treasury bills. This functional form is widely used in the empirical finance literature on yield curves. For example, Christensen et al. state:[79]

> *Our new AF* [arbitrage free] *model structure is based on the workhorse yield-curve representation introduced by Nelson and Siegel (1987). The Nelson-Siegel model is a flexible curve that provides a remarkably good fit to the cross section of yields in many countries, and it is very popular among financial market practitioners and central banks (e.g., Svensson, 1995, Bank for International Settlements, 2005, and Gurkaynak, Sack, and Wright, 2006).*

297. The Nelson Siegel functional form is used by academic and practitioners alike including in Australia.[80]

298. The Nelson Siegel model provides a flexible functional form that allows for a variety of shapes that one would expect a yield curve might take but which also limits the amount of computing power required to estimate the relevant parameters. Essentially, a spot rate curve is being estimated.

299. It is important to distinguish the Nelson-Siegel functional form from other methods of fitting curves that use methods of interpolation such as splines. Because Nelson-Siegel curves only have a small number of parameters, the fitted curve will not necessarily pass through or close to every observation. Interpolation methods are likely to be better at achieving this end. As Nelson and Siegel put it: [81]

> *It is quite clear from figure 4 that no set of values of the parameters would fit the data perfectly, nor is it our objective to find a model that would do so. A more highly parameterized model that could follow all the wiggles in the data is less likely to predict well, in our view, than a more parsimonious model that assumes more smoothness in the underlying relation than one observes in the data.*

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79 Christensen, Diebold and Rudebusch ,"The affine arbitrage-free class of Nelson–Siegel term structure models", *Journal of Econometrics*, Volume 164, Issue 1, 1 September 2011, pp. 4–20

80 For example, see the Commonwealth Bank, *Fixed Income: Weekly Strategy, 7 August 2012*.

81 Nelson and Siegel, "Parsimonious modelling of yield curves", *The Journal of Business*, Volume 60, Issue 4, October 1987, p. 479

300. More recently Diebold and Li have made empirical findings that appear to support these statements.[82]

301. The Nelson-Siegel functional form used is as set out below:

$$Yield(t) = \beta_1 + (\beta_2 + \beta_3)\frac{1 - e^{-t/\beta_0}}{t/\beta_0} - \beta_3 e^{-t/\beta_0}$$

302. Conceptually, β_1 can be interpreted as a long-term component (which never decays), β_2 as a short-term component (its loading starts nearly at 1, and then decays over term to maturity), β_3 as a medium-term component (its loading starts at zero, then peaks at some point and then decays to zero again), and β_0 as a parameter characterising the speed of decay of the short-term and medium-term effects. Therefore, as the term to maturity increases, the estimated yield goes to β_1 rather than to infinity as it would if a linear or quadratic specification were instead adopted. The parameter t refers to the bond's term to maturity.

303. This functional form gives the curve the flexibility to take on many different shapes (from monotonically increasing to hump shaped) which allows the curve to be fitted to the data rather than enforcing a shape that may not be consistent with the underlying data.

304. We estimate β_0, β_1, β_2 and β_3 to define a single Nelson-Siegel yield curve by minimising the sum of squared errors between the fair yield curve and the reported yield data over January 2015.[83]

305. It is worth noting that the regression is non-linear due to the inclusion of the speed-of-decay parameter β_0, and many statistics used to evaluate goodness of fit of a linear regression are not suitable for this model.

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82 Diebold and Li, "Forecasting the term structure of government bond yields", *Journal of Econometrics*, Volume 130, February 2006, pp. 337-364

83 In previous implementations of this methodology we have estimated a separate curve for each day of the averaging period and then averaged the parameter values derived from those curves. We have found that the implementation used in this report is more resistant to isolated outlier values and is a more consistent way of estimating a single Nelson-Siegel yield curve to represent the entire averaging period.

Appendix D AER/ACCC cost of debt regulatory decisions

306. Table 16 below shows 39 decisions made by either the AER or the ACCC over the past 10 years in which the cost of debt was set for regulated energy network businesses. These figures are also displayed at Figure 16 above as the spread to swap allowed at each decision against different fair value measures over time.

307. For each decision we sourced the final decision of the AER or ACCC and identified the averaging period and the cost of debt determined in that decision. If the decision was subject to an appeal, we identified the result of that appeal and used the averaging period and cost of debt resulting from that appeal. The averaging periods and cost of debt in Table 16 below reflect the outcome of this research.

308. For each decision, we sourced a 10 year swap rate for the final day of the averaging period and calculated a spread to swap as the allowed cost of debt less the 10 year interest rate swap on the final day of the regulatory period.

Table 16: Regulatory decisions

Company	Period	Final decision	End of averaging period	Cost of debt	10 year swap	Spread to swap
TransGrid	2004-09	27/04/2005	28/04/2004	6.88	6.33	0.55
EnergyAustralia	2004-09	27/04/2005	28/04/2004	6.88	6.33	0.55
Roma to Brisbane Pipeline	2006-11	20/12/2006	27/11/2006	6.84	6.05	0.79
Powerlink	2007-12	14/06/2007	1/12/2006	6.82	6.05	0.77
SP AusNet	2008-14	31/01/2008	14/12/2007	8.20	7.10	1.10
GasNet	2008-12	30/04/2008	30/04/2008	9.38	7.21	2.17
ElectraNet	2008-13	11/04/2008	17/03/2008	9.61	7.22	2.39
Transend	2009-14	28/04/2009	5/09/2008	8.81	6.43	2.39
Endeavour Energy (Integral Energy)	2009-14	28/04/2009	5/09/2008	8.82	6.43	2.40
Ausgrid (EnergyAustralia)	2009-14	28/04/2009	5/09/2008	8.82	6.43	2.40
Essential Energy (Country Energy)	2009-14	28/04/2009	5/09/2008	8.82	6.43	2.40
TransGrid	2009-14	28/04/2009	5/09/2008	8.85	6.43	2.43
ActrewAGL	2009-14	28/04/2009	27/02/2009	7.78	4.93	2.85
Envestra (Country Energy) Wagga Wagga	2010-15	26/03/2010	12/03/2010	8.98	6.13	2.85
ActewAGL (ACT, Queanbeyan and	2010-15	26/03/2010	12/03/2010	9.52	6.13	3.39

Palerang)						
Energex	2010-15	6/05/2010	26/03/2010	8.98	6.17	2.81
Ergon Energy	2010-15	30/03/2010	26/03/2010	8.98	6.17	2.81
ETSA Utilities	2010-15	30/03/2010	23/04/2010	8.87	6.23	2.64
Jemena Gas Networks (NSW)	2010-15	11/06/2010	6/05/2010	10.02	5.90	4.12
Jemena Electricity Networks (VIC)	2011-15	29/10/2010	31/05/2010	9.99	5.85	4.14
United Energy	2011-15	29/10/2010	27/08/2010	8.97	5.34	3.63
CitiPower	2011-15	29/10/2010	27/08/2010	8.97	5.34	3.63
Powercor	2011-15	29/10/2010	27/08/2010	8.97	5.34	3.63
SP AusNet	2011-15	29/10/2010	8/10/2010	9.36	5.61	3.75
Envestra (QLD) gas network	2011-16	17/06/2011	17/03/2011	10.23	5.86	4.37
Envestra (SA) gas network	2011-16	17/06/2011	17/03/2011	10.23	5.86	4.37
Amadeus Gas Pipeline	2011-16	20/07/2011	1/04/2011	9.32	6.05	3.27
APT Allgas	2011-16	17/06/2011	31/05/2011	9.77	5.78	3.99
Aurora Energy	2012-17	30/04/2012	6/02/2012	8.00	4.67	3.33
Powerlink	2012-17	30/04/2012	30/03/2012	8.10	4.80	3.30
Roma to Brisbane Pipeline	2012-17	10/08/2012	20/07/2012	7.01	3.74	3.28
APA GasNet	2013-17	15/03/2013	26/09/2012	6.68	3.67	3.02
Multinet Gas	2013-17	15/03/2013	20/11/2012	6.44	3.84	2.60
SP AusNet	2013-17	15/03/2013	7/12/2012	6.50	3.78	2.72
Envestra (Vic)	2013-17	15/03/2013	20/02/2013	6.76	4.06	2.70
Envestra (Albury)	2013-17	15/03/2013	20/02/2013	6.76	4.06	2.70
ElectraNet	2013-18	30/04/2013	15/03/2013	6.69	4.21	2.48
Murraylink	2013-18	30/04/2013	26/03/2013	6.69	4.17	2.52
AusNet Services (SP AusNet)	2014-2017	31/01/2014	13/12/2013	6.79	4.60	2.19

Sources: AER/ACCC regulatory decisions

Appendix E Swap yields

309. Table 17 below sets out the average swap yields reported by Bloomberg for maturities of 1 to 10 years over JGN's second averaging period of 19 January 2015 to 16 February 2015. Each of these yields is expressed on a semi-annual basis. The average of the 1 to 10 year swaps over the second averaging period is 2.575%.

Table 17: Average swap yields in second averaging period

Maturity	Average swap yield (%)
1 year	2.428
2 year	2.354
3 year	2.384
4 year	2.437
5 year	2.509
6 year	2.589
7 year	2.666
8 year	2.732
9 year	2.794
10 year	2.854
Simple average	**2.575**

Source: Bloomberg

Appendix F Terms of reference

The Expert will provide an opinion report that:

1. Reviews and, where appropriate responds to matters raised in the draft decision estimating the return on debt approach, including (but not limited to):

   (a) the need for a transition to the trailing average and the appropriate form of that transition (if needed);

   (b) the methods for selecting data sources, extrapolating data out to the benchmark term (if needed), and updating the return on debt annually;

   (c) whether the AER's proposed approach to the return on debt would result in the best estimate of the return on debt that contributes to the achievement of the allowed rate of return objective and meets the requirements of Rule 87; and

   (d) whether the return on debt estimate using the AER approach would produce a result consistent with the achievement of the NGO and the RPP.

2. In light of Expert's opinion on the above matters and any other matters the Expert considers relevant, and having regard to the AER's objective of implementing a trailing average approach in future periods:

   (a) recommends a method for estimating the return on debt for the forthcoming access arrangement period that best satisfies National Gas and Electricity Rules and Laws; and

   (b) applies this method to estimate the return on debt for the first year of the access arrangement period.

In preparing the report, the Expert will:

A. consider the theoretical and empirical support for different return on debt estimation methods;

B. consider any comments raised by the AER and other regulators on return on debt estimation;

C. use robust methods and data, where relevant;

D. use the sample averaging period of 2 January to 30 January 2015 (inclusive) to estimate any prevailing parameter estimates needed to estimate the return on debt for the **initial report** and the final averaging period of 19 January to 16 February 2015 (inclusive) for the **subsequent report**.