Attachment M.26

Attachment M26_ CEG: Transition to the trailing average rate of return on debt, Assessment and calculations for SAPN

June, 2015

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Transition to the trailing average rate of return on debt

Assessment and calculations for SAPN

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1 Introduction

1. CEG has been engaged by SAPN to prepare an expert report that assumes that the benchmark efficient entity previously managed its debt by issuing evenly staggered 10 year debt with 100% of the base rate of interest reset at the beginning of each regulatory period.[1] In this context, I have been asked to answer the following questions:

   i. If the business is assumed to be 100% hedged in the manner above would you consider a transition is required on the debt risk margin as proposed by the AER in Option 2 of its Preliminary Determination? Why?

   ii. Please identify which extrapolation method you consider preferable (a) during SAPN's averaging period; and (b) more generally.

   iii. Should you conclude that no transition is appropriate for the debt risk margin, please re-calculate the cost of debt for a 20 business day averaging period commencing on 9 February 2015 without a transition for the debt risk margin but otherwise adopting the AER's methodology. *In performing this calculation, please use a 50:50 weighting to each of the RBA and Bloomberg curves as per the AER's Preliminary Determination and apply the extrapolation method you recommend at Point 2. You should identify all the data inputs and their source and set out all the relevant calculations.*

   iv. Please perform again the calculation referred to at Point 3 but using the debt service provider (i.e. either RBA or Bloomberg) that Chairmont recommends to be preferable at the relevant time that the data points are sourced.

   v. Please perform again the calculations referred to at Points 3 and 4 but using the AER extrapolation method (if this differs from the extrapolation method used above).

   vi. If Lally's NPV principle were used to assess whether a business is under-compensated or over-compensated, please explain whether a debt allowance calculated using Option 2 or Option 3 would under-compensate or over-compensate SAPN (as those Options are described on pages 3-128 and 129 of the Preliminary Determination).

2. 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 I 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

[1] Terms of reference are provided at Appendix C.

calculation of the WACC and the use of the WACC in the AER's regulatory modelling.

3. This report traverses similar ground to other recent reports written by CEG. Rather than repeat all of the analysis previously provided, I will refer in this report, as appropriate, to the relevant sections of my most recent report for the Jemena Electricity Networks (JEN)[2].

4. I acknowledge that I 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". I have made all inquiries that I believe are desirable and appropriate to answer the questions put to me. No matters of significance that I regard as relevant have to my knowledge been withheld.

5. I have been assisted in the preparation of this report by Annabel Wilton in CEG's Sydney office. However, the opinions set out in this report are my own.

Thomas Nicholas Hird

[2] CEG, Critique of the AER's JGN draft decision on the cost of debt, April 2015.

2 Question 1

If the business is assumed to be 100% hedged in the manner above would you consider a transition is required on the debt risk margin as proposed by the AER in Option 2 of its Preliminary Determination? Why?

6. Clause 6.5.2.(c) of the National Electricity Rules (NER)[3] 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).*

2.1 A benchmark debt management strategy must be defined

7. As described in section 2 of my report for JEN, the requirements of clause 6.5.2.(c) and clause 6.5.2 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.

8. 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 clause 6.5.2.(c) would undertake.

9. Section 3 of my report for JEN describes the mechanics of two extreme debt management strategies:

   - one where 100% of base interest costs are reset at the beginning of each regulatory period using interest rate swaps but where the debt risk premium (DRP) is based on a trailing average of DRP relative to swap rates; and

[3] Throughout this report, references to the NER and National Electricity Law (NEL) can be read as also referring to the NGR and the National Gas Law (NGL).

- one where there is 0% use of interest rate swaps so both the base rate of interest and the DRP reflect a trailing average.

10. Of course, anything between these two extremes also reflects a replicable debt management strategy. For example, if interest rate swaps are used to hedge only x% of the base portfolio then the cost of debt will be a weighted average of the costs of the two extremes (x% of the costs associated with the 100% use of swaps and (1-x)% of the costs of the 0% use of swaps).

2.2 The AER's 'option 2' debt transition does not define a feasible debt management strategy

11. As explained in detail in section 4 of my report for JEN, the AER's methodology for setting the cost of debt does not comply with clause 6.5.2.(c) 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.

12. The reason is that the AER debt transition sets the cost of debt based on both the prevailing base rate of interest and the prevailing debt risk premium (DRP). However, it is accepted by all parties that a staggered debt issuance program has been, and continues to be, efficient. It is assumed that the debt issuance is targeted around 10 year maturity such that, at any given time, the benchmark efficient entity will maintain a portfolio of debt that has been issued over the preceding 10 years.

13. The benchmark efficient entity can potentially use interest rate swaps to reset the base rate of interest every 5 years at the beginning of each regulatory period. If it does this then its base rate of interest will reflect prevailing interest rates at the beginning of each regulatory period. Under such a strategy, which I have been instructed to assume the benchmark efficient entity would have put in place, the benchmark entity would have a base interest cost that reflects prevailing rates. Therefore, the AER's use of prevailing base rates of interest is not unreasonable.

14. However, there is no mechanism by which a business with a staggered debt portfolio will have a DRP cost which reflects the prevailing cost of debt. That is, there is no equivalent in interest rate swaps that can be used to reset the DRP on a portfolio of debt to the prevailing DRP. Consequently, the benchmark efficient business will have a trailing average DRP cost. This point is acknowledged by the AER and its advisers. The AER's 'Option 2' transition does not compensate for a trailing average DRP and, consequently, will not compensate for the efficient costs of the benchmark efficient entity. For this reason I do not consider that the AER's 'Option 2' transition is reasonable.

15. The AER accepts that its methodology does not set an allowance that is based on the costs of a specific debt management strategy. The AER justifies this based on an interpretation that the NER and National Electricity Law (NEL) 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. Specifically, the AER chooses to compensate based on a prevailing DRP on the basis that the prevailing DRP is lower than the trailing average DRP and that the loss imposed on the benchmark efficient entity will claw back past over-compensation where the DRP allowance has been set above the trailing average DRP.

16. In my view, the economic basis for the AER's interpretation of the NER and NEL is not sound. The previous 'on-the-day' approach to setting compensation for the cost of debt was flawed, including, in my 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.

17. 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. This includes the AER, which states that a benchmark efficient entity would have maintained a staggered debt maturity profile but would have used interest rate swaps to hedge the base rate of interest to the 'on the day' prevailing base rate but acknowledges that this would leave the benchmark efficient entity with a trailing average DRP cost.[4] This is consistent with the logic I set out in section 3 of my report for JEN.

18. In order to compensate the benchmark efficient entity for its prospective costs it is axiomatic that the DRP must be set in a manner consistent with its prospective costs (i.e., must be based on a trailing average). However, the AER deliberately departs from this on the basis that its "Option 2" transition will lead to the same expected level of compensation as would exist if the 'on the day' approach was maintained and, even though this involves prospective under-compensation, this is justified by past over-compensation.

19. Even if we assume that past over-compensation is a valid reason for prospective under-compensation:

    - The AER does not provide any empirical assessment of past over-compensation of SAPN. Rather, it simply assumes that such past over-compensation exists and that it is of a similar magnitude to prospective under-compensation under 'Option 2' transition;

4 For example, see p. 3-156 to 3-157 of AER, SA Power Networks preliminary decision, April 2015.

- I have attempted such an analysis and my best estimate is that SAPN has not been overcompensated for the cost of debt in past regulatory periods (see section 5).

20. Moreover, the AER's justification for its assumption appears to be that under the 'on the day' approach compensation would have approximately matched costs in some long run sense. That is, compensation would be unlikely to be close to actual costs in any year[5] but it would not be biased and, therefore, over many regulatory cycles the errors would tend to 'average out' to something close to zero. The AER appears to believe that this justifies what is, in effect, one last 'on the day' allowance under 'Option 2' that will 'true up' all past over/under-compensation.

21. In my view, there is no logical basis for this presumption. In fact, the AER's 'Option 2' 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[6] 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 one final time. In doing so, the AER creates uncertainty about, and instability in, prices faced by customers.

22. I address the AER's reasoning in defence of its proposed transition in more detail of section 4 of my report for JEN. However, 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. I do not consider that this is appropriate, because:

    i. As already stated, there are no past windfall gains for SAPN;

    ii. In any event, I consider that the AER's 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.

    iii. There are many unanswered questions about how the retrospective correction would actually be implemented if it was accepted as appropriate.

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5 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 while costs would reflect a 10 year trailing average (at least for the DRP).

6 Under the 'on the day' approach the initial averaging period is given 100% weight for five years. Therefore, the product of the weight and the number of years it is applied to is 500%. Under the AER transition it is given 100% weight for the first year, 90% weight for the second year and so on until the 10th year where it is given 10% weight. The product of the weights and years is therefore 550% (=100% + 90% …+10%).

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?

3 Questions 2

Please identify which extrapolation method you consider preferable (a) during SAPN's averaging period; and (b) more generally.

23. 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. The 10 year yield estimates (in annual terms) resulting from the application of the AER and SAPN extrapolation methods to RBA and Bloomberg BVAL yield estimates are reported in Table 1 below.

Table 1: Extrapolated third-party 10 year yield estimates over 9 February to 6 March (%, annualised)

	AER extrapolation	SAPN extrapolation
RBA estimates	4.53	4.71
Bloomberg BVAL estimates	4.17	4.63
Average	**4.35**	**4.67**

Source: RBA, Bloomberg, CEG analysis

3.1.1 AER extrapolation method

24. 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.

25. 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.

26. 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.

27. Application of this method to the RBA yield estimates over the period from 9 February 2015 to 6 March 2015 gives rise to a yield of 4.48% in semi-annual terms or 4.53% in annualised terms. This is consistent with a semi-annual spread to swap of 160.18 basis points.

28. 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.

29. The implementation of the AER's methodology to the Bloomberg BVAL BBB yield curve over the period from 9 February 2015 to 6 March 2015 gives rise to a yield of 4.13% in semi-annual terms, or 4.17% in annualised terms. This is consistent with a semi-annual spread to swap of 125.29 basis points.

30. In January 2015, February 2015 and March 2015 the RBA spread to swap estimates at a 10 year target are lower than those at a 7 year target (in March the 7 and 10 year estimates are very similar). Consequently, the AER's methodology results in a negatively sloped extrapolation during the 9 February 2015 to 6 March 2015 averaging period. Over this period, the slope of the extrapolation to 10 years was -7.0 bppa on spreads to swap for the RBA curve and -7.5 bppa on spreads to swap for the BVAL curve.

3.1.2 SAPN extrapolation method

31. The SAPN extrapolation method was proposed by SAPN in the context of its regulatory proposal to the AER.[7] The method extrapolates both the RBA and the Bloomberg BVAL curve by:

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

- 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.

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

33. Application of this methodology to the RBA and BVAL curves gives rise to, respectively, semi-annual yield estimates of 4.66% and 4.58% on average over the period from 9 February 2015 to 6 March 2015. These are equivalent to yields of 4.71% and 4.63% respectively in annual terms, and semi-annual spreads to swap of 178.0 and 170.4 basis points – with an average of 174.2 basis points. The resulting difference of 7.6 basis points is small.

34. 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 +4.9 bppa. The extrapolation of the implied BVAL spreads to swap, based on the slope of the implied spreads between 1 and 7 years, is +7.6 bppa.

3.2 Bond population

35. 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.[8] I consider that, other things equal, a broader sample is preferable. Consistent with these criteria, I 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;
- are issued by corporations in any industry, excluding governments or government bodies;

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

- have a credit rating issued by Standard & Poor's of BBB-, BBB or BBB+ on the final day of the averaging period.[9]

36. Over the period from 9 February 2015 to 6 March 2015, we have identified 157 bonds that meet these general criteria and report option adjusted spreads (OAS) to swap in this period. Table 2 below describes the breakdown of this population by credit rating, maturity and currency. Further we note that 106 of the bonds are issued by non-financial corporations, while a further 51 are issued by financial corporations.

Table 2: Description of bonds in population

Credit rating	# bonds	Maturity	# bonds	Currency	# bonds
BBB-	25	**0-4 years**	60	**AUD**	95
BBB	73	**4-6 years**	39	**USD**	13
BBB+	59	**6-8 years**	27	**EUR**	43
		8-12 years	23	**GBP**	6
		12+ years	8		
	157		157		157

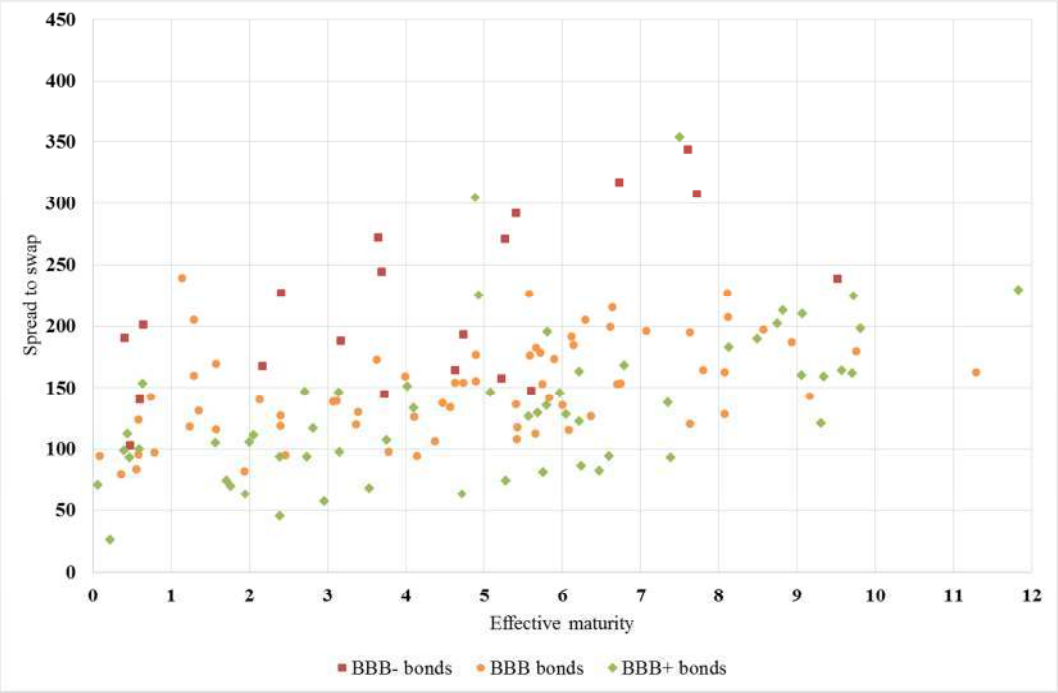
Source: Bloomberg, CEG analysis

37. 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.

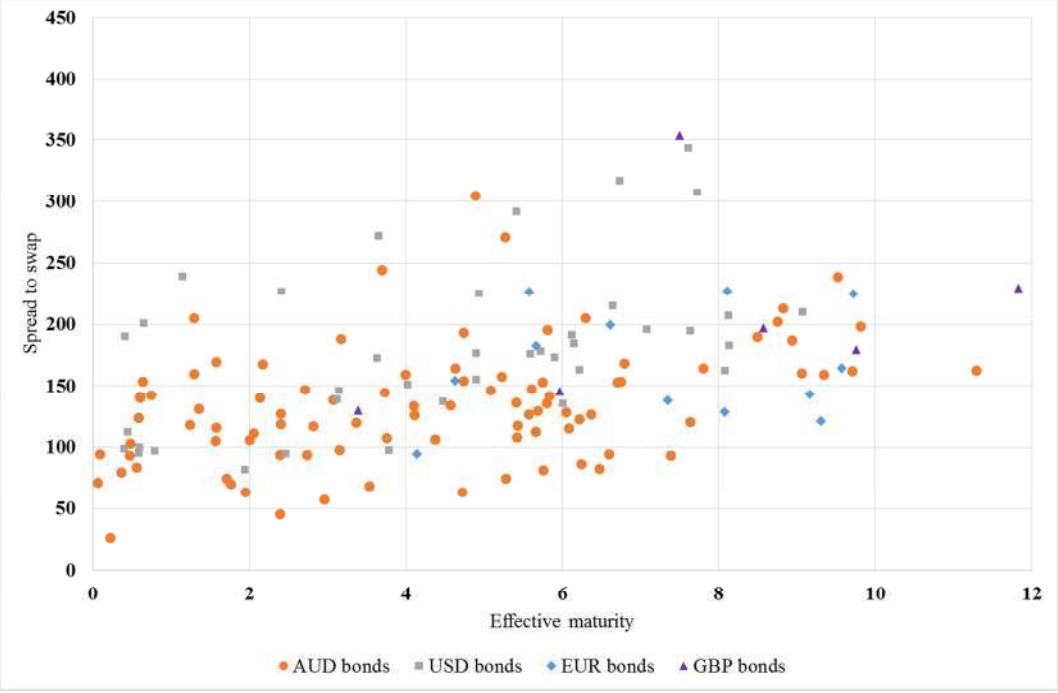
9 I note that JGN's criteria are narrower than the RBA's only in this respect, since the RBA also includes bonds that do not have a rating if the issuer has a rating from Standard & Poor's in the relevant range.

Figure 1: Full bond sample OAS by credit rating



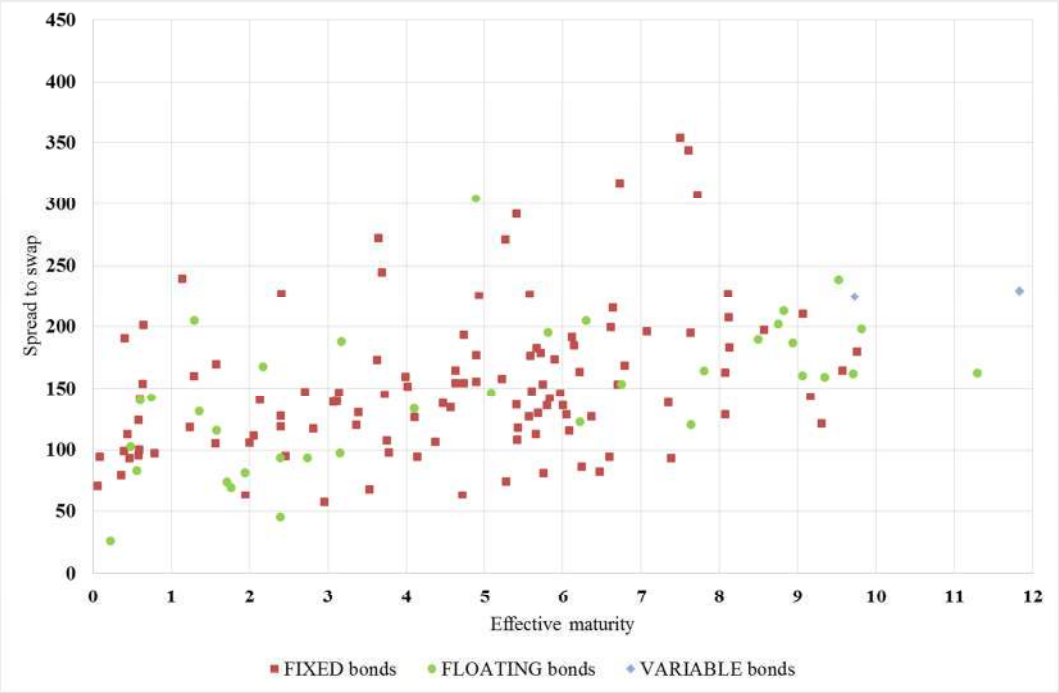
Source: Bloomberg, CEG analysis

Figure 2: Full bond sample OAS by currency of issue



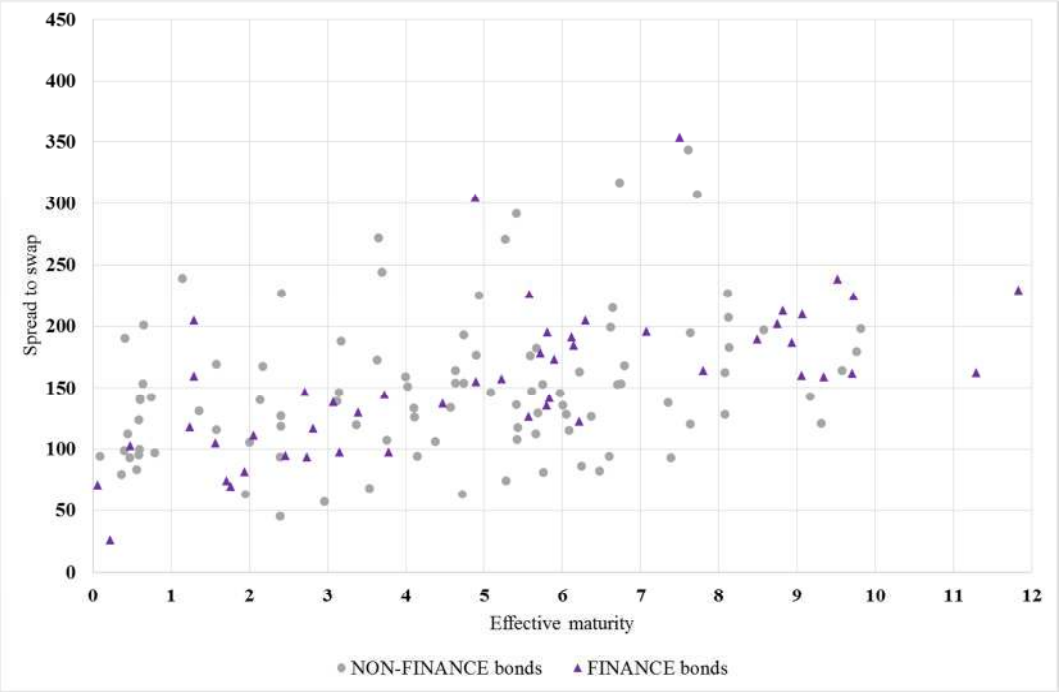
Source: Bloomberg, CEG analysis

Figure 3: Full bond sample OAS by coupon type



Source: Bloomberg, CEG analysis

Figure 4: Full bond sample OAS by sector



Source: Bloomberg, CEG analysis

3.3 Goodness of fit test of extrapolated fair value curves

38. I 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.[10] 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.

39. 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.

40. 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.

3.3.1 Full bond sample

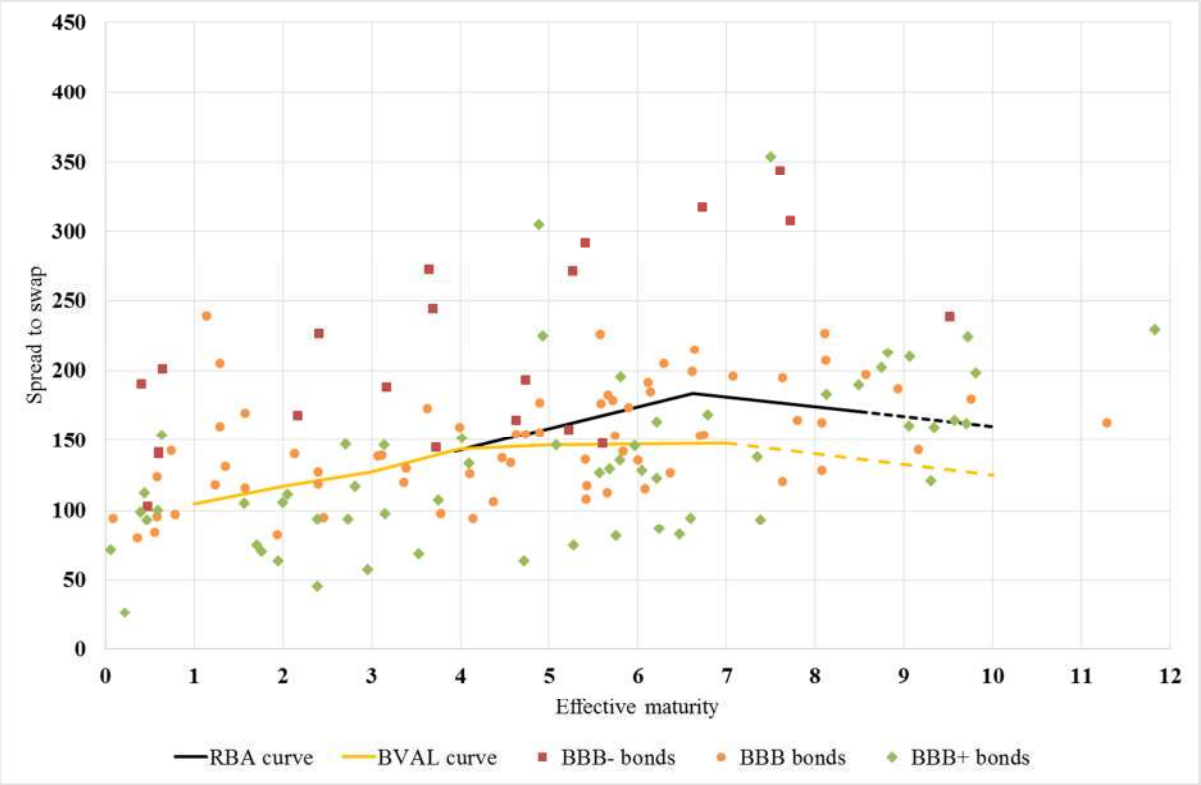
41. Figure 5 and Figure 6 below show the OAS estimates for the full bond sample defined above. Figure 5 presents the AER's extrapolation method for both the RBA and the Bloomberg BVAL yield estimates, while Figure 6 presents the SAPN extrapolation method for both.

42. 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

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

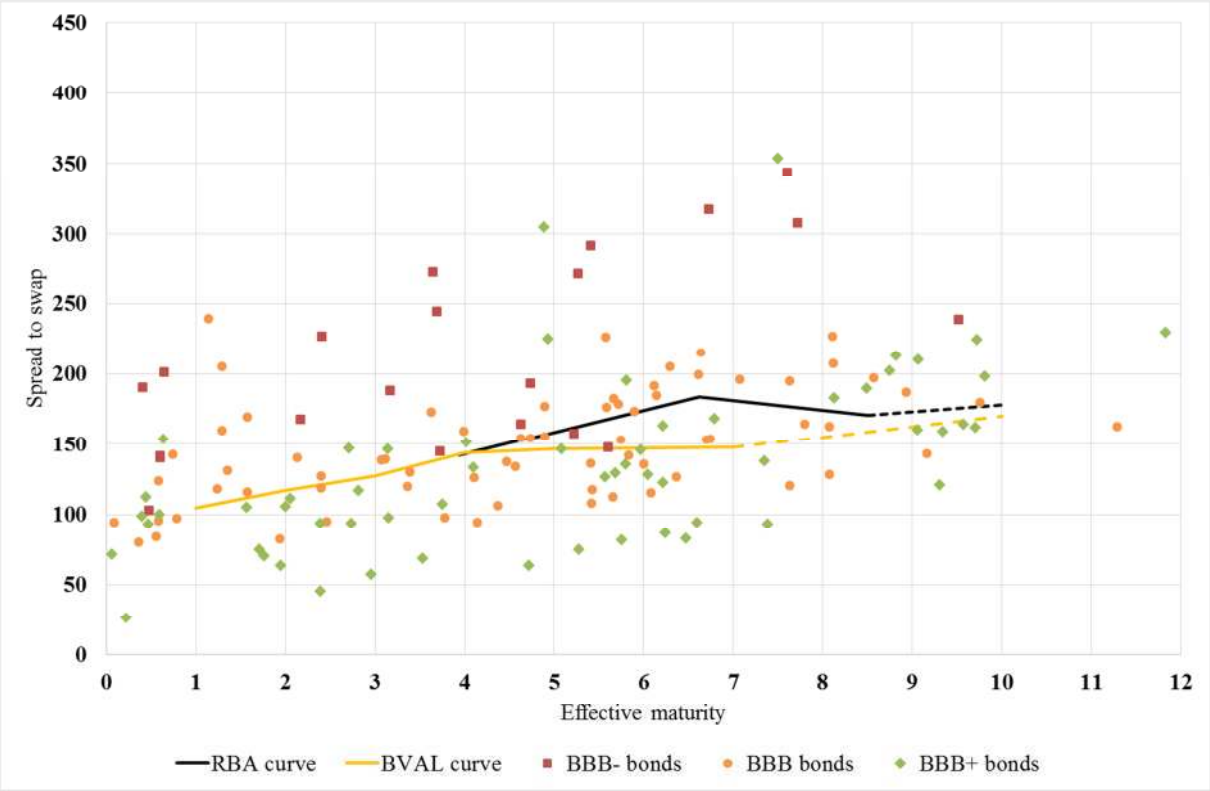
slope to both the RBA and Bloomberg BVAL spread to swap estimates which results in the estimates at 10 years being below the majority of bonds with maturities at or close to 10 years. By contrast the SAPN methodology sets an upwards slope for both the RBA and the Bloomberg BVAL spread to swap estimates 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 5: Full sample OAS estimates by credit rating, AER extrapolation



Source: RBA, Bloomberg, CEG

Figure 6: Full sample OAS estimates by credit rating, SAPN extrapolation



Source: RBA, Bloomberg, CEG

43. Table 3 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.

44. The results in Table 3 confirm the *a priori* expectations developed by visual inspection of Figure 5 and Figure 6 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 3: Goodness of fit tests applied to full sample, weighted SSE

	AER extrapolation	SAPN extrapolation
RBA estimates	2,541	2,273
Average estimates	3,487	2,482
Bloomberg BVAL estimates	5,017	2,806

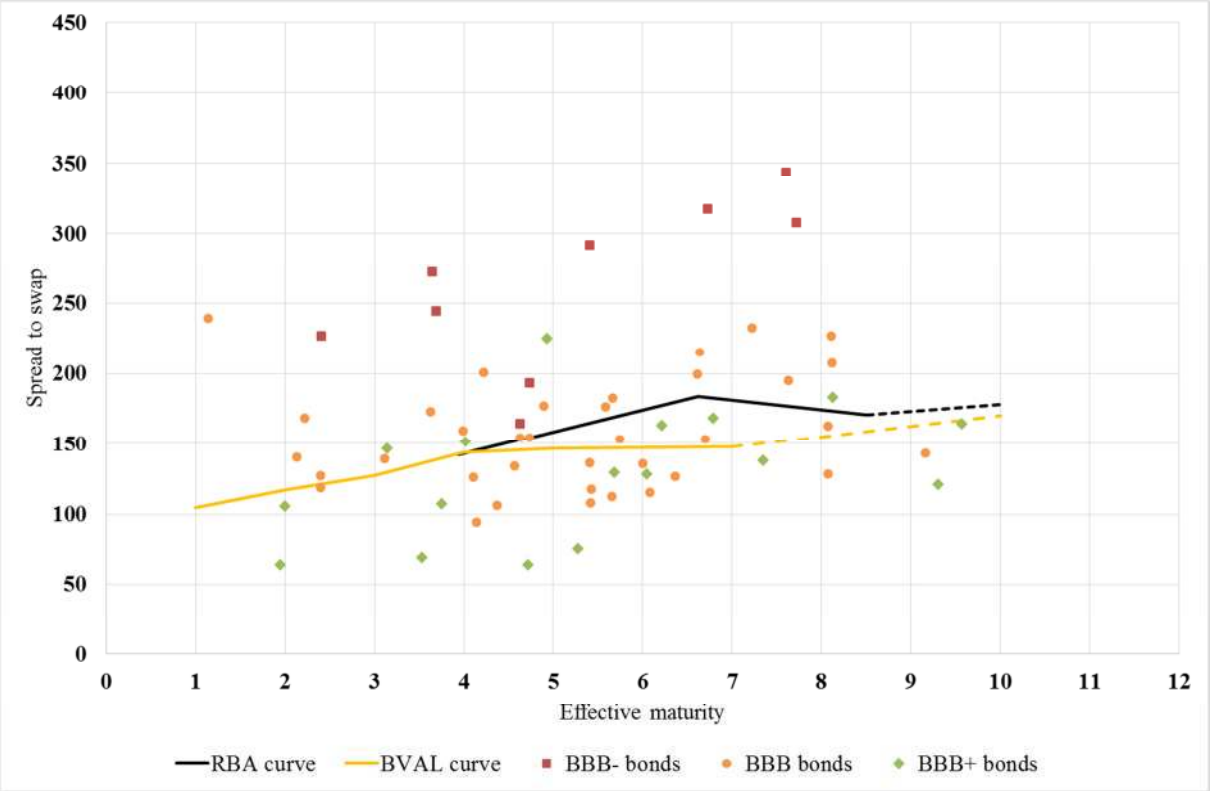
Source: CEG

3.3.2 RBA bond sample

45. Figure 7 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 7: RBA sample OAS estimates by credit rating, SAPN extrapolation



Source: RBA, Bloomberg, CEG

46. *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.

47. Table 4 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.

48. 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.[11]

[11] See Figure 3 and Figure 4 above for more details.

Table 4: Goodness of fit tests applied to RBA sample, weighted SSE

	AER extrapolation	SAPN extrapolation
RBA estimates	3,125	3,314
Average estimates	3,693	3,677
Bloomberg BVAL estimates	4,835	4,220

Source: CEG

3.4 Conclusion

49. 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. Based on goodness of fit tests, 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.

50. On this basis, I conclude that over the period from 9 February 2015 to 6 March 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 174.2 basis points in semi-annual terms, when added to the prevailing 10 year swap rate of 2.88%, corresponds to a 10 year cost of debt 4.62% in semi-annual terms, or an annualised yield of 4.67%.

4 Questions 3, 4 and 5

4.1 Question 3

Should you conclude that no transition is appropriate for the debt risk margin, please re-calculate the cost of debt for a 20 business day averaging period commencing on 9 February 2015 without a transition for the debt risk margin but otherwise adopting the AER's methodology. In performing this calculation, please use a 50:50 weighting to each of the RBA and Bloomberg curves as per the AER's Preliminary Determination and apply the extrapolation method you recommend at Point 2. You should identify all the data inputs and their source and set out all the relevant calculations.

51. The AER's proposed transition methodology initially gives 100% weight to the prevailing 10 year cost of debt. Applying the same method but without a transition for the debt risk premium requires 100% weight to be given to the prevailing 10 year swap rate but that the DRP to be based on the trailing average of the DRP to the 10 year swap rate.[12]

52. The resulting cost of debt is comprised of:

- 2.88% base rate of interest; plus
- 2.35% DRP; giving
- 5.22% semi-annual cost of debt; or
- 5.29% annualised cost of debt.

53. The derivation of the 2.35% DRP is further explained below. For SAPN, a 10 year trailing average DRP must be measured over each of the years 2005/06 to 2014/15. The DRP in each year and the average is summarised below.

[12] As explained in section 3.3 of my report for JEN, (CEG, *Critique of the AER's JGN draft decision on the cost of debt*, April 2015) the actual swap strategy that would be implemented by a business transitioning to a trailing average would be to undertake a series of 1 to 10 year swap transactions. Of course, this would incur swap transaction costs. I have separately costed this strategy when answering question 6.

Table 5 Best estimate of 10 year maturity trailing average DRP to 10 year swap rate, financial years

Financial year	DRP
2005/06	0.63
2006/07	0.79
2007/08	1.69
2008/09	4.39
2009/10	2.82
2010/11	2.74
2011/12	3.03
2012/13	2.89
2013/14	2.75
9 February 2015 to 6 March 2015	1.74
Average (10 years)	2.35

Source: Bloomberg, RBA, CEG analysis

54. In all periods the average of Bloomberg[13] and RBA curves has been used to estimate the DRP. Two different methods for extrapolation have been used:

- Over the 9 years to 2013/14 I have used the AER's methodology for both extrapolating the Bloomberg and RBA series and also for averaging these two series. My reasons for adopting this approach are discussed in section 6 of my report for JEN. [14]
- Over the 9 February 2015 to 6 March 2015 averaging period I have used the SAPN extrapolation methodology for the reasons set out in section 3.1.2 and have averaged Bloomberg and RBA estimates.

4.2 Question 4

Please perform again the calculation referred to at Point 3 but using the debt service provider (i.e. either RBA or Bloomberg) that Chairmont recommends to be preferable at the relevant time that the data points are sourced.

[13] Prior to May 2014 I use the Bloomberg Fair Value BBB curve. Post May 2014 I use the Bloomberg BVAL curve. I explain the reasons for this in section 6 of my report for JEN.

[14] There has been a slight change in approach to applying the AER's methodology for extrapolating the Bloomberg series over history since my report for JEN (CEG, *Critique of the AER's JGN draft decision on the cost of debt,* April 2015). In periods where the longest tenor yield estimate published by Bloomberg was for a tenor that does not correspond to a RBA yield, we estimate a corresponding RBA yield by interpolating the DRP and using difference in Bloomberg swap rates to adjust the swap rate underlying the RBA yield. The resulting average DRP over the 9 years from 2005/06 to 2013/14 is 0.0011% higher than under the previous approach.

55. The resulting cost of debt is comprised of:

- 2.88% base rate of interest; plus
- 2.29% DRP based on Chairmont's preferred choice of third-party data provider over time (which is explained further in section 5.1 below) and applying the AER extrapolation method from 2005-06 to 2013-14 and the SAPN extrapolation method during SAPN's averaging period; giving
- 5.17% semi-annual cost of debt; or
- 5.24% annualised cost of debt.

4.3 Question 5

Please perform again the calculations referred to at Points 3 and 4 but using the AER extrapolation method (if this differs from the extrapolation method used above).

56. Amending the calculation made in responding to question 3 to adopt the AER extrapolation method in all periods (noting that it is already applied for the 9 years prior to 2014/15) the resulting cost of debt is comprised of:

- 2.88% base rate of interest; plus
- 2.31% DRP based on CEG's preferred choice of third-party data provider over time and applying the AER extrapolation method in all periods; giving
- 5.19% semi-annual cost of debt; or
- 5.26% annualised cost of debt.

57. Amending the calculation made in responding to question 4 to adopt the AER extrapolation method in all periods (noting that it is already applied for the 9 years prior to 2014/15) the resulting cost of debt is comprised of:

- 2.88% base rate of interest; plus
- 2.26% DRP based on Chairmont's preferred choice of third-party data provider over time and applying the AER extrapolation method in all periods; giving
- 5.14% semi-annual cost of debt; or
- 5.21% annualised cost of debt.

5 Question 6

If Lally's NPV principle were used to assess whether a business is under-compensated or over-compensated, please explain whether a debt allowance calculated using Option 2 or Option 3 would under-compensate or over-compensate SAPN (as those Options are described on pages 3-128 and 129 of the Preliminary Determination).

58. In this section I first assess the level of prospective under-compensation associated with the AER's proposed transition. I then compare this with any past over/under compensation for SAPN. For the purpose of this analysis I assume, unless otherwise stated and consistent with the AER's position, that a 100% swap debt management strategy was undertaken by SAPN in the past.

5.1 Deriving a series for actual costs

5.1.1 Methodology

59. I estimate the cost of debt faced by a firm employing a 100% swap debt management strategy as the sum of:

- the trailing average of 10 year DRP measured relative to swap rates over the period 2005/06 to 2014/15;
- the 1 to 10 year swap rates (sourced from Bloomberg) over the averaging period immediately prior to the regulatory period (9 February 2015 to 6 March 2015); and
- the costs of swap transactions required to effect the transition (23bppa).

60. I estimate the 10 year DRP relative to swap rates from two series of 10 year yield estimates since July 1995. My best estimate DRP is derived from a series which consists of the simple average of RBA and Bloomberg yield estimates extrapolated to 10 years from 4 December 2001 onwards.[15] Prior to December 2001, I estimate the yield as the 10 year swap rate plus four times the swap-to-CGS spread, an approach consistent with Chairmont (2015).[16] In this report I will refer to this as the "CEG series".

[15] When I refer to "Bloomberg" yield estimates, unless otherwise stated, I am referring to Bloomberg Fair Value estimates from 4 December 2001 to May 2014 and Bloomberg BVAL estimates thereafter. I adopt the Bloomberg BVAL curve which is identical to the Bloomberg Fair Value curve from that date onwards.

[16] Chairmont, *Cost of debt: Transitional analysis,* April 2015, herein Chairmont (2015).

61. I also estimate the trailing average DRP associated with a yield series described and used by Chairmont (2015), as set out in Table 6 below. Chairmont (2015) estimates yields using a combination of swap rates, CGS rates, Bloomberg Fair Value, RBA yields and Bloomberg BVAL, extrapolated to 10 years. I assume that Chairmont's approach to estimating yields pre-1999 was consistent with its approach from July 1999 to November 2001, i.e. the 10 year swap rate plus four times the swap-to-CGS spread. I assume that post-June 2014 Chairmont yields are the average of RBA and Bloomberg BVAL yields, consistent with Chairmont's approach from April 2010.

Table 6 Chairmont (2015) data sources

Date (from)	Date (to)	Data Source
July 1999	November 2001	Swap Rate + (swap-to-CGS spread) x 4
December 2001	December 2004	Bloomberg Fair Value (BFV)
January 2005	November 2007	Average BFV + RBA
December 2007	March 2010	RBA
April 2010	June 2014	Average RBA + Bloomberg BVAL

Table 4: Data Sources

Source: Chairmont (2015), p. 41.

62. My approach to extrapolating Bloomberg and RBA estimates of the cost of debt is as follows:[17]

- Over the 9 years to 2013/14 I have used the AER's methodology for both extrapolating the Bloomberg and RBA series and also for averaging these two series.[18]
- Over the 9 February 2015 to 6 March 2015 averaging period I have used the SAPN extrapolation methodology and have averaged Bloomberg and RBA estimates.

63. Chairmont (2015) noted that a 10 year staggered portfolio of debt is too theoretical and concluded "that the BEE [benchmark efficient entity] would likely have a somewhat uneven refinancing profile with some concentration around the end of the previous regulatory period."[19] It is not clear how exactly debt would be distributed if I were to assume an uneven refinancing profile. I investigated the effect of assuming all debt issuance was concentrated around the regulatory

17 The implementation of these methodologies is set out in detail in Appendix B.

18 In the period prior to 31 January 2005 in which the RBA information is not available and cannot inform extrapolation of the Bloomberg curve, I extrapolate the Bloomberg curve using RBA data from 31 January 2005. In the absence of RBA data in this period, I assume that the 10 year cost of debt and DRP from this source is equal to the extrapolated Bloomberg data.

19 Chairmont (2015), p. 34.

averaging periods.[20] If all debt was issued within 1.5 years either side of the two most recent averaging periods, the DRP would be 2.46% (or 2.42% using the Chairmont series). If all debt were issued within 1.25 years of each averaging period, the DRP would be 2.36% (or 2.25% using the Chairmont series). These are higher than or similar to DRP estimates assuming even issuance (2.34% for CEG series or 2.29% for Chairmont series). I assume even issuance in the calculations in this report.

5.1.2 DRP

64. Table 7 below shows the best estimate of the DRP in each of the last 10 years, based on the CEG series. The resulting trailing average DRP is 2.35%. Using Chairmont's cost of debt series, described above, the trailing average DRP is 2.29%.

Table 7 Best estimate of trailing average DRP, financial years

Financial year	DRP
2005/06	0.63
2006/07	0.79
2007/08	1.69
2008/09	4.39
2009/10	2.82
2010/11	2.74
2011/12	3.03
2012/13	2.89
2013/14	2.75
9 February 2015 to 6 March 2015	1.74
Average (10 years)	2.35

Source: Bloomberg, RBA, CEG analysis

5.2 Under-compensation with AER transition

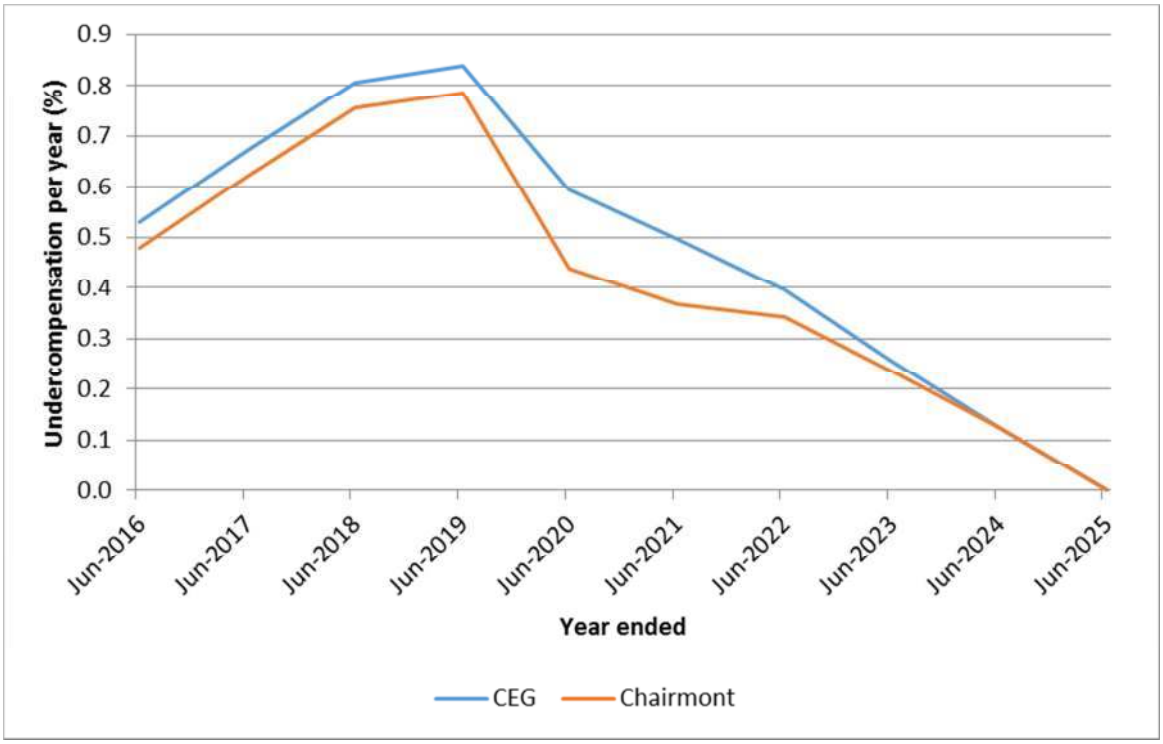
65. If one accepts the AER's view that the benchmark efficient debt management strategy is uniquely the hybrid debt management strategy, then the adoption of a transition to the trailing average debt management strategy would be appropriate. Under this transition the cost of debt would be set equal to the trailing average debt

[20] For the 2005-06 to 2009-10 regulatory period, ESCOSA set a trailing average cost of debt and therefore did not set an averaging period for the DRP close to the beginning of the regulatory period. Notwithstanding this, for the purposes of implementing the Chairmont 'bunching' of debt issue analysis I assumed an averaging period of 29 March 2005 to 23 April 2005 with debt issuance bunched around this date. This 29 March 2005 to 23 April 2005 period is in line with the AER's averaging period for the following regulatory period. A year and a half is, on average, 383 business days.

risk premium (DRP) plus the cost of base interest rates utilised in the unwinding of the business's swap portfolio. As explained in section 3.3 of my report for JEN,[21] the actual swap strategy that would be implemented by a business transitioning to a trailing average would be to undertake a series of 1 to 10 year swap transactions. Of course, this would incur swap transaction costs. Relative to the cost of this strategy, the transition imposed by the AER will, applied at the present time, undercompensate all businesses.

66. The level of under-compensation in each of the next ten years is presented in Figure 8 below. The initial level of under-compensation is 53bp and this rises initially (as the pre-2008 years fall out of the trailing average DRP) and then falls to zero by the end of the transition.

Figure 8 Under-compensation with AER transition



Source: Bloomberg, RBA, CEG analysis

67. The level of under-compensation can be accurately modelled with currently available information because variations in future DRP and swap rates cancel out and the only source of difference between the two transition approaches is the difference between DRP and swap rates *prior* to the next regulatory period.

[21] CEG, Critique of the AER's JGN draft decision on the cost of debt, April 2015.

68. The 53bp can be decomposed into two separate components. The first is a trailing average DRP (measured relative to 10 year swaps) that is 89bp higher than the prevailing DRP allowed by the AER which is measured relative to 10 year swaps in the SAPN averaging period. The second is a 36bp higher base rate of compensation allowed by the AER (which is the difference between the prevailing 10 year swap rate and the average of prevailing 1 to 10 year swap rates in the SAPN averaging period).

69. Similarly, the 53bp initial level of under-compensation can be compared with the 94bp difference between the cost of debt allowance calculated in answering question 3 (5.29%) and the cost of debt allowance associated with the AER allowance (4.35% from Table 1). As noted above, 53bp represents the net under-compensation associated with the cost of debt assuming that a series of 1 to 10 year swaps are entered into. This is 41bp lower than the 94bp difference between 5.29% and 4.35%. This 41bp is mainly[22] comprised of the 36bp higher base rate underpinning the 5.29% figure. This reflects the use of the 10 year swap rate (2.88%) in answering question 3 rather than the average cost of a 1 to 10 year series of swap transactions (2.52%) used in the analysis in this section.

70. Consistent with the above, under-compensation on the DRP component of efficient costs, which all parties agree will reflect on a trailing average, is highly material (89bp) under the AER's proposed 'option 2' transition. It is less obvious that there is under-compensation on the base rate if it is assumed, as I have been instructed to, that 100% of the base rate is hedged using interest rate swaps. In this context, the AER transition would, in the SAPN averaging period, compensate for the base rate at 2.88% but costs would be 2.52% plus swap transaction costs. I estimate swap transaction costs at around 23bppa.[23] Thus, the difference between base rate allowance and base rate costs (inclusive of swap transaction costs) is around 13bp.

71. However, this calculation is based on the assumption that a benchmark efficient entity would have hedged 100% of its base rate exposure to be reset at the beginning of each regulatory period using interest rate swaps. As discussed in section 5.4 and Appendix A, I consider that this is an extreme assumption and that less than 100% hedging would have been adopted by a benchmark efficient entity. This means that the base rate would most accurately be a weighted average of the prevailing swap rates (2.52%) and the trailing average swap rates (5.27%).[24] Even if only 5% of the

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22 The remaining 5bp difference reflects the fact that, in order to focus solely on under-compensation from the AER transition, in this section I use the AER extrapolation in all calculations (both cost and allowance) while the 5.29% figure uses SAPN extrapolation in the most recent SAPN averaging period (and the fact that the 53bp figure is calculated from semi-annual returns while the 5.29%/4.35% figures are annualised).

23 In section 3.4 of my report for JEN.

24 See paragraph 267 of my report for JEN.

base rate were left unhedged this would raise base rate costs by more than 13bp (5%*(5.27-2.52)>13).

5.3 Past over/under-compensation with AER transition

5.3.1 AER's views on reversing past windfall gains

72. 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. It is difficult to extract a short precise statement of the AER's reasoning. Consequently, I summarise my 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.[25]

    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[26] (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 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).[27]

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25 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, …*"

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

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

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.[28]

e. Adopting a trailing average DRP immediately would help ensure that there was no future windfall loss (or gain).[29] 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.[30]

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.[31]

73. 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.

74. The clearest justification for this is, in my view, not found in the AER decision but in Professor Lally's report. Lally states:[32]

> *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*

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28 Ibid, p. 3-301

29 Ibid, p. 3-302

30 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)

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

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

> *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.*

75. 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 will naturally tend to cancel out overtime. A new approach (such as the trailing average approach) can remove this source of over/under-compensation and, instead, 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.

76. 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".[33]

5.3.2 Past over/under compensation

77. I have attempted to calculate, from publicly available information, the cost of debt that would have actually been paid by a benchmark efficient entity over the past two regulatory periods. I note that, the following statement by the AER is not correct.

> *Over the past 10 years, SAPN has been subject to two full regulatory determinations by ESCOSA in 2005 and by us in 2010.[478] In each determination the regulator adopted an on-the-day approach to the return on debt. This was also the approach we adopted in other past decisions for other service providers as it was the approach required by the NER.*

78. ESCOSA's cost of debt decision for the regulatory period beginning in 2005-06 was actually based on a five year average of corporate bond yields:[34]

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

34 ESCOSA, *2005-2010 electricity distribution price determination, Part A – Statement of reasons,* April 2005, p. 154-155

As noted under section 10.5 the Commission has used average Government bond yields taken from the period 14 February 2000 to 11 February 2005 to derive the risk free rate. The Commission has taken the CBASpectrum yield in excess of bonds over the same period, which provides a debt premium of 1.34%.

79. It is relevant to note that in 2010 the AER did not impose a transition on SAPN (then ETSA Utilities) notwithstanding its application of the 'on the day' approach was not the same as the regulatory approach applied in the previous regulatory decision.

80. For the 2005-06 regulatory period, ESCOSA set the cost of debt based on a 5 year average rather than an 'on the day' estimate. I therefore assume that a benchmark efficient entity was not using interest rate swaps in the 2005-06 to 2009-10 regulatory period and estimate the cost of debt faced by such a firm as the 10 year trailing average cost of debt. The allowed cost of debt in the 2005-06 to 2009-10 averaging period is 7.14%, the rolling trailing average risk-free rate plus debt credit margin.[35]

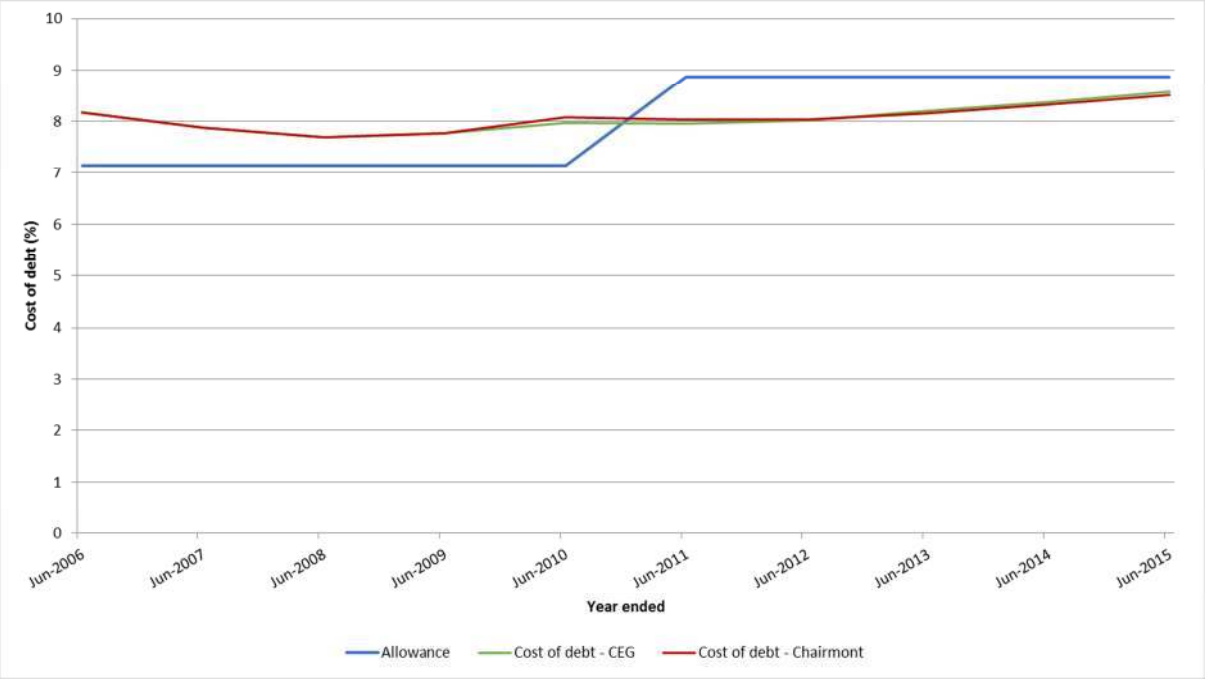
81. For 2010-11 to 2014-15, I assume the benchmark efficient entity implemented the AER's benchmark efficient entity hybrid strategy (hedging using 5 year swaps in the regulatory averaging period). For this more recent period, I add 23bppa to the cost of debt for swap transaction costs. The allowed cost of debt in the 2010-11 to 2014-15 averaging period is 8.87%. The averaging period was the 20 days to 23 April 2010.[36]

82. I compare the (annualised) cost of debt faced by entities over the past two regulatory periods using the cost of debt series described in section 5.1 above to the cost of debt that was actually compensated for in the past regulatory decisions. I also compare the cost of debt according to Chairmont's cost of debt series also described in section 5.1. I compare the CEG and Chairmont efficient cost of debt estimates to the allowed cost of debt over the past two regulatory periods in Figure 9 below. While there was some over-compensation in the most recent regulatory period, it was offset by under-compensation in the preceding period. The average under-compensation is 0.053% and 0.059% for CEG and Chairmont cost of debt estimates over the previous two regulatory periods.

35 ESCOSA, *2005-2010 electricity distribution price determination, Part A – Statement of reasons,* April 2005, p. 161.

36 AER, *Final decision, South Australia distribution determination 2010-11 to 2014-15,* May 2010, p. 193.

Figure 9 Allowed cost of debt vs. benchmark efficient cost of debt



Source: RBA, Bloomberg, CBASpectrum, AER and ESCOSA regulatory decisions, and CEG analysis

5.4 Under-compensation on the cost of debt due to other factors

83. The analysis set out in the last two sections does not include under-compensation for the cost of debt (both prospective and historical) the source of which are:

- The AER's past overestimation of inflation in the 2010-11 to 2014-15 regulatory period; [37]
- The fact that something less than a 100% hedging strategy using interest rate swaps was likely efficient; [38]

[37] The AER used a forecast inflation estimate of 2.52% in its decisions for 2010-11 to 2014. However, actual inflation averaged only 2.33%. As explained in my companion report (CEG, Measuring expected inflation for the PTRM, June 2015), the effect of this is that the actual nominal compensation for the cost of debt (and equity) that SAPN will receive, in the form of both revenues and RAB escalation, will be 0.19% lower than the nominal compensation set out in the AER's 2010 decision.

[38] Based on analysis performed by CEG for Networks NSW (CEG, Efficient debt financing costs, A report for Networks NSW, January 2015, section 4.5) I estimated that a 0% hedging strategy resulted in an actual cost of debt that was a better match to the regulatory allowance than a 100% hedging strategy. This suggests an efficient debt management strategy would involve something materially less than 100% use of interest rate swaps. I also note that this conclusion is consistent with the findings of the empirical finance literature, surveyed in Appendix A, to the effect that there is an inverse relationship between

- The existence of a new issue premium in primary debt markets. [39]

5.5 Conclusion

84. In section 5.2 above I show that businesses employing the 100% swap hedging debt management strategy (that the AER argues was the uniquely efficient strategy in the past) will be undercompensated over the next ten years. I also note that the under-compensation is more material if less than a 100% swap hedging strategy is assumed. 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. However I have shown in section 5.3 that over the previous two regulatory periods, a benchmark efficient firm was not over-compensated. Moreover, this conclusion is reached without relying on the factors surveyed in section 5.4.

DRP and risk free rates. This inverse relationship creates a "natural hedge" under the on-the-day approach; such that when base rates of interest fall (rise) the regulatory allowance will tend to fall (rise) by less due to an offsetting move in the DRP. As is explained in a simple example in Appendix A, in the presence of such a natural hedge the optimal use of interest rate swaps to hedge the base rate of interest will by less than 100%. Prospective under-compensation under the AER transition will be materially higher with less than 100% interest rate swap hedging because the prevailing swap rates are materially lower than trailing average swap rates.

39 I 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. See CEG, *The new issue premium*, October 2014.

Appendix A Relationship between DRP and risk free rates

85. In the presence of negative correlation between risk free rates and the DRP, leaving *at least some* of the base rate of interest unhedged will be the most efficient strategy for hedging the cost of debt to the regulatory allowance – which is comprised of both the base rate of interest and the DRP.

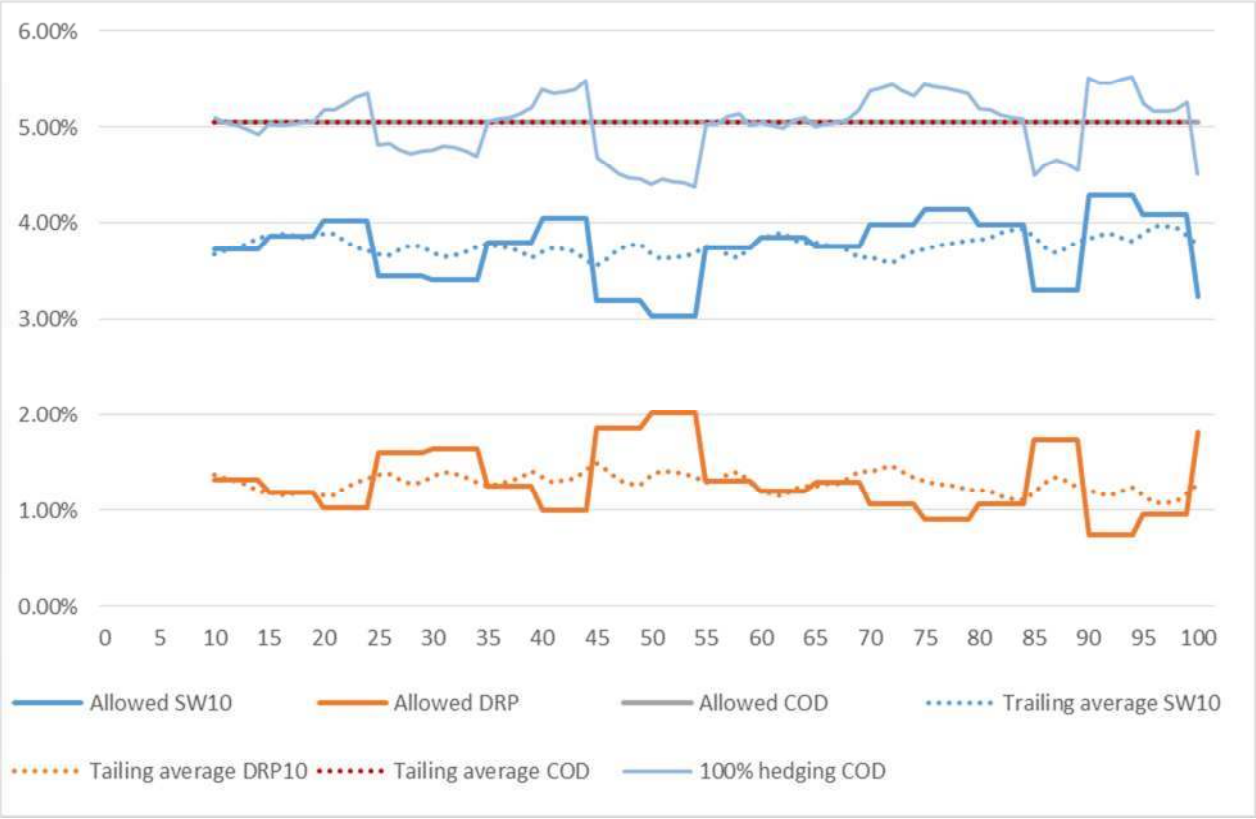
86. The intuitive basis for this conclusion can be illustrated with an extreme example. Imagine that the prevailing DRP (measured relative to swap rates) always moved in an exactly offsetting way to movements in swap rates – such that the cost of debt was constant. Such a scenario is depicted in Figure 10 which shows a variable swap rate series and a DRP series with an exactly offsetting pattern – such that the prevailing cost of debt (COD) is constant.

Figure 10: Variable base rate of interest with perfect offsetting variation in DRP

87. Under the on the day approach, the cost of debt allowance is set equal to the prevailing cost of debt at the beginning of a five year regulatory cycle (which is why the data is broken into 5 year blocks on the horizontal axis). The allowed cost of debt in each five year period is represented in Figure 11 by the grey line – which is by construction constant. Superimposed on this is the trailing average cost of debt

(with 0% use of swap rates) which is also constant by construction (given that it is simply a trailing average of the constant prevailing cost of debt).

Figure 11: Trailing average and 100% swap strategy with perfect offsetting variation in swap rates and DRP



88. By contrast the cost of debt associated with a 100% swap strategy is not constant but, rather, has much the same variability as the swap rate at the beginning of the regulatory period (which is locked in under the 100% swap strategy). It does not have exactly the same volatility as the prevailing swap rate because the trailing average DRP, which is a component of the costs for both strategies, has low, but non zero, variability.

89. It can be seen that, despite the 100% swap strategy 'locking in' the prevailing swap rate used by the regulator, it provides a worse hedge to the total regulatory allowance because the swap contracts undo (or double up) on a natural hedge that already existed. Specifically, variability in the swap rates was dampened (in this example perfectly dampened) by offsetting variability in the DRP (a negative correlation). By entering into 100% swap contracts, the business made the actual cost of debt more volatile than the regulatory allowance because it failed to take into account the existence of a natural hedge.

90. There are a number of academic studies that examine the relationship between the DRP and risk free rates (with the latter used as independent explanatory variables in explaining changes in the former). A summary of the coefficients on the risk-free rate explanatory variable as estimated in various empirical studies is shown in Table 8 along with the explanatory variables used in each respective model. These results show that a change in the risk-free rate is typically associated with a negative change in the DRP, and this observation holds across almost all credit ratings, maturities, and leverage values.

Table 8: Summary of empirical estimates in literature

	Coefficient of the risk-free rate	Category	Explanatory variables
Longstaff and Schwartz (1995)	-0.184	Baa utilities	• Change in Treasury bond yield • Return on stock index
Duffee (1998)	-0.424	Baa non-callable bonds with long maturities (15 to 30 years)	• Change in 3-month Treasury bill yield • Change in slope of the Treasury term structure (difference between 30-year and 3-month Treasury bill yield)
Collin-Dugresene et al (2001)	-0.211	Bonds with >55% leverage and time to maturity exceeding 12 years	• Change in firm leverage ratio • Change in yield on 10-year Treasury • Squared change in yield on 10-year Treasury • Change in 10-year minus 2-year Treasury yields • Change in implied volatility of S&P 500 • Return on S&P 500 • Change in slope of Volatility Smirk
Huang and Kong (2003)	-22.4 (bp)	BBB-A bonds with maturities exceeding 15 years	• Changes in yield of Merrill Lynch Treasury Master Index • Changes in yield of Merrill Lynch 15+ years Treasury Index minus yield of Merrill Lynch 1-3-year Treasury Index • Changes in historical volatility of Merrill Lynch Treasury Master Index yields
Landschoot (2008)	-0.40	US BBB bonds	• Default risk factors (interest rate and stock market variables) • Liquidity risk factors • Credit cycle • Taxation
Lepone and Wong (2009)	-16.44 (bp)	BBB Australian Corporate bonds	• Changes in the 10 year government bond yield • Changes in the squared value of the 10 year government bond yield • Changes in the yield of 10 year government bonds minus the yield of 3 year government bonds • Changes in the volatility implied by options on 3 year government bond futures • Changes in the leverage ratio of banks and financial institutions • Returns on SPI 200™ Index Futures • Changes in the volatility implied by options on SPI 200™ Index futures • Changes in the dollar value of outstanding corporate bonds • Changes in the total net fund flow to bond mutual funds, standardised by net assets
QTC (2012)	-0.4 (correlation coefficient)		• The correlation between the DRP from the Bloomberg 7-year BBB Fair Value Curve and the 7 year risk-free rate from 2001 onwards

A.1 Longstaff and Schwartz (1995)[40]

91. Longstaff and Schwartz (1995) carried out an empirical study using monthly data from Moody's corporate bond yield indexes, as well as the yields of 10-year and 30-year Treasury bonds. The corporate bonds consisted of utilities, industrials, and railroads, each with credit ratings ranging from Baa to Aaa (except railroads, which did not have any Aaa-rated bonds). Based on this data, credit spreads could then be computed as the difference between the yields of corporate bond and Treasury bonds.

92. In order to determine the impact of interest rates on credit spreads, Longstaff and Schwartz (1995) used a linear regression with the change in credit spread as the dependent variable, while the explanatory variables consisted of the return on the corresponding index and the change in the 30-year Treasury yield.

93. The coefficient of the 30-year Treasury yield was negative for all 11 categories of bonds investigated, ranging from -0.044 for Aaa utilities to -0.823 for Baa railroads. The coefficient for Baa utilities was -0.184, which meant that a 100-basis-point increase in the 30-year Treasury yield led to an 18-basis-point fall in Baa-utility credit spreads. The estimates were statistically significant for 10 of the 11 categories, and generally became more negative for bonds with lower credit ratings.

A.2 Lepone and Wong (2009)[41]

94. Lepone and Wong (2009) carried out an empirical study of the determinants of credit spread changes of Australian corporate bonds, using weekly data during the period 29 June 2003 through 2 March 2007.

95. Data on bond index levels and their corresponding yields were obtained from the Australian Financial Markets Association Services (AFMA), while the yield on the 10-year government bond rate was used as a proxy for the risk-free rate. In addition, similar to Collin-Dufresne et al (2001), the squared value of the 10-year government bond rate was also included to account for non-linear effects.

96. The model had the change in credit spreads as the dependent variable, along with the following explanatory variables:

    a. Changes in the 10-year government bond yield;

    b. Changes in the squared value of the 10-year government bond yield;

40 Longstaff and Schwartz (1995), "Valuing credit derivatives", *Journal of Fixed Income*, 5, pg 6-12.

41 Lepone and Wong (2009), "Determinants of Credit Spread Changes: Evidence from the Australian Bond Market", *Australasian Accounting, Business and Finance Journal*, 3(2).

c. Changes in the yield of 10-year government bonds minus the yield of 3-year government bonds;

d. Changes in the volatility implied by options on 3-year government bond futures;

e. Changes in the leverage ratio of banks and financial institutions;

f. Returns on SPI 200™ Index Futures;

g. Changes in the volatility implied by options on SPI 200™ Index Futures;

h. Changes in the dollar value of outstanding corporate bonds; and

i. Changes in the total net fund flow to bond mutual funds, standardised by net assets.

97. The authors analysed eight different credit spread changes, corresponding to four different credit ratings and four different maturity ranges. Of these, six categories had negative coefficients on both the change in 10-year government bond yield and the change in squared value of the 10-year government bond yield. The remaining two categories corresponded to the BBB credit rating and 5-7 years maturity categories.

98. The BBB credit rating category had a coefficient of -16.44 on the change in 10-year government bond yield, which was significant at the 1% level. Its coefficient on the change in squared government bond yield was 5.02, but this was insignificant even at the 10% level.

99. With the 5-7 years maturity category, the coefficient on the change in government bond yield was 0.53, while the coefficient on the change in squared government bond yield was -15.04. Both coefficients were insignificant.

A.3 Duffee (1998)[42]

100. Duffee carried out a study on the relation between yields on non-callable Treasury bonds and spreads of corporate bond yields over Treasury yields. He did so using a model similar to Longstaff and Schwartz (1995), but distinguished between callable and non-callable corporate bonds.

101. This study was motivated by the observation that higher prices of non-callable Treasury bonds were associated with higher values of call options, and that this relation should also be reflected in the relation between Treasury yields and non-callable corporate bond yields. Specifically, Duffee argued that the relation between

[42] Duffee (1998), "The relation between treasury yields and corporate bond yield spreads", *Journal of Finance*, 53, pg 2225-2241.

Treasury yields and yield spreads of callable corporate bonds should be more negative than the relation between Treasury yields and non-callable corporate bonds.

102. Duffee obtained month-end data for non-callable bonds using the University of Houston's Fixed Income Database for the period January 1985 through March 1995. The data was separated into 48 different time series indexes, consisting of:

- four business-sector categories (all sectors' bonds, industrial-sector bonds, utility-sector bonds, and financial-sector bonds);
- four Moody's rating categories (Aaa, Aa, A, and Baa); and
- three bands of remaining maturities (2-7 years, 7-15 years, and 15-30 years).

103. Duffee's model involved a regression of the monthly change in spreads, with the change in three-month Treasury yields and the change in slope of the Treasury yield (defined as the spread between the 30-year and three-month Treasury yields) as explanatory variables.

104. The model found that an increase in the three-month bill yield was associated with a decline in yield spreads, and that this relation applied to all combinations of maturity and credit rating. The relation was weaker for Aaa-rated bonds and stronger for bonds of lower credit quality. In addition, the relation tended to be stronger for bonds for higher maturities.

105. In particular, the coefficient for short-term Aaa bonds was -0.103, which meant that an increase in the Treasury yield by 10 basis points was associated with a decrease in yield spreads by 1.03 basis points. On the other hand the coefficient for long-term Baa bonds was -0.424, such that the same increase in the Treasury yield resulted in a 4.24 basis points reduction in yield spreads.

106. Duffee did not present the regression results for the callable bonds in his dataset, but stated that the coefficients for indexes containing both callable and non-callable bonds were far more negative than the corresponding coefficients in the regression with non-callable bonds alone. For example, the coefficient for the Aaa Industrials Index was roughly eight times the corresponding estimate for non-callable bonds. This observation was further confirmed with estimates using a different dataset constructed with Lehman Brothers Corporate Bond Indexes.

A.4 Collin-Dugresene, Goldstein and Martin (2001)[43]

107. Collin-Dusgresene et al (2001) examined the determinants of credit spread changes, with the primary conclusion being that the monthly credit spread changes in the corporate bond market were predominantly driven by local supply/demand shocks that were independent of changes in credit risk and other measures of liquidity.

108. While the study did not focus specifically on the relationship between credit spreads and the risk-free rate as proxied by Treasury yields, the model nevertheless concurred with Longstaff and Schwartz (1995) and Duffee (1998) that an increase in the risk-free rate lowered the credit spreads for all bonds.

109. The dataset was obtained from a range of sources:

- **Credit spreads**: Corporate bond data was obtained from Lehman Brothers via the Fixed Income (or Warga) Database. Monthly bond data was obtained from July 1988 to December 1997. The risk-free rate was obtained using Benchmark Treasury rates from Datastream, with the yield curve estimated based on a linear interpolation of rates at 3, 5, 7, 10, and 30 years maturity. The credit spread was then defined as the difference between the yield of bond i and the yield of the Treasury curve at the same maturity.
- **Treasury rate level**: Obtained from Datastream's monthly series of 10-year Benchmark Treasury rates.
- **Slope of the yield curve**: Defined as the difference between Datastream's 10-year and 2-year Benchmark Treasury yields.
- **Firm leverage**: Quarterly data was obtained from COMPUSTAT and linear interpolation was used to estimate monthly debt figures. Firm leverage was calculated according to the formula:

$$Firm\ leverage\ = \frac{Book\ value\ of\ debt}{Market\ value\ of\ equity + Book\ value\ of\ debt}$$

  For robustness, each firm's monthly equity return was also obtained from CRSP and used as an explanatory variable.
- **Volatility**: Since most of the investigated firms did not have publicly traded options, the authors used changes in the VIX index provided by the Chicago Board Options Exchange as a measure of volatility. This index corresponds to a weighted average of eight implied volatilities of near-the-money options on the OEX (S&P 100) index.

43 Collin-Dufresne, Goldstein, and Martin (2001), "The determinants of credit spread changes", *Journal of Finance*, 56(6), pg 2177-2207.

- **Jump magnitudes and probabilities**: Obtained based on changes in the slope of the "smirk" of implied volatilities of options on S&P 500 futures. Options and futures prices were obtained from Bridge using the shortest maturity on the nearby S&P 500 futures contract. The jump magnitude was then calculated from implied volatilities and a linear-quadratic regression.
- **Changes in business climate**: Obtained using monthly S&P 500 returns from CRSP.

110. The model grouped the bonds according to leverage ratios and then regressed the monthly change in credit spreads against the following explanatory variables:

- Change in firm leverage ratio;
- Change in yield on 10-year Treasury bonds;
- Square of the change in yield on 10-year Treasury bonds;
- Change in 10-year minus 2-year Treasury yields;
- Change in implied volatility of S&P 500;
- Return on S&P 500; and
- Change in slope of Volatility Smirk.

111. The coefficient of the change in yield on 10-year Treasury bonds was negative for all leverage groups, and this observation also applied when the data was further separated into bonds with short maturities and bonds with long maturities. In particular, when firm leverage (D/E) is assumed to be above 55% (implies D/(E+D)>35%), the coefficient of the change in Treasury yields is -0.342 for all maturities, -0.414 for short maturities, and -0.211 for long maturities. This implies that a 10 basis points increase in the Treasury yields will result in a reduction of the credit spread by 3.42, 4.14, and 2.11 basis points respectively in the three datasets.

A.5 Huang and Kong (2003)[44]

112. Similar to Collin-Dugresene et al (2001), Huang and Kong (2003) examined the determinants of credit spread changes, but with additional macroeconomic factors as explanatory variables.

113. Specifically, the authors constructed sets of explanatory variables that characterised:

- The realised overall default rate in the U.S. corporate bond market;

44 Huang and Kong (2003), "Explaining credit spread changes: New evidence from option-adjusted bond indexes", *Journal of Derivatives*, Fall 2003, pg 30-44.

- The dynamics of the risk-free interest rate;
- U.S. equity market factors such as return and volatility;
- Liquidity indicators from corporate bond mutual funds; and
- State of the U.S. economy.

114. Unlike other empirical studies that used the three-month or ten-year Treasury yield curve as measures of the general interest rate level, the authors argued that a Treasury yield index was a more appropriate proxy. As such, the Merrill Lynch Treasury Master Index was used as a measure of the general interest rate level, while the difference between the Merrill Lynch 15+ year Treasury index yield and the 1- to 3-year yield was used as a measure of the yield curve slope.

115. The paper carried out regressions at two levels. First, group-level regressions were used to examine the explanatory power of individual sets of variables, separated into variables that captured the realised default rates, interest rates, equity market factors, liquidity indicators, and macroeconomic indicators. These group-level regressions served to identify which sets of explanatory variables had the highest influence on credit spread movements. It was found that interest rate dynamics, equity market returns and volatility, and the general state of the economy had the largest explanatory power.

116. The explanatory variables in the group-level interest rate model were:

    a. Changes in yield of Merrill Lynch Treasury Master Index;

    b. Changes in yield of Merrill Lynch 15+ years Treasury Index minus yield of Merrill Lynch 1-3-year Treasury Index; and

    c. Changes in historical volatility of Merrill Lynch Treasury Master Index yields.

117. The coefficients for the changes in Treasury index yields were negative across all of the credit ratings investigated, and were generally higher for bonds of lower credit rating, with a coefficient of -7.14 for AA-AAA bonds with 1-10-year maturities and -21.92 for BBB-A bonds with 1-10-year maturities. There was no obvious trend for bonds with different maturities in the same credit rating. For example, the coefficients were -14.18 and -22.4 for BBB-A bonds with 10-15-year maturities and >15-year maturities respectively.

118. Alternative model specifications were also tested using:

    - option-implied interest rate volatility instead of the historical volatility of Treasury Indexes; and
    - combined regression specifications.

119. Under these specifications the coefficients were still generally negative but were not as negative as in the previous specifications and were sometimes positive.

A.6 Landschoot (2008)[45]

120. Landschoot (2008) compared the determinants of Euro and US dollar yield spread dynamics using a dataset of bonds identified from the Merrill Lynch Euro and US dollar Corporate Broad Market Indices, with the price data obtained using Bloomberg Generic (BGN) prices. The 3 month Euribor and US Treasury bill rates were used as proxies of the Euro and US dollar default-free rates. In addition, the model also included other explanatory variables that accounted for liquidity risk factors, the credit cycle, and differences in taxation systems.

121. The study concluded that US yield spreads were more sensitive to interest rate variables than Euro yield spreads, which was explained by the fact that financial sector bonds – which were less sensitive to interest rate changes – dominated the Euro sample. In addition, the Euro yield spreads were significantly affected by the level and slope of US interest rates instead of Euro interest rates.

122. The coefficient of the change in US interest rate level was negative for both Euro and US bonds at all credit ratings. Euro and US AA-rated bonds had coefficients of -0.03 and -0.15 respectively, while the corresponding coefficients for A rated bonds were -0.11 and -0.18. For BBB rated bonds, the coefficients were -0.22 and -0.40.

123. Analysing the dataset by sector produced the same observations. For the financial sector, the coefficients of the change in US interest rate level for Euro and US bonds were -0.05 and -0.18 respectively, while the industrial sector had coefficients of -0.19 and -0.18.

A.7 Queensland Treasury Corporation (2012)[46]

124. In its submission into the Productivity Commission's inquiry regarding Electricity Network Regulation, the Queensland Treasury Corporation (QTC) submitted that several interrelationships between WACC parameters needed to be recognised, including a negative relationship between the DRP and the risk-free rate.

125. The QTC further stated that the correlation between the DRP from the Bloomberg 7-year BBB Fair Value Curve and the 7 year risk-free rate was -0.4 based on monthly data from 2001 onwards.[47]

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45 Landschoot (2008), "Determinants of yield spread dynamics: Euro versus US dollar corporate bonds", *Journal of Banking and Finance*, 32, pg 2597-2605.

46 Queensland Treasury Corporation, "QTC Submission to the AEMC Directions Paper on Economic Regulation of Network Service Providers", Attachment 1 – Response to the AEMC Directions Paper, April 2012

47 Ibid, p 4.

Appendix B Implementation of extrapolation methodologies

126. 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.

127. 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.

128. 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 extrapolation methodology[48]

B.1.1 Extrapolation of the RBA curve

129. 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;

[48] 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.

- $Spread_{10}$ is the RBA's estimated spread to swap at the target 10 year tenor;
- $Spread_7$ 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.

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

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

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

Calculate a daily series for $Yield_{10}{}^{RBA\ AER}$ as the daily spread to CGS calculated in step 0 above plus a daily series of interpolated 10 year yields on CGS.

131. Finally, we calculate a daily series for $Spread\ to\ swap_{10}{}^{RBA\ AER}$ as the daily yield series calculated in step 0 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

132. 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.

133. 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:

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*.

Calculating daily spreads to CGS for each target tenor *t* by linearly interpolating between month-end spreads to CGS calculated in step 0 above using equation B.

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

Calculating a daily yield series for each target tenor *t* as the daily spreads to CGS calculated in step 0 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 0 above).

Calculating a daily series of spreads to swap for each target tenor *t* as the daily yield series calculated in 0 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

134. 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 AGN's placeholder 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.

135. This method relies on the RBA publishing $Yield_T{}^{RBA}$, a yield for target tenor T. Where T is 4, 8 or 9 years, $Yield_T{}^{RBA}$ is not published by the RBA. $Yield_{10}{}^{RBA\ AER}$ for T = 4, 8 and 9 is therefore calculated according to the following equations:[49]

$$Yield_4{}^{RBA\ AER} = Yield_3{}^{RBA} + (Swap_4^{BB} - Swap_3^{BB}) + (4 - Tenor_3) * \frac{(Spread_5 - Spread_3)}{(Tenor_5 - Tenor_3)}$$

$$Yield_8{}^{RBA\ AER} = Yield_{10}{}^{RBA} - (Swap_{10}^{BB} - Swap_8^{BB}) + (8 - Tenor_{10}) * \frac{(Spread_{10} - Spread_7)}{(Tenor_{10} - Tenor_7)}$$

$$Yield_9{}^{RBA\ AER} = Yield_{10}{}^{RBA} - (Swap_{10}^{BB} - Swap_9^{BB}) + (9 - Tenor_{10}) * \frac{(Spread_{10} - Spread_7)}{(Tenor_{10} - Tenor_7)}$$

Where:

- $Yield_T{}^{RBA\ AER}$ is the extrapolated yield at the effective T year tenor using the AER methodology;
- $Yield_T{}^{RBA}$ is the RBA's estimated yield at target T year tenor;
- $Swap_T^{BB}$ is the T-year swap rate published by Bloomberg;
- $Tenor_T$ is the effective tenor associated with the RBA's estimated spread to swap at the target T year tenor; and
- $Spread_T$ is the RBA's estimated spread to swap at the target T year tenor.

136. 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*:

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

(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 AGN's 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;

49 This is a slight change in approach to applying the AER's extrapolation methodology historically since my report for JEN (CEG, *Critique of the AER's JGN draft decision on the cost of debt,* April 2015).

- 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;[50]
- $Tenor_T$ 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}.

137. 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:

$$ {Yield_{10}}^{RBA\ AER} - {Yield_T}^{RBA\ AER} $$

138. 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.

139. 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 137 above.

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50 Over AGN's placeholder 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:

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

Where terms are defined as in step 135 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}.

B.1.4 Construction of the BVAL curve

140. 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.

141. 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

142. 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.

143. 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 129, step 130 and step 131 above substituting $Yield_{10}{}^{RBA\ SAPN}$ where $Yield_{10}{}^{RBA\ AER}$ is mentioned.

B.2.2 Extrapolation of the BVAL curve

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

145. 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 AGN's averaging period T is equal to 7;
- $Spread_T$ is the T year spread to swap calculated in step 144 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 144 above; and
  - Regression is applied to estimates at tenors of one year or greater for which the BVAL curve is published.

Appendix C Terms of reference

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28 May 2015

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CEG

TERMS OF REFERENCE

You are engaged by Jones Day on behalf of SA Power Networks (SAPN).

You have written several reports concerning the determination by the AER of the allowed rate of return for debt pursuant to National Electricity Rule 6.5.2 and in that context you have been briefed with the text of the allowed rate of return objective, the National Electricity Objective and Revenue and Pricing Principles. You have previously reviewed the AER's Rate of Return Guidelines and the draft and final determinations issued by the AER since that time.

The AER has stated in several of the above documents that it considers an efficient debt financing practice of the benchmark efficient entity under the previous 'on the day' approach to be that it would:

(a) hold a debt portfolio with staggered maturity dates; and
(b) use swap transactions to hedge interest rate exposure for the duration of a regulatory control period,

(together the "**staggered debt with 100% hedging assumption"**).

Please review the AER's Preliminary Determination for SAPN concerning the allowed rate of return allowance for debt and, in particular note that the Determination has provided for a transition on both the base rate and debt risk margin when moving from the "on the day" method to the "trailing average" method. Please also review the supporting expert reports by Associate Professor Lally and Chairmont consulting. Note also the AER's use of a different extrapolation method in place of that which was proposed by SAPN.

Your views on what constitutes an efficient financing practice are already on record and in particular that you consider that a business would have taken a more sophisticated approach to determining the optimal level of hedging and that you therefore do not subscribe to the 100%

hedging assumption. However, for the purposes of this brief, you are asked to provide your opinion as follows on the basis that the AER's staggered debt with 100% hedging assumption **does apply**:

1. If the business is assumed to be 100% hedged in the manner above would you consider a transition is required on the debt risk margin as proposed by the AER in Option 2 of its Preliminary Determination? Why?
2. Please identify which extrapolation method you consider preferable (a) during SAPN's averaging period; and (b) more generally.
3. Should you conclude that no transition is appropriate for the debt risk margin, please re-calculate the cost of debt for a 20 business day averaging period commencing on 9 February 2015 without a transition for the debt risk margin but otherwise adopting the AER's methodology. *In performing this calculation, please use a 50:50 weighting to each of the RBA and Bloomberg curves as per the AER's Preliminary Determination and apply the extrapolation method you recommend at Point 2. You should identify all the data inputs and their source and set out all the relevant calculations.*
4. Please perform again the calculation referred to at Point 3 but using the debt service provider (i.e. either RBA or Bloomberg) that Chairmont recommends to be preferable at the relevant time that the data points are sourced.
5. Please perform again the calculations referred to at Points 3 and 4 but using the AER extrapolation method (if this differs from the extrapolation method used above).
6. If Lally's NPV principle were used to assess whether a business is under-compensated or over-compensated, please explain whether a debt allowance calculated using Option 2 or Option 3 would under-compensate or over-compensate SAPN (as those Options are described on pages 3-128 and 129 of the Preliminary Determination).

Compliance with the Code of Conduct for Expert Witnesses

Attached as **Annexure 1** is a copy of the Federal Court's Practice Note CM 7, entitled "Expert Witnesses in Proceedings in the Federal Court of Australia", which comprises the guidelines for expert witnesses in the Federal Court of Australia (Expert Witness Guidelines).

Please read and familiarise yourself with the Expert Witness Guidelines, and comply with them at all times over the course of your engagement.

In particular, your report prepared should contain a statement at the beginning of the report to the effect that the author of the report has read, understood and complied with the Expert Witness Guidelines.

Your report must also:

1. contain particulars of the training, study or experience by which the expert has acquired specialised knowledge;

2. identify the questions that the expert has been asked to address;

3. set out separately each of the factual findings or assumptions on which the expert's opinion is based;

4. set out each of the expert's opinions separately from the factual findings or assumptions;

5. set out the reasons for each of the expert's opinions; and

6. otherwise comply with the Expert Witness Guidelines.

The expert is also required to state that each of the expert's opinions is wholly or substantially based on the expert's specialised knowledge.

The declaration contained within the report should be that "[the expert] has made all the inquiries that [the expert] believes are desirable and appropriate and that no matters of significance that [the expert] regards as relevant have, to [the expert's] knowledge, been withheld from the report".

Please also attach a copy of these terms of reference to the report.

Kind regards

Nicolas Taylor

Nicolas Taylor

Partner

Annexure 1

FEDERAL COURT OF AUSTRALIA
Practice Note CM 7
EXPERT WITNESSES IN PROCEEDINGS IN THE FEDERAL COURT OF AUSTRALIA

Practice Note CM 7 issued on 1 August 2011 is revoked with effect from midnight on 3 June 2013 and the following Practice Note is substituted.

Commencement

1. This Practice Note commences on 4 June 2013.

Introduction

2. Rule 23.12 of the Federal Court Rules 2011 requires a party to give a copy of the following guidelines to any witness they propose to retain for the purpose of preparing a report or giving evidence in a proceeding as to an opinion held by the witness that is wholly or substantially based on the specialised knowledge of the witness (see **Part 3.3 - Opinion** of the Evidence Act 1995 (Cth)).

3. The guidelines are not intended to address all aspects of an expert witness's duties, but are intended to facilitate the admission of opinion evidence[1], and to assist experts to understand in general terms what the Court expects of them. Additionally, it is hoped that the guidelines will assist individual expert witnesses to avoid the criticism that is sometimes made (whether rightly or wrongly) that expert witnesses lack objectivity, or have coloured their evidence in favour of the party calling them.

Guidelines

1. General Duty to the Court[2]

1.1 An expert witness has an overriding duty to assist the Court on matters relevant to the expert's area of expertise.

1.2 An expert witness is not an advocate for a party even when giving testimony that is necessarily evaluative rather than inferential.

1.3 An expert witness's paramount duty is to the Court and not to the person retaining the expert.

2. The Form of the Expert's Report[3]

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1 As to the distinction between expert opinion evidence and expert assistance see Evans Deakin Pty Ltd v Sebel Furniture Ltd [2003] FCA 171 per Allsop J at [676].

2 The "*Ikarian Reefer*" (1993) 20 FSR 563 at 565-566.

2.1 An expert's written report must comply with Rule 23.13 and therefore must

(a) be signed by the expert who prepared the report; and

(b) contain an acknowledgement at the beginning of the report that the expert has read, understood and complied with the Practice Note; and

(c) contain particulars of the training, study or experience by which the expert has acquired specialised knowledge; and

(d) identify the questions that the expert was asked to address; and

(e) set out separately each of the factual findings or assumptions on which the expert's opinion is based; and

(f) set out separately from the factual findings or assumptions each of the expert's opinions; and

(g) set out the reasons for each of the expert's opinions; and

(ga) contain an acknowledgment that the expert's opinions are based wholly or substantially on the specialised knowledge mentioned in paragraph (c) above[4]; and

(h) comply with the Practice Note.

2.2 At the end of the report the expert should declare that "[the expert] has made all the inquiries that [the expert] believes are desirable and appropriate and that no matters of significance that [the expert] regards as relevant have, to [the expert's] knowledge, been withheld from the Court."

2.3 There should be included in or attached to the report the documents and other materials that the expert has been instructed to consider.

2.4 If, after exchange of reports or at any other stage, an expert witness changes the expert's opinion, having read another expert's report or for any other reason, the change should be communicated as soon as practicable (through the party's lawyers) to each party to whom the expert witness's report has been provided and, when appropriate, to the Court[5].

2.5 If an expert's opinion is not fully researched because the expert considers that insufficient data are available, or for any other reason, this must be stated with an indication that the opinion is no more than a provisional one. Where an expert witness who has prepared a report believes that it may be incomplete or inaccurate without some qualification, that qualification must be stated in the report.

2.6 The expert should make it clear if a particular question or issue falls outside the relevant field of expertise.

2.7 Where an expert's report refers to photographs, plans, calculations, analyses, measurements, survey reports or other extrinsic matter, these must be provided to the opposite party at the same time as the exchange of reports[6].

(continued…)

3 Rule 23.13.

4 See also *Dasreef Pty Limited v Nawaf Hawchar* [2011] HCA 21.

5 The "Ikarian Reefer" [1993] 20 FSR 563 at 565

6 The "Ikarian Reefer" [1993] 20 FSR 563 at 565-566. See also Ormrod "Scientific Evidence in Court" [1968] Crim LR 240

3. Experts' Conference

3.1 If experts retained by the parties meet at the direction of the Court, it would be improper for an expert to be given, or to accept, instructions not to reach agreement. If, at a meeting directed by the Court, the experts cannot reach agreement about matters of expert opinion, they should specify their reasons for being unable to do so.

J L B ALLSOP
Chief Justice
4 June 2013