COMPETITION ECONOMISTS GROUP

Mechanistic cost of debt extrapolation from 7 to 10 years

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1 Introduction

1. The ENA has asked CEG to respond to the Australian Energy Regulator's (AER's) analysis of the difficulties associated with mechanistically updating an estimate of the extrapolation from 7 to 10 years of the Bloomberg BBB fair value curve.

2. The National Electricity Rules require the AER to estimate an allowance for the return on debt for a regulatory year to be estimated such that it contributes to the achievement of the allowed rate of return objective. The allowed rate of return objective requires that:

> *The allowed rate of return objective is that the rate of return for a Distribution Network Service Provider is to be commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk as that which applies to the Distribution Network Service*

3. The AER is proposing the use of the Bloomberg BBB fair value curve (FVC) to estimate the cost of debt and this curve is currently only published up to a 7 year maturity. Consequently, adopting a benchmark term of greater than 7 years would require specification of a mechanistic way of extrapolating the Bloomberg BBB FVC beyond 7 years.[1]

4. The AER concludes that mechanistic extrapolation from 7 to 10 years is problematic. This conclusion feeds into the AER's justification for proposing a 7 year term for the cost of debt estimation. Specifically, the AER cites difficulty in mechanistically updating the extrapolation method during a business's 5 year regulatory period as an obstacle to adopting a 10 year term for the cost of debt. It is a conclusion of this report that no such obstacle exists.

[1] See pages 107 to 109 of the Draft Explanatory Statement.

2 AER approach

5. The Draft Explanatory Statement considers and rejects three mechanistic approaches to extrapolating the Bloomberg BBB fair value curve from 7 to 10 years (including bond pair analysis).[2] These are rejected as being either too inaccurate or too hard to specify in full to ensure mechanistic application in all possible future circumstances.

6. Notably, the AER does not perform a relative assessment of these approaches versus an approach that simply applies zero extrapolation (does nothing). It is correct of the AER to note that any extrapolation approach may be less than perfectly accurate. However, the relevant question is not whether some inaccuracy may creep into extrapolation methods. The relevant question is whether the AER's proposed method (which is not to apply any extrapolation) results in a more accurate cost of debt estimate than other methods that do apply extrapolation - even if these alternatives may be imperfect in some conceivable circumstances.

7. It is important to note that in this section[3] of the Draft Explanatory Statement the AER's analysis proceeds 'as if' an estimate of the 10 year cost of debt is the ideal but practical problems of extrapolation place obstacles in the way of implementing this ideal. In the immediately following section of the Draft Explanatory Statement, the AER argues that the difference between the 10 and 7 year cost of debt is not, on average, material.[4]

> *The AER has calculated the average difference in the yield between the 10 year and the seven year Bloomberg BBB fair value curve for all currently available data. From December 2001 to October 2007 the average difference in yield is 21 basis points. PwC estimated a 7.6 basis points annual increment using the paired bond approach over the 20 day period ending on 16 December 2011.*
>
> *We consider that the debt term is likely to be less than 10 years, that there is a practical difficulty in automating annual updates and that the term premium difference is small. In light of these points, the AER considers that a debt term of seven years should be adopted.*

8. In this quote the AER does not state that it believes the debt term is 7 years – only that it is likely to be less than 10 years. The question of whether a mechanical extrapolation methodology can be specified (and whether it would give a materially

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2 Ibid.

3 The section beginning at the bottom of page 107 of the Draft Explanatory Statement. entitled "Reliability regarding the automatic updating of the trailing average portfolio return on debt".

4 See pages 107 to 109 of the Draft Explanatory Statement.

different result) only arises if one believes that a benchmark term in excess of 7 years would, but for any difficulties in extrapolation, be appropriate. It follows that, at least in the discussion of the alleged difficulty of mechanical extrapolation, the Draft Explanatory Statement is presuming that, but for this difficulty, a term in excess of 7 year would be appropriate.

9. The AER's solution to the alleged problem is simply to adopt a 7 year term. This is, in effect, the adoption of an assumption that the term premium in the cost of debt is zero beyond 7 years. Or, more precisely, that, notwithstanding the fact that the efficient debt financing strategy is associated with a benchmark debt term in excess of 7 years, a term of 7 years should be set because:

   - mechanistic annual updating of the term premium between 7 and 10 years is difficult; and
   - the term premium between 7 and 10 years is not material.

3 Simple, mechanistic extrapolation

10. In order to derive a 10 year BBB+ cost of debt from a 7 year BBB+ cost of debt it is necessary to extrapolate both the risk free rate and the debt risk premium (DRP) from 7 years to 10 years. This is described mathematically in the formula below (where the symbol "Δ" signifies a change in the variable).

$$\Delta yield\ 7\ to\ 10\ years = \Delta riskfree\ rate\ 7\ to\ 10\ years + \Delta DRP\ 7\ to\ 10\ years$$

11. Equivalently, one can express the 10 year cost of debt in term of the 7 year cost of debt (7 yr Rd) as follows:

$$10\ yr\ Rd = 7\ yr\ Rd + (10\ yr\ RFR - 7\ yr\ RFR) + (10\ yr\ DRP - 7\ yr\ DRP) \quad (1)$$

12. As this formula makes clear, the extrapolation of the 7 year cost of debt to the ten year cost of debt is comprised of the sum of:

- Extrapolation of the risk free rate *(10 yr RFR-7 yr RFR)*; and
- Extrapolation of the DRP *(10 yr DRP- 7 yr DRP)*.

13. The following two sections deal with the question of whether there is a better way of mechanically extrapolating the risk free rate and the DRP than simply assume zero extrapolation.

3.1 Mechanistic extrapolation of the risk free component of the cost of debt

14. Clearly, the risk free component of the extrapolation can be mechanistically estimated and updated. This is simply the difference between the yield on 10 and 7 year CGS. The information necessary to estimate this is published daily by the Reserve Bank of Australia and there is no controversy about how this can be used to derive an interpolated yield at both 7 and 10 years.

15. Of course, this would not sufficiently compensate for efficient financing costs because it would not account for the additional term premium in the DRP. However, as illustrated below, simply accounting for the risk free rate extrapolation between 7 and 10 years is more accurate than assuming a zero extrapolation of both the risk free rate and the DRP (the AER's proposal).

16. Therefore, it is demonstrably wrong to assume a 7 year cost of debt is the best estimate of the 10 year cost of debt. A better estimate of the 10 year cost of debt is the seven year cost of debt (as published by Bloomberg) plus the difference between the 10 and 7 year CGS yield. This is still not 'the best' estimate of extrapolation (because it ignores extrapolation in the DRP) but it is a 'better' estimate of extrapolation than the AER's proposed zero extrapolation.

17. In order to demonstrate this we sourced historical yields on CGS from the RBA website, interpolated between these to create a time series of 7 and 10 year CGS yields, annualised all yields and subtracted the 7 year values from the 10 year values.[5] This gives us a time series for the risk free component of the extrapolation which is presented in Figure 1 below.

3.1.1 Comparison with benchmark

18. In order to assess the relative accuracy of assuming zero extrapolation overall versus purely accounting for the CGS (risk free) component of extrapolation we require a benchmark against which to compare the two approaches.

19. In order to do this we have derived several historical benchmarks and compared the approaches to the benchmark through time. The following dot points specify precisely the nature of the construction of these benchmarks:

    - When available, the 10 year Bloomberg BBB FVC was used. The green series in Figure 1 shows the difference between 7 and 10 year Bloomberg BBB FVC, when available, up until October 2007, when Bloomberg last stopped publishing a 10 year BBB FVC;
    - During the periods 15/3/2002-10/6/2003, 21/10/2004-9/11/2005 and 10/10/2007-22/6/2010, the Bloomberg BBB FVC was not published at 10 years. Instead, the benchmark extrapolation was calculated using the shape of a higher rated Bloomberg fair value curve.[6] The blue series in Figure 1 shows these values during these periods;
    - Bloomberg stopped publishing the last of its fair value curves (the AAA FVC) to 10 years in June 2010. During the period 23/6/2010-30/12/2011, AER precedent for extrapolation was to calculate the 10 year cost of debt as the 7 year cost of debt plus the yield on 10 year CGS less the yield on 7 year CGS (difference in risk free rates) plus an additional term premium in the DRP of 0.44 (based on the difference between the CGS extrapolation and Bloomberg AAA FVC extrapolation during the 20 days leading up to 22/6/2010). The blue series in Figure 1 shows these values during this period;

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5 www.rba.gov.au/statistics/tables/xls/f16.xls

6 In all periods the fair value curve closest to the Bloomberg BBB fair value curve was used with the exception of the period from the 17th of March 2009 to the 18th of August 2009. This was a period including the worst of the global financial crisis, and he Bloomberg A fair value curve was discontinued on the 18th of August 2009. Between March and August 2009 using the A curve to extrapolate resulted in erratic estimates – many of which were negative even though CGS yields in that period implied strongly positive risk free extrapolation (as did the Bloomberg AAA fair value curve). For this short period the Bloomberg AAA fair value curve was used (as was the case after the A fair value curve was discontinued).

- From the beginning of 2012, the additional DRP term premium of 0.44 was replaced with 0.23, based on PWC's DRP extrapolation method (for the 20 day period ending 16 December 2011).[7] In our August 2013 bond pair analysis,[8] we estimated a DRP extrapolation result of 30.4. In this report we have assumed a constant premium of 0.23 for 2012 and beyond (which is conservative compared to our own August 2013 result). The blue series in Figure 1 shows these values during this period;

Figure 1 : 7 to 10 year extrapolation approaches

Source: Bloomberg, RBA, CEG analysis

20. An important conclusion from the above graph is that at times, including most recently, the magnitude of extrapolation between 7 and 10 years is highly material

7 PwC, *SP AusNet, Multinet Gas, Envestra, and APA Group: Estimating the benchmark debt risk premium*, March 2012, p. v.

8 See p. 16 of Victorian Electricity Distribution Businesses , Submission on the rate of return to apply to the charges revision applications of Advanced Metering Infrastructure, August 2013, available online at <http://www.aer.gov.au/sites/default/files/DNSPs%27%20Joint%20WACC%20submission%20for%20AMI%20-%2030%20August%202013.PDF>

and has averaged 54bp since 23 June 2010. This is in contrast to the AER's conclusion that the impact of extrapolation is not likely to be material.

21. While the AER's zero extrapolation approach is simple and capable of being mechanistically updated, it is not accurate. Simply accounting for extrapolation using CGS yields is more accurate than the AER's proposed zero extrapolation assumption. Moreover, it is as simple (or trivially more complicated) and can be mechanistically applied throughout the regulatory period.

22. Applying the proposed CGS extrapolation approach would have been more accurate than applying zero extrapolation between December 2001 and 2013 and within each sub period examined. Table 1 shows the average errors of the CGS extrapolation and the AER's zero extrapolation approach. In each case the error is equal to the 10 year cost of debt estimated using CGS/zero extrapolation less the benchmark 10 year cost of debt as described at paragraph 19. Each row of the Table 1 corresponds to a different period:

    - The first row corresponds to periods when Bloomberg published a 10 year BBB FVC (4/12/2001-14/3/2002, 11/6/2003-20/10/2004, 10/11/2005-9/10/2007);
    - The second row corresponds to periods when Bloomberg did not publish a 10 year BBB FVC but when extrapolation using the a higher rated contemporaneous Bloomberg FVCs was used (15/03/2002-10/6/2003, 21/10/2004-9/11/2005, 10/10/2007-22/6/2010);
    - The third row corresponds to periods when the AER calculated the extrapolation from the CGS curve plus an additional term premium in the DRP based on either the most recently published shape of the AAA curve or, more recently, paired bond analysis (23/06/2010-20/09/2013); and
    - The fourth row corresponds to the whole period (4/12/2001-20/09/2013).

23. Zero extrapolation consistently had higher average errors than the CGS extrapolation.

Table 1 Errors of mechanistic approaches

	Average error from past AER approaches (bp)	
Past AER extrapolation approach	**CGS approach**	**Zero extrapolation**
Bloomberg BBB FVC	-7.42	-9.56
Higher rated Bloomberg FVC	-17.13	-27.26
CGS plus a premium (23/6/2010-2013)	-32.93	-53.70
All (December 2001-2013)	-18.35	-28.99

Source: Bloomberg, RBA, CEG analysis

24. Over the entire period, and within each sub-period, the CGS extrapolation significantly underestimated the benchmark but by less than the zero extrapolation did.

25. In summary, there is no obstacle to adopting a mechanistically updated 10 year cost of debt estimate applying an extrapolation approach based on the CGS yield curve. CGS yields are published daily by a reputable source (the RBA) and this extrapolation provides a more accurate estimate than assuming zero extrapolation. This means that any suggestion that the best estimate of mechanistically updated 10 year cost of debt is the 7 year Bloomberg FVC cost of debt is simply wrong. This estimate can be improved on by mechanistically adding the CGS extrapolation.

26. However, it is also true that CGS extrapolation tends to underestimate the 10 year cost of debt – albeit by less than an assumption of zero extrapolation. This is because CGS extrapolation only captures the term premium in the risk free rate between 7 and 10 years. It does not capture the term premium in DRP.

3.2 Mechanistic extrapolation of the DRP component of the cost of debt

27. In addition to assuming a zero risk free extrapolation the AER proposes a zero extrapolation of the DRP. The AER argues that this approach is simple to implement (which is correct). However, ultimately, what is required is an estimate of efficient financing costs and this must include an estimate of the DRP term premium between 7 and 10 years – even if it is not simple to estimate. Moroever the AER gives limited consideration to whether there are any equally simple but more accurate approaches than providing zero compensation for the term premium in the DRP.

28. CEG has most recently, in August 2013, estimated the extrapolation in the DRP between 7 and 10 years at 30.4bp. [9] Similarly, as shown in Table 1, since June 2010, CGS extrapolation has underestimated the benchmark extrapolation by 33bp. Clearly, if one were constrained to assume a constant extrapolation in the DRP then clearly, based on the historical record, the best estimate would not be a zero extrapolation. Rather an estimate of around 30bp would be a better estimate based recent estimates and the historical average since mid 2010. It must be noted that the Rules require the AER to estimate an allowance for the return on debt for a regulatory year to be estimated such that it contributes to the achievement of the allowed rate of return objective. The benchmark cost of debt includes both a risk free component and a risk premium component. Both of these must be estimated to the benchmark term. This means that if the benchmark term is 10 years then both the risk free rate and the DRP need to be extrapolated to 10 years.

29. Put simply, if the Guidelines were to specify a fixed DRP extrapolation then the best estimate would not be zero extrapolation (as is implicit in the Draft Guidelines'

[9] See p. 16 of Victorian Electricity Distribution Businesses , Submission on the rate of return to apply to the charges revision applications of Advanced Metering Infrastructure, August 2013, available online at <http://www.aer.gov.au/sites/default/files/DNSPs%27%20Joint%20WACC%20submission%20for%20AMI%20-%2030%20August%202013.PDF>

adoption of a 7 year term). The best estimate would be a current or recent average estimate of the DRP extrapolation from 7 to 10 years.

30. Moreover, there is no need for the Draft Guidelines to specify a number. The Draft Guidelines could simply specify that an extrapolation be estimated at the beginning of each regulatory period (call this value "X" bp) and that the value estimated be held constant over each year of the regulatory period. Combining this with a contemporaneous CGS extrapolation would mean that the cost of debt in each year of the regulatory period would be set equal to:

$$10\ yr\ Rd = 7\ yr\ Rd + (10\ yr\ CGS - 7\ yr\ CGS) + (10\ yr\ DRP - 7\ yr\ DRP) \quad (1)$$

$$10\ yr\ Rd = 7\ yr\ Rd + (10\ yr\ CGS - 7\ yr\ CGS) + X \quad (2)$$

31. The value of "X" at the beginning of the regulatory period could be arrived at in a number of ways including:

- The AER's current method of applying a paired bond analysis;
- Estimation of the shape of the fair value curve beyond 7 years using Nelson Siegel type regression analysis; or
- Reference to foreign fair value curves.

32. Alternatively, variations in the DRP extrapolation from year to year during a regulatory period could be mechanistically estimated in a number of ways. For example, the QTC has provided an historical analysis that suggests the 10 year DRP measured relative to the swap curve[10] is reliably:

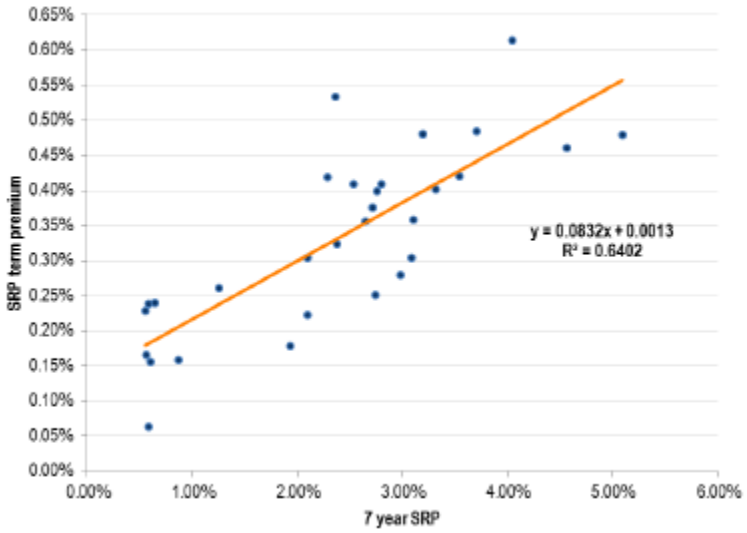
DRP extrapolation = 13bp + 0.083(the 7 yr Rd – 7 yr Swap)* [11]

33. Figure 4 from the QTC submission (reproduced below) shows the fit of this regression.

[10] The 10 year cost of debt less the 10 year swap rate.

[11] See equation 1 of Attachment A to the QTC submission on the Draft Guidelines: *An alternative extrapolation method to estimate the 10-year BBB+ corporate yield.*

FIGURE 4: 7-YEAR SRP VS. SRP TERM PREMIUM BETWEEN 7 AND 10 YEARS



34. Each of the parameters in this formula (the fixed term of 13bp and the variable coefficient of 0.083) is known in advance because they have been estimated from regressions of historical time series. The 7 year DRP can be mechanistically observed based on the Bloomberg BBB FVC less the AFMA 7 year swap value (both published daily). Consequently, this method can provide a mechanistic update of the 10 year cost of debt inclusive of a term premium in the DRP between 7 and 10 years.

35. Moreover, the QTC has tested the accuracy of this estimate relative to the AER's current practice of applying a paired bonds analysis and have found an average difference of just 1bp over five different averaging periods.[12] Similarly, this approach is currently estimating a very similar DRP extrapolation to CEG's estimate of 30.4bp using the paired bond analysis in August 2013. [13] Similarly, the QTC approach applied to regulatory averaging periods since April 2010 has come very close (but always slightly underestimated) the extrapolation adopted by the AER.[14] Only in the rather unusual circumstances of January and February 2009, in the worst of the global financial crisis did the QTC method overestimate the DRP extrapolation arrived at by the AER by more than 16bp. [15] This was for ActewAGL's averaging period from 2 to 27 February 2009 and the level of overestimation was 38bp. However, it must be noted that measurement in financial markets in this period was

12 Ibid, see Table 2.

13 See Figure 6, ibind. See alsop. 16 of Victorian Electricity Distribution Businesses, Submission on the rate of return to apply to the charges revision applications of Advanced Metering Infrastructure, August 2013.

14 Ibid, see Tables 3 and 4.

15 Ibid, see Tables 5.

extremely difficult and it is plausible that much, if not all, of this overestimate is due to the AER's estimate being too low rather than QTC's estimate being too high.

4 Conclusion

36. The Rules require the AER to estimate an allowance for the return on debt for a regulatory year to be estimated such that it contributes to the achievement of the allowed rate of return objective. In our view the evidence (including from Australian network service providers) overwhelmingly supports a term of issuance of at least 10 years. The task of the AER is, therefore, to estimate the benchmark cost of debt with a 10 year term to maturity. This requires estimating the risk free rate and the DRP at 10 years.

37. An important conclusion of the analysis in this report is that, generally, including most recently, the magnitude of extrapolation between 7 and 10 years is highly material.

38. A zero extrapolation has, applied to historical data, resulted in a material underestimate of the benchmark extrapolation. There are clearly superior methodologies for estimating the appropriate extrapolation between 7 and 10 years that, applied to current and historical data, give rise to more accurate estimates of the 10 year cost of debt than applying a zero extrapolation. Moreover, these methods of extrapolation are capable of mechanistic updating during a business's regulatory period.

39. The AER is wrong to argue that difficulties in extrapolation make the adoption of a 7 year term necessary. Clearly extrapolating using the CGS curve is mechanistically possible and better than 'no extrapolation'. Similarly, more accurate and equally mechanistic extrapolations of the DRP exist than simply assuming zero extrapolation (such as assuming a constant extrapolation).

40. This DRP extrapolation need not be performed using purely contemporaneous information during each business's averaging period (as was the case for the approaches considered and rejected by the AER in the Draft Explanatory Statement). Rather, any of the approaches discussed in the previous section, including the QTC proposal, could be adopted. This would be more accurate than applying zero extrapolation (or just CGS extrapolation) and would be perfectly mechanistic in nature – with no need to exercise any judgement nor any risk of additional data necessary for the extrapolation not being available.

41. The Guidelines should state that extrapolation of the 7 year cost of debt to the 10 year benchmark must include:

    - extrapolation reflecting the contemporaneous CGS extrapolation from 7 to 10 years; and
    - extrapolation of the DRP component of the cost of debt from 7 to 10 years. However, this extrapolation need not be based on purely contemporaneous data during each annual averaging period. Rather, it could be based on a fixed

amount, or a fixed formula (QTC proposal), agreed at the beginning of the regulatory period.

42. The Guidelines could specify a specific form(s) of mechanistic extrapolation of the DRP component – such as the QTC proposal, a paired bond analysis or Nelson Siegel estimate performed in an averaging period immediately prior to the beginning of the regulatory period. However, the actual mechanistic DRP extrapolation approach proposed by businesses/adopted by the AER must, consistent with the Rate of Return Objective, be expected to give rise to the most accurate extrapolation of the Bloomberg DRP from 7 to 10 years.