COMPETITION
ECONOMISTS
GROUP

Estimating the debt risk premium

June 2013

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1 Introduction

1. My name is Tom Hird, and I have a Ph.D. in Economics from Monash University and over 20 years' experience as a professional economist. My curriculum vitae is attached at Appendix E to this report.

2. I have been asked by the ENA to assess indicators of the debt risk premium (DRP) for benchmark 10 year corporate bonds rated BBB+ by Standard & Poor's, consistent with the current benchmark used by the Australian Energy Regulator (AER).

3. Specifically, I have been asked to consider:

   - whether the extrapolated Bloomberg BBB fair value curve remains a reasonable basis for estimating DRP on the benchmark 10 year BBB+ bond, and what method of extrapolation is suggested by current market data;
   - what robust alternatives exist to relying on Bloomberg BBB fair value curves and what outcomes are produced by relying on these; and
   - whether methodologies proposed in recent years by the Western Australian Economic Regulation Authority (ERA) or the New South Wales Independent Pricing and Regulatory Tribunal (IPART) represent a robust basis for estimating this benchmark; and

4. In this report I have estimated the cost of debt based on a 10 year benchmark bond and calculated the DRP in comparison to the yield on 10 year Commonwealth Government securities (CGS).[1]

5. In my opinion the extrapolated Bloomberg BBB fair value curve remains a reasonable basis with which to estimate a 10 year cost of debt for BBB+ rated bonds.

6. I consider that there are important benefits inherent in using a benchmark that is external to the process of regulation. These benefits underpinned previous use by regulators of Bloomberg and CBASpectrum fair value estimates and in my opinion is no less relevant now that there is a only a single fair value alternative.

7. I also note that in the absence of a 10 year BBB fair value estimate, there is a wide variety of market data available with which to estimate a reasonable extrapolation from 7 to 10 years. This is not a significant source of uncertainty and does not undermine reliance upon Bloomberg's fair value estimates. Alternative extrapolation approaches (bond pairing analysis and extrapolation based on differences implied by the curve fitting methods presented in this report) estimate a

[1] My accompanying report on debt strategies sets out why the use of a 10 year benchmark is appropriate. See CEG, *Debt strategies for utility businesses*, June 2013.

DRP at a 10 year maturity in the relatively tight range of 2.88% to 3.07% for the month of February 2013.

8. Reliance on the Bloomberg BBB fair value curve is supported by a broad selection of bond yield observations. The curve fitting techniques performed upon these data in this report produce results at a 10 year maturity that are very similar to the extrapolated Bloomberg BBB fair value curve. The BBB+ 10 year DRP estimate based on the widest sample of bonds - which includes BBB to A- bonds issued in Australia in any currency or in Australian dollars in any country - is 2.98%. The equivalent estimate for Australian dollar bonds issued in Australia only is 3.07%, just 9 basis points higher.

9. Finally I note that methodologies proposed by the ERA and IPART produce DRP estimates which are below the Bloomberg BBB fair value curve, sometimes substantially so. However, these methodologies are not fit for purpose. I demonstrate in chapter 5 that they are not capable of reliably and accurately estimating a DRP for a given term and credit rating. Only curve fitting techniques such as that used by Bloomberg or the alternatives applied within this report are capable of doing so.

10. The remainder of this report is set out as follows:

- **Section 2** sets out my general views on the use of Bloomberg's fair value curve and provides relevant background on its use in regulatory decisions over time;
- **Section 3** examines the population of relevant bond yields. I compare these to the Bloomberg BBB fair value curve and use them to empirically estimate alternative yield curves for BBB+ rated debt. I also look at Bloomberg's fair value curves from foreign jurisdictions and how these compare to the Australian BBB curve;
- **Section 4** assesses the evidence available to inform extrapolation of the Bloomberg fair value curve. I examine bond pairing analysis and the results of curve fitting as sources of information; and
- **Section 5** sets out the DRP methodologies currently used by the AER, ERA and IPART and applies these methodologies to February 2013. I also critique the methodologies proposed by the ERA and IPART.

11. 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. I have been provided with a copy of the Federal Court of Australia's *Guidelines for Expert Witnesses in Proceeding in the Federal Court of Australia*, and confirm that this report has been prepared in accordance with those Guidelines.

12. I have been assisted in the preparation of this report by Daniel Young, Johanna Hansson and Annabel Wilton in CEG's Sydney office. However the opinions set out in this report are my own.

Thomas Nicholas Hird

26 June 2013

2 Bloomberg fair value curve

13. I consider that there are significant advantages to relying on an independent expert opinion, such as that of Bloomberg, when setting the DRP. This does not mean that the Bloomberg BBB fair value curve should be accepted uncritically. Rather, if it can be shown to provide a robust fit to observed yields on BBB+ or similarly rated bonds, I consider that to use a different then this is likely to be superior to imposing an estimate that is formulated without an in depth understanding of all of the available information would introduce the significant potential for additional and unpredictable divergence between the regulated allowance for debt and the market costs of debt faced by businesses in reality.

2.1 Benefits of relying upon Bloomberg

14. The Bloomberg BBB fair value curve is built for and commercially provided to debt market participants who pay to use it for commercial purposes. In deriving its fair value curves Bloomberg has a great deal of information available to it - including estimates of market prices of many hundreds of bonds across a range of credit ratings and maturities (including but, again, not limited to the BBB to A- rated bonds analysed in this report).

15. Bloomberg's fair value curves are independent of market participants and there is not obvious incentive for it to bias its estimates up or down. On the other hand, in order for Bloomberg to have a saleable product, it is to be expected that it would protect the confidentiality of its methodology and input data. It is therefore not surprising that it is not possible to observe directly Bloomberg's methodology.

16. Given the above, setting out to produce an alternative estimate to one based on the Bloomberg fair value estimates is a fraught exercise. This is particularly so in the absence of compelling evidence suggesting that the measurement of the DRP based on the Bloomberg curve is unreasonable.

17. It must also be kept in mind that many of the bond yield observations that we and regulators work from are not bond yields based on actual trades but are estimates of bond yields if the bonds were to trade. Some estimates will be better than others depending on factors such as when the most recent trade took place in that bond (or in other of the issuers' bonds) and the extent to which comparable bonds have recently traded. Moreover, some bond yield estimates may be more reliable than others. For example, a UBS yield estimate might be more reliable for a particular bond than an ABNAmro yield estimate because UBS trades in those bonds more frequently (or vice versa).

18. Properly synthesising debt market information is a difficult and complex task. Bloomberg has access to a large amount of information which can be applied to the

task of assessing the quality of the data that is actually employed in the construction of fair value curves.

2.2 Disadvantages of relying upon Bloomberg

19. Although I consider that reliance upon the Bloomberg BBB fair value curve has many important benefits, there are also some disadvantages associated with this reliance.

20. Bloomberg's fair value estimates are opaque and non-replicable. To my knowledge, Bloomberg has never publicised the precise basis upon which it selects the data to be included in its fair value curves and has also not described how it constructs its curves. I have seen some high level descriptions of principles that are applied but this is not sufficient for replication.

21. This lack of transparency can be a particular issue when the yields estimated by the fair value curve do not appear to be consistent with other observed market data. As I state above, this is an important reason why the Bloomberg BBB fair value curve must not be accepted uncritically, or without regard to how it compares to observed bond yield data.

22. I also note that Bloomberg's BBB fair value curve does not include an estimate at a 10 year maturity. This raises a level of uncertainty as to how to appropriately extrapolate the 7 year maturity DRP to 10 years. However, as I conclude in section 4, the use of alternative extrapolation methodologies does not give rise to significant uncertainty in the 10 year estimate due to the existence of market data to inform it. By comparison, the application of alternative methodologies to estimate the 10 year DRP gives rise to much greater variability in the final result.

2.3 Alternatives to reliance on Bloomberg

23. In section 5 of this report I consider methodologies used by the ERA and IPART to estimated DRP instead of reliance on the Bloomberg BBB fair value curve. In my view, the methodologies used by these regulators cannot be reasonably relied upon as an alternative to the Bloomberg BBB fair value curve. These methods are not sophisticated enough to estimate a DRP accurately and reliably for a given term and credit rating.

24. However, I consider that the curve fitting analysis set out at section 3.2.2 of this report provides greater potential than these methodologies as an alternative to reliance on the Bloomberg fair value curve. The yield curves derived using the methods described in this report are fit for purpose. Based on analysis over February 2013, this methodology produces results for 10 year BBB+ rated debt that are consistent with the range of extrapolated Bloomberg BBB fair value yields.

25. On this basis I do not consider that analysis of bond yields at the current time suggests a need to consider alternatives to reliance on the extrapolated Bloomberg BBB fair value curve to estimate the benchmark DRP.

3 Analysis of debt risk premium

26. In this section, I analyse observed yields on bonds issued in Australia and overseas:

- to assess the reasonableness of the Bloomberg BBB fair value curve; and
- to implement Nelson-Siegel curve-fitting techniques to estimate a benchmark DRP for BBB+ rated bonds at 10 years maturity.

27. I find that the observed yield data support the level and shape of the Bloomberg BBB fair value curve. I examine a number of alternative criteria for defining which bond yield data to use. Most of these alternatives suggest that the level of the Bloomberg BBB fair value curve is reasonable at its longest maturity of 7 years.

28. Application of Nelson-Siegel yield curve fitting techniques to the same data finds results that are strongly supportive of the Bloomberg BBB fair value curve. The Nelson-Siegel approach is discussed in more detail in Appendix A. Most BBB+ rated 10 year DRP estimates produced by applying this methodology to larger samples of input bond yield data lie at or about the DRP level estimated by the extrapolated Bloomberg BBB fair value curve.

29. However, particular criteria applied to the selection of bond yields are capable of producing fitted results that are significantly lower at 10 years than the extrapolated Bloomberg BBB fair value curve. I note that these estimates generally coincide with very small sample sizes and consequently I do not consider that great weight should be attached to these results as they are unlikely to be reliable.

3.1 Identifying a bond yield population

30. The total bond population used in this analysis includes bonds which are:

- rated BBB to A- by Standard & Poor's; and
- issued by any firm in Australian dollars, or issued by an Australian firm in foreign currency, swapped to Australian dollar yields.

31. Applying these criteria in Bloomberg's bond search function results in a total population of 421 bonds (which were active/current during February 2013). Only 307 of the 421 bonds have yield data available from either Bloomberg or UBS during February 2013, so in effect the analysis in this report is based on a bond population of 307 bonds.

32. The bonds in this total population have myriad different characteristics. For example, the bonds:

- have different ratings from S&P;

- are issued by firms domiciled in several different countries;
- are issued in different currencies;
- are either fixed bonds or floating rate notes;
- can contain embedded options that could influence the yield (such as call options, put options, downgrade options or options to convert to equity); and/or
- have yields from either Bloomberg, UBS, or both sources. Different price sources within Bloomberg may potentially be available.

33. I have estimated yields on floating rate notes from UBS data using trading margins reported by UBS added to swap rates sourced from Bloomberg. I do not rely on UBS swap rates because for a number of bonds UBS appears to report swap rates to the first call date rather than the final maturity date. This issue is discussed in greater detail in my previous reports.[2]

34. In order to assess the impact of different bond characteristics (and source data) on the average DRP, I have systematically analysed the effects of varying five binary options. The five binary options result in 32 unique combinations of characteristics, i.e. 32 different but overlapping samples.

35. The binary options which I consider in this section include:

- rating (BBB+ only vs. BBB to A-);
- type (excluding bonds with optionality features other than make-whole callable vs. all);
- currency (AUD only vs. all[3]);
- country of domicile for issuer (AU only vs. all[4]); and
- data source (Bloomberg only vs. Bloomberg and UBS).

36. While I report the results for all 32 possible samples/sub-samples, I do not believe that they are all of equal relevance. This is partly because the rationale for analysing particular sub-groups is weak and partly because some subsamples simply have too few observations to be reliable.

37. In my view the most relevant samples are ones that:

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2 See for example, CEG, *Estimating the regulatory debt risk premium for Victorian gas businesses*, March 2012, Appendix A.

3 'All' in this context includes bonds issued in a non-AUD currency by Australian domiciled companies.

4 'All' in this context includes bonds issued in AUD by companies domiciled outside Australia.

- include A- and BBB bonds as these bonds provide valuable information used to fit both the shape and placement of the BBB+ curve;
- include bonds issued with optionality features[5] because this is the practice of many Australian companies including regulated utilities;
- include bonds issued by Australian companies in foreign currency because this is the practice of many Australian companies including regulated utilities;
- exclude bonds issued in AUD by foreign companies (assuming a large sample size can be obtained without recourse to these bonds). This is because there may be some self-selection bias in this source (namely because only the largest international companies tend to issue bonds in Australia).

38. This leaves only two core samples, namely, the full sample excluding foreign companies using either both UBS and Bloomberg or just Bloomberg data. The rationale for using Bloomberg only data is that it is publicly available (albeit at a cost) while UBS data is not (UBS must make a decision to provide it albeit at no cost). However, I note that these two samples give very similar results (the curve fitting estimates a DRP of 2.96% including UBS data and 2.99% excluding it) so very little turns on this issue at least in the period analysed.

39. In this analysis I have included both fixed bonds and floating rate notes. This is also consistent with the practice now adopted by the AER and the ERA, although IPART continues to exclude floating rate notes. I have previously shown that:

- one would not expect a company to be able to obtain different yields in the issue of fixed rate bonds versus floating rate notes, or for these to trade at different yields since this would give rise to arbitrage opportunities; and
- this expectation was verified by reference to fixed and floating rate bonds with the same maturity issued by the same company.

40. The aforementioned analysis and its conclusions were accepted by the Australian Competition Tribunal ('the Tribunal').[6] I have used Bloomberg pricing data in the following order of preference: BGN, BVAL and BCMP. That is, I rely on BGN yield data where this is available, on the basis that these data are the most reliable as they are used by Bloomberg in the construction of its fair value curves. If it is unavailable, then BVAL data is my second preference, and then BCMP data. This order of preference is consistent with IPART. However, the AER prefers to use BVAL data only, although it has not clearly stated why that is the case. The ERA uses Bloomberg data but does not state its source and I have been unable to replicate its data.

5 Including call options, put options, downgrade options and options to convert to equity.

6 Application by ActewAGL Distribution [2010] ACompT 4 (17 September 2010), paras. 49-53

3.2 Analysis of observed bond yield data

41. In this section I form samples of observed bond yield data based on the criteria set out in paragraph 35 and:

    - compare these to the yields estimated in the Bloomberg BBB fair value curve reported out to 7 years;[7] and
    - fit Nelson-Siegel yield curves to the yield data in order to estimate the DRP on 10 year BBB+ rated debt.

42. The functional form of the Nelson-Siegel yield curve and the methodology that I use to fit bond data to this curve is described in greater detail at Appendix A to this report.

43. The inclusion or exclusion of bonds with different characteristics will influence the results of the analysis to varying degrees. I have systematically explored how taking particular samples of the total bond population based on specific bond characteristics influences the comparison between the Bloomberg BBB fair value curve and my own DRP estimates.

44. I present figures demonstrating the result of three of the binary options: currency, country and type (options 2 – 4 in the bullet list in paragraph 35 above). I focus on these binary options because it is already possible to identify in each chart the rating of a bond, as well as the data source (i.e. Bloomberg or UBS). These three binary options are associated with 8 unique combinations. The results of varying country are presented in the remainder of this section, while the results of varying currency and type are presented in Appendix D.

45. Section 3.2.2 also contains Table 1 which shows the DRP at 10 years resulting from curve fitting analysis for each of the 32 overlapping combinations of these five binary options. I conclude that whilst the average DRP does vary by sample, the variations are within a relatively small range. For samples with more than 15 bonds, the BBB+ DRP at 10 years to maturity falls in a range from 2.66% to 3.34%. However, for some samples with fewer than 15 bonds the BBB+ DRP is much lower. The reliability of results with such small sample sizes is highly questionable.

46. The large sample results are consistent with the Bloomberg fair value curve extrapolated using a variety of methods, which fall in the range 2.88% to 3.07% (these results are presented in chapter 4).

47. The first set of figures (Figure 1 to Figure 2) in section 3.2.1 presents the bonds associated with each sample, overlaid with the Bloomberg fair value curve to 7 years. The second set of figures (Figure 3-Figure 4) in section 3.2.2 presents the

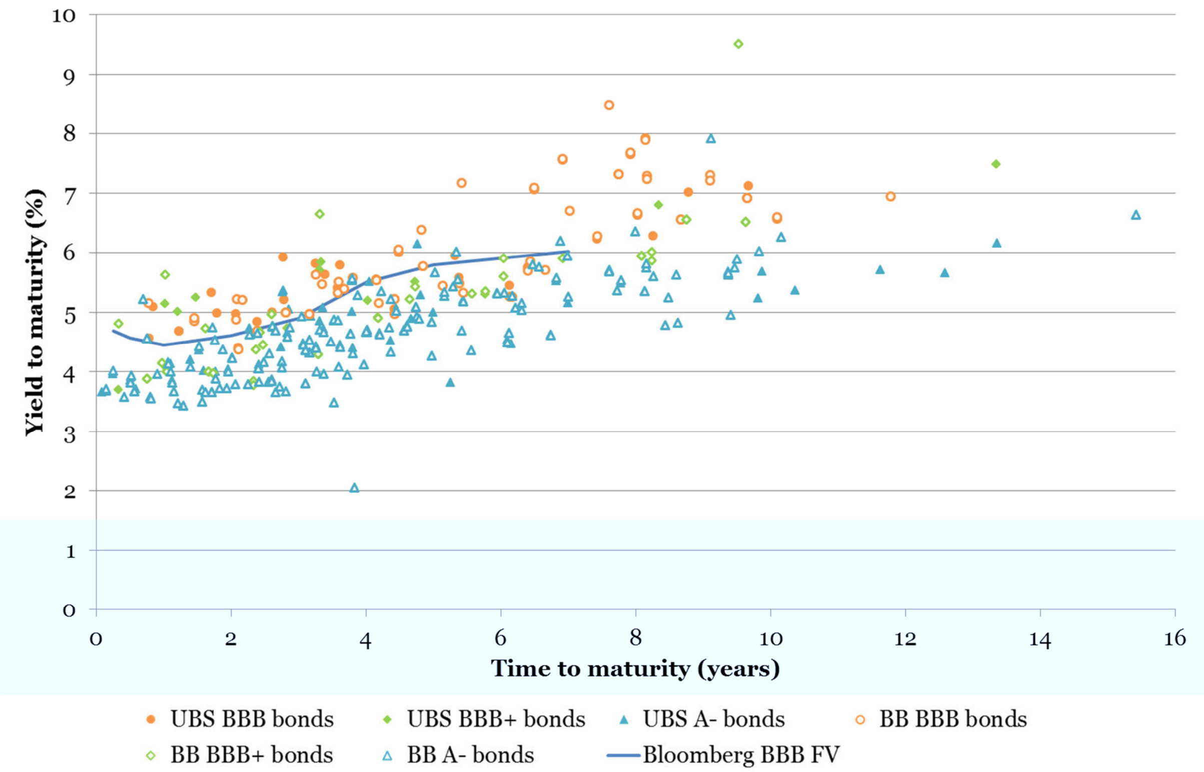
[7] In this section I do not seek to extrapolate the Bloomberg fair value curve to 10 years. I discuss alternatives for extrapolating the Bloomberg BBB fair value curve to 10 years at section 4 below.

results of the Nelson-Siegel yield curve fitting analysis using the bonds from each of the 8 samples.

3.2.1 Bonds contained in samples with different characteristics

48. Figure 1 shows the yields on BBB to A- bonds issued in Australian dollars by any company or in any foreign currency by Australian domiciled companies, swapped to Australian dollar yields. This sample contains 307 bonds and represents the entire bond population for which yields are available from either Bloomberg or UBS (or both).

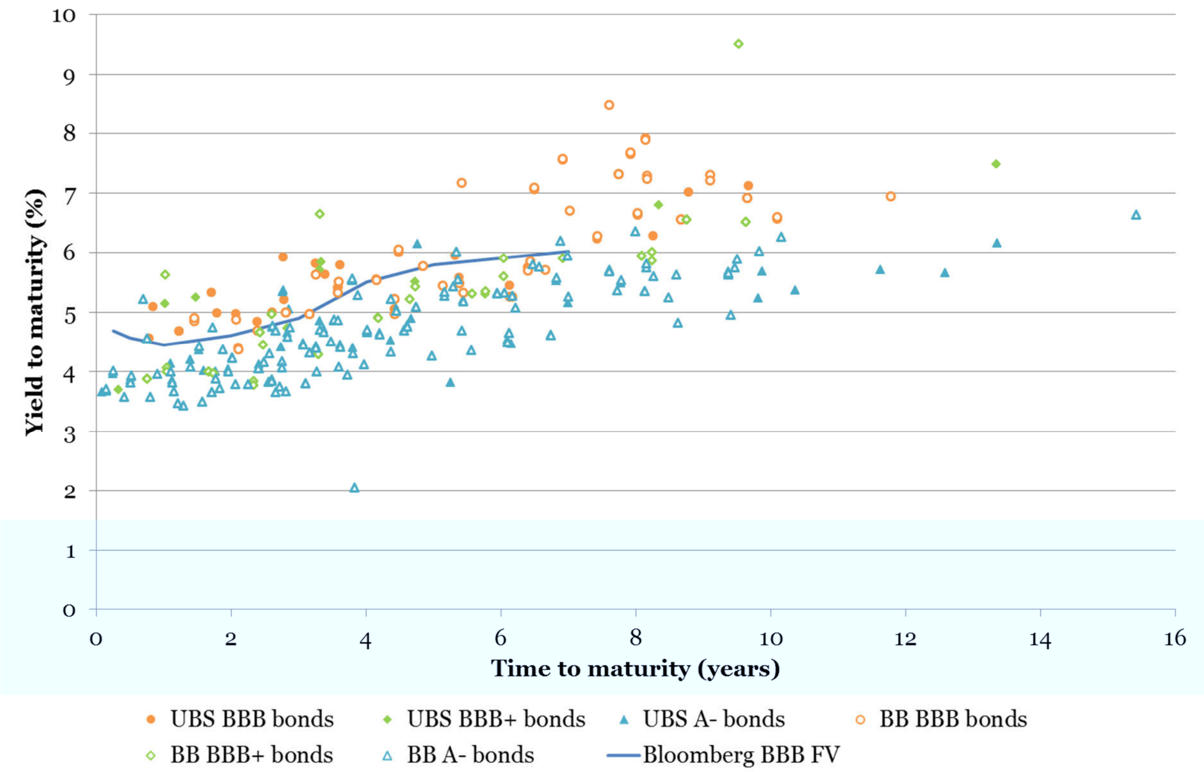
Figure 1: BBB to A- bonds issued in AUD by any company plus all foreign currency bonds issued by Australian companies



Source: Bloomberg and UBS data, CEG analysis

49. Figure 2 illustrates BBB to A- bonds issued by Australian domiciled companies in any currency (i.e., does not include AUD bonds issued by foreign companies). This sample contains 258 bonds. That is, Figure 2 contains a subset of the bonds in Figure 1, excluding bonds issued in Australian dollars by foreign domiciled companies.

Figure 2: BBB to A- bonds issued in any currency by Australian companies



Source: Bloomberg and UBS data, CEG analysis

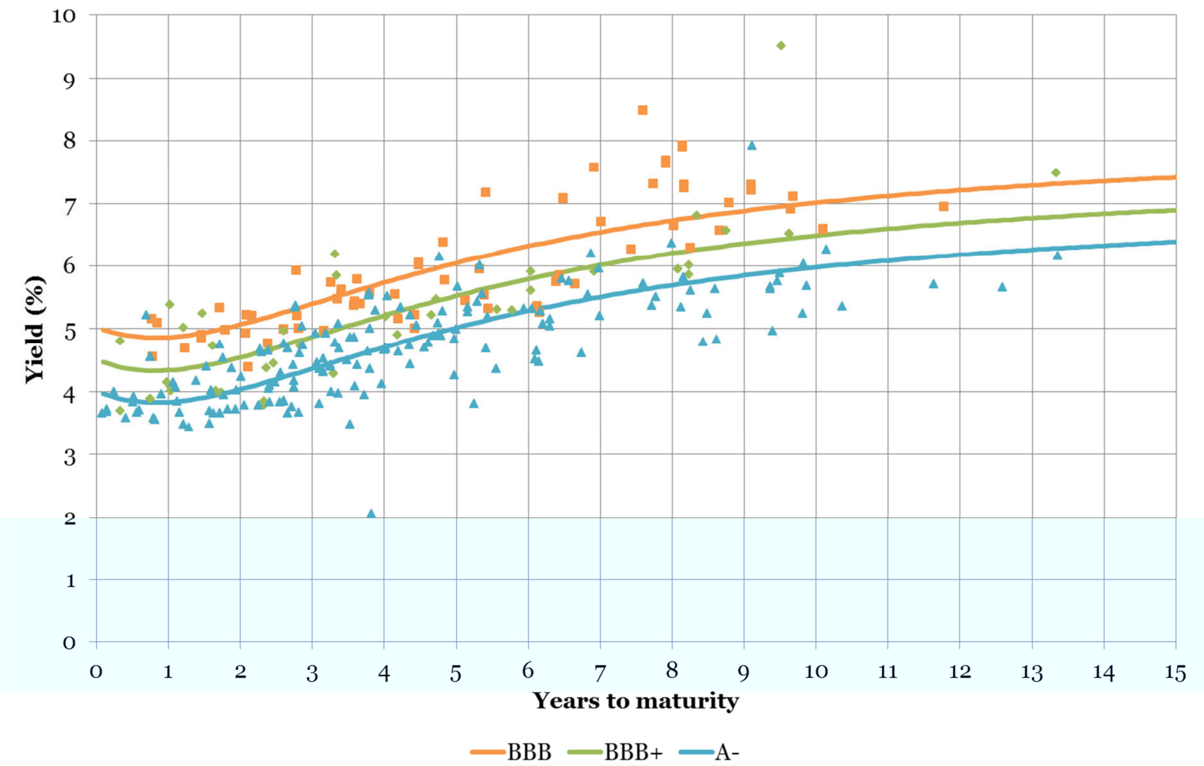
50. I provide similar graphical representations of the Bloomberg curve against a range of other subsamples of the larger dataset in Appendix D. The Bloomberg fair value curve remains a good fit to the data in these subsamples.

3.2.2 Curve fitting results

51. Figure 3 and Figure 4 show the Nelson-Siegel yield curve fitting results when relying on the same bond samples as in Figure 1 to Figure 2 above. At the end of this section I present a more systematic analysis (in tabular form) of the impact of each binary option used to define the bond sample on the estimated 10 year DRP for BBB+ rated bonds.

52. Figure 3 illustrates the result of fitting a Nelson-Siegel curve to the daily Bloomberg and UBS yields for BBB to A- bonds issued in Australian dollars by any company or in any foreign currency by Australian domiciled companies across all 20 working days in February 2013. This figure is based on the bonds in Figure 1 in the previous section. The BBB+ 10 year yield is 6.49%, and the corresponding DRP is 2.98%.

Figure 3: BBB to A- bonds issued in AUD by any company or in any currency by Australian companies



Source: Bloomberg and UBS data, CEG analysis

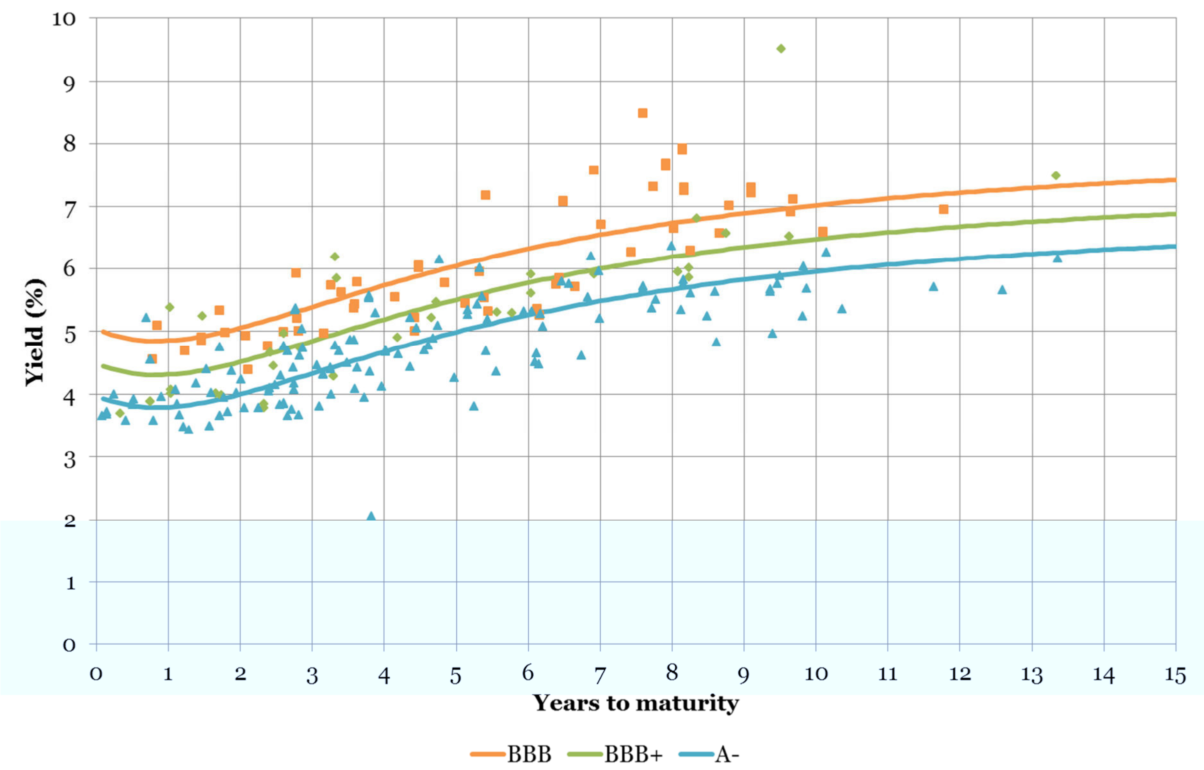
53. As explained in more detail in Appendix A, the curve fitting approach uses yields on bonds of all credit ratings to determine the shape of the fair value curves and uses yields on the bonds of each credit rating to determine the level of each curve – subject to the requirement that the A- curve be below the BBB+ curve and the BBB+ curve be below the BBB curve.

54. The BBB+ curve has a similar shape and level (both have a yield of 6% at 7 years) to the Bloomberg BBB fair value curve. Both curves have an inverse shape (negative slope) at short maturities and a positive concave slope as maturity lengthens. The negative slope at short maturities is consistent with a negative slope for CGS at short maturities in the relevant period.[8]

55. The upward sloping but concave shape of the curve at longer maturities is consistent with the standard shape of most estimated yield curves – with investors demanding higher (annualised) returns for holding longer lived, and hence riskier, securities. However, the rate of increase in this required annualised compensation for risk reduces with maturity (i.e., the shape of the curve is concave).

56. Figure 4 illustrates the result of curve fitting the average Bloomberg and UBS yields for BBB to A- bonds issued by Australian domiciled companies in any currency. This figure is based on the bonds in Figure 2 in the previous section. The BBB+ 10 year yield is 6.47%, and the corresponding DRP is 2.96%.

Figure 4: BBB to A- bonds issued in any currency by Australian companies



Source: Bloomberg and UBS data, CEG analysis

[8] During February 2013, the average semi-annual yield on TB118 maturing in May 2013 was 2.872%. The equivalent yield on TB129/TB125 maturing in December/June 2013/2014 was 2.740%/2.729%

57. Appendix D provides the results of curve fitting applied to other sub-samples of the wider data set.

58. The DRP for all 32 combinations are presented in Table 1 below. In summary, the DRP at 10 years for the 32 unique combinations I have considered ranges from 0.74% to 3.34%. The mean (median) across the 32 samples is 2.81% (3.06%). For the reasons already set out in section 3.1, I consider that the two most relevant samples are those highlighted purple in Table 1 below (being the widest available sample that excludes bonds issued by foreign companies in AUD). It can also be seen that including bonds issued by foreign companies in AUD makes no material difference (the relevant rows are highlighted orange and are adjacent to the rows that I define as most relevant).

59. Table 1 below includes estimates using small bond samples such as those with less than 30 bonds. These results are provided for completeness only. I do not consider that the results of regression analysis using such a small sample should be given any weight when considerably larger samples are available and when the results from using a small subset differ materially from the results using larger samples.

60. As mentioned at the beginning of this section, the results of the curve fitting in this report, using all but the smallest sub-samples, are consistent with extrapolating the Bloomberg fair value curve to 10 years using a variety of methods (the results of which are outlined in the next chapter). Therefore, I conclude that the evidence presented in this section supports the continued use of the Bloomberg fair value curve.

Table 1 Average DRP at 10 years across all 32 samples

Ratings	Currency	Source	Country of domicile	Type*	# Bonds	Average DRP
BBB+	AUD	BB	AU	All	7	0.74%
BBB+	AUD	BB	All	All	11	1.25%
BBB+	AUD	BB & UBS	AU	No options	9	1.61%
BBB+	AUD	BB	AU	No options	6	1.62%
BBB+	AUD	BB & UBS	All	No options	14	1.90%
All	AUD	BB	All	No options	101	2.66%
All	AUD	BB & UBS	All	No options	129	2.75%
All	AUD	BB & UBS	AU	No options	83	2.93%
All	All	BB & UBS	AU	All	258	2.96%
All	All	BB & UBS	All	All	307	2.98%
All	All	BB	AU	All	221	2.99%
All	All	BB	All	All	260	2.99%
All	AUD	BB	AU	No options	64	3.02%
All	All	BB & UBS	All	No options	197	3.03%
All	AUD	BB & UBS	All	All	164	3.03%
All	All	BB & UBS	AU	No options	151	3.04%
BBB+	All	BB	All	All	47	3.07%
All	AUD	BB & UBS	AU	All	115	3.07%
BBB+	All	BB	AU	All	43	3.08%
BBB+	All	BB & UBS	All	All	55	3.09%
BBB+	All	BB & UBS	AU	All	49	3.09%
All	All	BB	All	No options	169	3.09%
BBB+	All	BB & UBS	AU	No options	20	3.10%
BBB+	All	BB & UBS	All	No options	25	3.10%
All	All	BB	AU	No options	132	3.13%
BBB+	All	BB	All	No options	21	3.17%
BBB+	AUD	BB	All	No options	10	3.17%
BBB+	AUD	BB & UBS	All	All	19	3.22%
BBB+	AUD	BB & UBS	AU	All	13	3.24%
BBB+	All	BB	AU	No options	17	3.25%
All	AUD	BB	All	All	117	3.25%
All	AUD	BB	AU	All	78	3.34%

Source: Bloomberg, UBS and RBA data, CEG analysis

4 Extrapolation of the Bloomberg fair value curve

61. The Bloomberg BBB fair value curve is produced for terms to maturity of up to seven years. To use the curve as a 10 year benchmark it is necessary to extrapolate it to 10 years.

4.1 History of extrapolation

62. Bloomberg has not reported a 10 year yield for the BBB fair value curve since October 2007. Since that time the AER has extrapolated it to 10 years using a slope sourced from other Bloomberg corporate fair value curves (such as the A and the AAA curves) for which yields were published to 10 years. On 23 June 2010, the Bloomberg AAA fair value curve ceased to report 10 year yields and this method for extrapolating the BBB curve could no longer be used.

63. Subsequently, CEG suggested[9] (and the AER accepted[10]) that the increase in DRP between 7 and 10 years that was implied by the AAA fair value curve, with observations recorded over the 20 days to 22 June 2010, should be used to extrapolate the Bloomberg BBB fair value curve. The extrapolation implied by the methodology was 15.9 bppa.

64. More recently, the AER has accepted the use of "bond pair analysis" to perform this extrapolation.[11] Bond pair analysis involves assessing the increase in DRP per year of maturity for bonds issued by the same company that have approximately 7 and 10 years maturity respectively.

65. In its most recent final decision for the Victorian gas businesses, the AER conducted bond pair analysis, based on two sets of bonds issued by Stockland and Sydney Airport, to extrapolate the Bloomberg BBB fair value curve from 7 to 10 years. Applied over February 2013, this methodology gives an increase in DRP of 14.12 basis points per annum (bppa).

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9 CEG, *Use of the APT bond yield in establishing the NER cost of debt*, October 2010, pp. 55-56

10 AER, *Final decision: Victorian electricity distribution network service providers, Distribution determination 2011-2015*, October 2010, pp. 510-511

11 AER, *Access arrangement draft decision Envestra Ltd 2013-17, Part 2 Attachments*, September 2012, pp. 160-161

4.2 Bond pair analysis

66. I have conducted analysis on the total bond sample of 421 bonds to identify suitable bond pairs which can be used to extrapolate the Bloomberg BBB fair value curve from 7 to 10 years.

67. I identify from the total bond population five bond pairs from four different issuers which:

- are between 5 and 12 years from maturity;
- are issued by the same issuer;
- have the same credit rating;
- are issued in Australian dollars;
- do not have any optionality features other than make whole callable bonds;
- are either both fixed bonds or both floating rate notes; and
- have yields from the same source (i.e. yields from the same Bloomberg price source or from UBS).

68. The bond pairs are issued by Coca-Cola, Commonwealth, GPT and Sydney Airport. Table 2 provides some summary information about the bond pairs which I use for the purpose of this analysis.

Table 2: Bond pairs in Australian dollars

Pair	Issuer	ISIN	Maturity date	Time to maturity	DRP BB (BGN)	DRP BB (BVAL)	DRP UBS
1	Coca-Cola	XS0822418686	6/9/2018	5.52	1.266	1.252	N/A
	Coca-Cola	XS0680309191	27/9/2021	8.58	N/A	1.423	N/A
2	Coca-Cola	AU3CB0201747	13/11/2019	6.70	1.385	1.378	1.409
	Coca-Cola	XS0803234094	11/7/2022	9.36	N/A	1.490	N/A
3	Commonwealth	AU3CB0202901	13/12/2019	6.79	N/A	2.353	2.296
	Commonwealth	AU3CB0202919	13/12/2022	9.79	N/A	2.530	N/A
4	GPT	AU3CB0189009	24/1/2019	5.90	2.185	2.171	2.190
	GPT	AU3CB0198075	16/8/2022	9.46	N/A	2.413	N/A
5	Sydney Airport	AU3FN0001244	20/11/2021	8.73	N/A	N/A	3.585
	Sydney Airport	AU3FN0001251	11/10/2022	9.62	N/A	N/A	3.615

Source: Bloomberg, UBS, RBA, CEG analysis

69. Table 3 shows that the average increase in DRP across the five bond pairs from Table 2 is 5.170 basis points per annum.

Table 3: Bond pair analysis and implied increase in DRP (bppa)

Issuer	BGN	BVAL	UBS	Average
Coca-Cola (1)	N/A	5.613	N/A	5.613
Coca-Cola (2)	N/A	4.221	N/A	4.221
Commonwealth	N/A	5.908	N/A	5.908
GPT	N/A	6.802	N/A	6.802
Sydney Airport	N/A	N/A	3.304	3.304
Average				5.170

Source: Bloomberg, UBS, RBA, CEG analysis

4.3 Curve fitting results

70. An alternative approach to using bond pair analysis is to extrapolate the Bloomberg BBB fair value curve to 10 years using curve fitting. In the previous chapter, I present a range of different 10 year DRP values based on different sample scenarios. These results are re-iterated in Table 4 below, together with an estimate of the DRP at 7 years (using the same curve fitting method).

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Table 4: Change in DRP derived from curve fitting scenarios

Ratings	Curr.	Type	Source	Country of domicile	# Bonds	7 year DRP	10 year DRP	Δ DRP (bppa)
All	All	All	BB	All	260	2.76	2.99	7.62
All	All	All	BB	AU	221	2.76	2.99	7.38
All	All	All	BB & UBS	All	307	2.78	2.98	6.67
All	All	All	BB & UBS	AU	258	2.76	2.96	6.71
All	All	No options	BB	All	169	2.86	3.09	7.92
All	All	No options	BB	AU	132	2.88	3.13	8.29
All	All	No options	BB & UBS	All	197	2.8	3.03	7.54
All	All	No options	BB & UBS	AU	151	2.8	3.04	8.16
All	AUD	All	BB	All	117	2.84	3.25	13.81
All	AUD	All	BB	AU	78	2.96	3.34	12.62
All	AUD	All	BB & UBS	All	164	2.77	3.03	8.74
All	AUD	All	BB & UBS	AU	115	2.79	3.07	9.54
All	AUD	No options	BB	All	101	2.59	2.66	2.26
All	AUD	No options	BB	AU	64	2.74	3.02	9.36
All	AUD	No options	BB & UBS	All	129	2.55	2.75	6.81
All	AUD	No options	BB & UBS	AU	83	2.57	2.93	12.1
BBB+	All	All	BB	All	47	2.87	3.07	6.61
BBB+	All	All	BB	AU	43	2.88	3.08	6.57
BBB+	All	All	BB & UBS	All	55	2.87	3.09	7.17
BBB+	All	All	BB & UBS	AU	49	2.88	3.09	6.95
BBB+	All	No options	BB	All	21	2.87	3.17	9.72
BBB+	All	No options	BB	AU	17	2.97	3.25	9.19
BBB+	All	No options	BB & UBS	All	25	2.82	3.1	9.25
BBB+	All	No options	BB & UBS	AU	20	2.82	3.1	9.09
BBB+	AUD	All	BB	All	11	2.05	1.25	-26.77
BBB+	AUD	All	BB	AU	7	1.77	0.74	-34.32
BBB+	AUD	All	BB & UBS	All	19	2.8	3.22	13.97
BBB+	AUD	All	BB & UBS	AU	13	2.83	3.24	13.45
BBB+	AUD	No options	BB	All	10	2.54	3.17	21
BBB+	AUD	No options	BB	AU	6	1.91	1.62	-9.67
BBB+	AUD	No options	BB & UBS	All	14	2.08	1.9	-6.08
BBB+	AUD	No options	BB & UBS	AU	9	1.89	1.61	-9.23

Source: Bloomberg, UBS, RBA, CEG analysis

71. The increase in DRP from 7 years to 10 years based on curve fitting techniques for the broadest sample of 307 bonds is 6.67 bppa. Excluding foreign domiciled bonds the figure is 6.71 bppa. Only relying on Bloomberg data these figures are higher (7.62 bppa and 7.38 bppa). These rows are highlighted in Table 4 in same fashion they were highlighted in Table 1.

72. There are some larger increases (and decreases) implied by some sub-samples, however these samples are very narrow and contain only a very limited sub-set of bonds. As has already been discussed, I believe that it is more reliable to rely on broader rather than narrower samples of bonds.

73. The results in Table 4 are slightly higher albeit not inconsistent with the increase in DRP, resulting from the bond pairing analysis in the previous section, of 5.17 bppa.

4.4 Summary

74. In sections 4.2 and 4.3 I have present the outcome of two different extrapolation methods:

- the alternative bond pair method; and
- the use of results from alternative curve fitting scenarios;

75. Table 5 shows a summary of these outcomes. The outcomes range from 3.30 bppa to 9.54 bppa. This is associated with a DRP at 10 years of between 2.88% and 3.07% (extrapolated from the 7 year BBB Australian Bloomberg fair value curve).

Table 5: Summary of outcomes of different extrapolation methods

Extrapolation methodology	Average increase in DRP (bppa)	Implied 10 year DRP
Bond pair analysis		
Coca-Cola (1)	5.61	2.95%
Coca-Cola (2)	4.22	2.91%
Commonwealth	5.91	2.96%
GPT	6.80	2.98%
Sydney Airport	3.30	2.88%
CEG curve fitting analysis		
BBB to A- bonds issued in AUD by any issuer and bonds in any currency by Australian issuers including UBS data and bonds with options	6.67	2.98%
As above, but excluding foreign domiciled bonds issued in AUD	6.71	3.02%

Source: Bloomberg, UBS, RBA, CEG analysis

5 Assessment of regulatory precedent

76. In this section I review the DRP methodologies used by the AER, ERA and IPART. The AER has in recent decisions relied upon the extrapolated Bloomberg fair value curve to estimate DRP. However, the ERA and IPART have both proposed and implemented methodologies based on forming a sample of DRP observations and determining a representative DRP for the benchmark.

77. In my view, the methods proposed by the ERA and IPART are not sufficiently sophisticated to reliably and accurately estimate a DRP for a benchmark of a given maturity and credit rating. Also, I note that both the ERA and IPART apply their methods for the purpose of estimating a DRP for a benchmark bond of 5 years maturity. As I set out in more detail in my accompanying debt strategies report, I believe that the use of a 10 year benchmark is appropriate.[12]

78. The AER's reliance on the extrapolated Bloomberg fair value curve and/or a curve fitting process as described in section 3 is preferable to these methods.

5.1 AER's DRP methodology

79. In its final decision on the Victorian gas businesses' access arrangements, the AER determined the DRP on a benchmark 10 year corporate bond with a BBB+ credit rating based on the yield of the Bloomberg BBB fair value curve, extrapolated from 7 years to 10 years. The method of extrapolation used was a paired bond analysis.[13]

80. The paired bond analysis applied by the AER relied upon the increase in DRP per year of maturity based on only two pairs of bonds, being:[14]

    - Stockland fixed rate bonds maturing in 2016 and 2020 respectively, using data averaged from Bloomberg and UBS; and
    - Sydney Airport floating rate bonds maturing in 2015 and 2021 respectively, using data from UBS only.

81. Applying the AER's bond pair choice over February 2013 results in an estimated increase in DRP of 14.1 basis points per annum between 7 and 10 years. Given a DRP on 7 year Bloomberg BBB fair values of 2.78%, applying this extrapolation methodology gives rise to a 10 year extrapolated Bloomberg BBB DRP estimate of 3.20%.

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12 See CEG, *Debt strategies for utility businesses*, June 2013.

13 AER, *Access arrangement final decision, Envestra Ltd, 2013-17, Part 1*, March 2013, pp. 29-30

14 AER, *Access arrangement final decision, Envestra Ltd, 2013-17, Part 2: Attachments*, March 2013, p. 150

5.2 ERA's DRP methodology

82. I have reviewed the ERA's methodology for estimating DRP as originally canvassed in its 2010 discussion paper on the issue[15] and further informed by how it has most recently implemented its methodology for Western Power.[16]

5.2.1 Methodology used by the ERA

83. The ERA's method is generally to determine the DRP by:

- forming a sample of bonds with features similar to the benchmark bond; and
- estimating a representative DRP based on an average from that sample.

84. In concept, this is similar to the approach preferred by IPART (discussed in more detail at section 5.3 below). However, there are specific features of the ERA's methodology that differentiate it from IPART's methodology.

85. The ERA's benchmark bond has a maturity of five years.[17] The credit rating on the benchmark bond is not explicitly set by the ERA. Its final determination for Western Power puts forward reasons for both BBB+ and A- to be the benchmark credit rating. Ultimately, the ERA decided to estimate the DRP based upon a sample of bonds with credit ratings of BBB, BBB+ and A- by Standard and Poor's.

86. For bonds with these credit ratings, the ERA included in its sample:

- Australian dollar bonds issued by Australian corporates;
- bonds with at least two years to maturity;
- both fixed rate and floating rate bonds;
- bonds with options and credit guarantees; and
- bonds with yield data from Bloomberg

87. While it considers that floating rate bonds should be included in its sample, the ERA's use of Bloomberg yield data effectively means that it only uses data on fixed rate bonds, as yield data is not readily available for floating rate notes in Bloomberg. It is important to note that the ERA does not specify the particular Bloomberg source from which it obtains its yield data, and I have been unable to establish this source in previous attempts at replication.

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15 ERA, *Discussion paper: Measuring the debt risk premium: A bond-yield approach*, 1 December 2010

16 ERA, *Final decision on proposed revisions to the access arrangement for the Western Power Network*, 5 September 2012

17 Ibid, pp. 346-348

88. The ERA estimates its benchmark DRP by:

- calculating the DRP on each bond in its sample in the standard fashion (i.e., by reference to the yield on CGS with the same maturity); and
- computing a weighted average of DRPs in its sample, using as weights the product of time to maturity and amount issued[18].

5.2.2 Results of the ERA's methodology

89. In its most recent application of this methodology, the ERA estimated the DRP for the 20 days to 15 June 2012. Over this period, it formed a sample of 36 bonds with Bloomberg yield data satisfying its criteria.

90. Applying its method to the DRPs of bonds in this sample, the ERA estimated a weighted average DRP of 2.71%. The average maturity of bonds in this sample was 4.67 years. It is useful to note that of these 36 bonds, 24 are rated A-, 3 rated BBB+ and 9 rated BBB.

91. When same methodology is applied for the month of February 2013, I form a sample of 63 bonds with Bloomberg source data.[19] The weighted average DRP taken over this sample is 1.85%. The average maturity of bonds in this sample is 4.78 years. 43 bonds are rated A-, 6 are rated BBB+ and 14 are rated BBB.

92. More generally, Table 6 below examines the results of the ERA's methodology applied to the same 32 scenarios examined in section 3 above. I consider alternatives with:

- bonds of greater than 2 years maturity, reflecting the ERA's desire to estimate a DRP associated with a benchmark maturity of 5 years; and
- bonds of greater than 7 years maturity, reflecting an alternative objective to estimate a DRP associated with a benchmark maturity of 10 years.

18 ERA, F*inal Decision on Proposed Revisions to the Access Arrangement for the Western Power Network* September 2012, page 369.

19 I have not been able to precisely replicate the ERA's estimates of DRP from Bloomberg sources. In estimating the result of the ERA's methodology applied to February, I assume that BGN yields are preferred to BVAL where both are available.

Table 6: Results of ERA methodology applied to different samples

Ratings	Currency	Type	Source	Country	#Bonds > 2 years*	DRP	#Bonds > 7 years	DRP
All	All	All	BB	All	212	2.55	63	2.72
All	All	All	BB	AU	184	2.57	61	2.72
All	All	All	BB & UBS	All	247	2.56	74	2.73
All	All	All	BB & UBS	AU	211	2.58	72	2.74
All	All	No options	BB	All	141	2.75	24	3.28
All	All	No options	BB	AU	114	2.81	23	3.29
All	All	No options	BB & UBS	All	161	2.75	26	3.31
All	All	No options	BB & UBS	AU	126	2.83	25	3.31
All	AUD	All	BB	All	91	1.96	11	2.32
All	AUD	All	BB	AU	63	1.85	9	2.31
All	AUD	All	BB & UBS	All	126	2.26	22	2.79
All	AUD	All	BB & UBS	AU	90	2.28	20	2.80
All	AUD	No options	BB	All	79	1.98	8	2.44
All	AUD	No options	BB	AU	52	1.85	7	2.52
All	AUD	No options	BB & UBS	All	99	2.19	10	3.16
All	AUD	No options	BB & UBS	AU	64	2.20	9	3.21
BBB+	All	All	BB	All	35	2.41	17	2.46
BBB+	All	All	BB	AU	34	2.42	17	2.46
BBB+	All	All	BB & UBS	All	40	2.43	19	2.47
BBB+	All	All	BB & UBS	AU	38	2.43	19	2.47
BBB+	All	No options	BB	All	17	2.34	4	2.62
BBB+	All	No options	BB	AU	16	2.35	4	2.62
BBB+	All	No options	BB & UBS	All	19	2.33	4	2.62
BBB+	All	No options	BB & UBS	AU	17	2.34	4	2.62
BBB+	AUD	All	BB	All	7	2.31	-	-
BBB+	AUD	All	BB	AU	6	2.39	-	-
BBB+	AUD	All	BB & UBS	All	12	2.65	2	3.37
BBB+	AUD	All	BB & UBS	AU	10	2.74	2	3.37
BBB+	AUD	No options	BB	All	6	2.13	-	-
BBB+	AUD	No options	BB	AU	5	2.19	-	-
BBB+	AUD	No options	BB & UBS	All	8	2.13	-	-
BBB+	AUD	No options	BB & UBS	AU	6	2.15	-	-

Source: Bloomberg and RBA data, CEG analysis
There are fewer bonds in Table 14 than there are in similar sub-samples reported in tables earlier in this report. This is because the ERA excludes bonds with fewer than 2 years to maturity.

93. It is interesting to note that all the samples examined for maturities of greater than two years result in a DRP of above that implied by the ERA's methodology (highlighted in grey) of 1.85%.

94. The other rows highlighted above are the core sample I consider most reliable (purple) and that same sample including foreign domiciled issuers of AUD bonds (orange). These are the same rows highlighted in Table 1 and Table 4 and highlighted in the same fashion as in those tables.

95. Comparison of this with the ERA sample shows that not only does the ERA sample deliver the lowest estimated DRP of all the 32 possible sub-samples, it is materially below the estimate derived using the ERA method and the wider sample I propose. As expected, restricting the sample of bonds to exclude those under 7 years maturity materially increases the estimated DRP in most scenarios (to around 2.7% for my preferred sample). This increases to around 3.30% if bonds with options are excluded.

96. This provides a useful case-study of the properties (and problems) with the ERA weighting methodology. The following two charts show the bonds with maturity above 7 years first including all bonds and then excluding bonds with options (other than make whole callable bonds).

Figure 5: Bond spreads with maturity greater than 7 years: full sample excluding foreign domiciled issuers

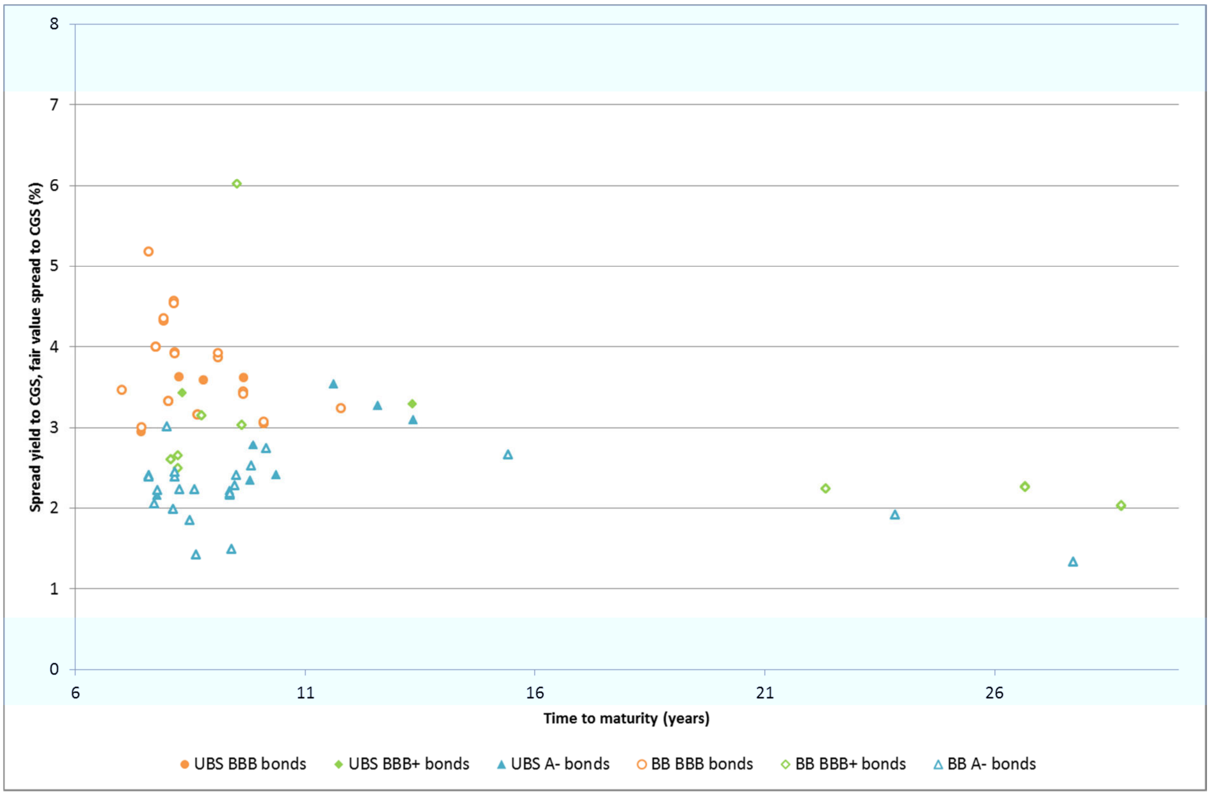
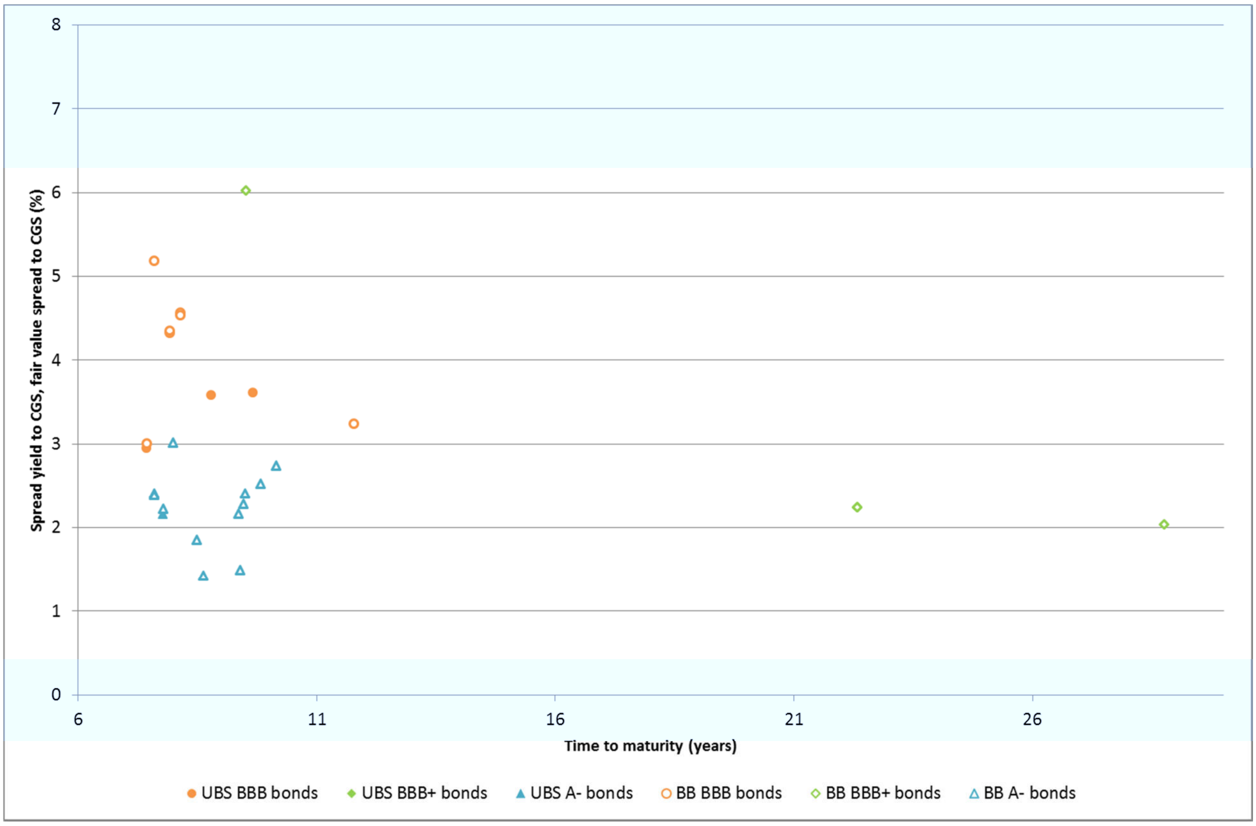


Figure 6: Bond spreads with maturity greater than 7 years: full sample excluding foreign domiciled issuers and excluding bonds with options (other than make whole callable bonds)



97. Visual examination of these figures suggests a simple average that is similar and around 3%. This is indeed the case with the average in the first figure 2.94% and the average in the second figure 3.03%. However, the ERA methodology gives radically different values for the first figure (2.74%) and the second figure (3.31%).

98. The reason for the significant difference is the ERA weighting mechanism gives radically higher weights to some bonds than to others. In the second figure, there are 25 bonds but 72% of the weight is given to just 11 of these bonds. The jump in DRP estimated using the ERA weighting scheme is largely due to the fact that 25% weight is given to Macquarie Bank BBB bonds that have spreads of around 4.5%.

99. With the inclusion of bonds that have options attached to them (Figure 5) the larger number of bonds reduces the weight given to the Macquarie bonds. Moreover, it introduces bonds that have very low spreads and have very high weights. For example, the highest weighted bond in this sample is an A- callable bond issued by Rio Tinto that also has the lowest spread in the sample (a spread of just 1.34%). This bond has a weight of 7.4% even though it is just one bond out of 72 bonds (in an unweighted sample it would have a weight of just 1.4%). The Rio Tinto bond has

such a high weight in the ERA sample because it is a very large bond issue ($1.2bn) and because it is a very long maturity bond issue (27 years).

5.2.3 Critique of the ERA methodology

100. In my view, the ERA methodology is overly simplistic and is not a methodology that should be considered an appropriate option for deriving a BBB+ rated benchmark DRP.

101. Its most critical failings as a methodology are that:

- it proposes no method by which to ensure that the benchmark DRP that it derives from the application of its methodology is consistent with a particular maturity. Rather, the underlying maturity of its estimate depends on the maturity of bonds that fall in its sample and also the weighting the ERA gives to each bond;
- it does not control for the composition of the credit ratings included in the sample. As a result, the sample is overwhelmingly weighted towards bonds that are rated A-. This is simply because there are more A- bonds than any other rating;
- in weighting by the amount issued, it does not make appropriate use of the bond yield information that is available; and
- a large amount of relevant yield information is excluded by the ERA's bond selection criteria or is lost in the ERA's implementation of its methodology.

102. These issues are set out in more detail below.

5.2.3.1 The ERA's method does not control for maturity

103. The ERA's methodology in its current form uses the DRP on bonds of many different maturities to make inferences about the DRP on the benchmark bond of 5 years maturity. However, the method does not properly take into account these maturity differences in assessing the relevance of bonds with maturities different from 5 years in informing the benchmark DRP.

104. This means that the ERA is in essence relying on 'chance' to ensure that taking the weighted average DRP of bonds in its sample is relevant to the benchmark term. While the ERA does check that the average maturity of its sample is close to 5 years, this does not provide any assurance that the result of its method is relevant at 5 years. This is because one would not expect the bond yield curve (or the resulting DRP curve) to be straight – but rather it would likely be convex. As a result, calculating the average DRP of a set of bonds that have an average maturity of 5 years will not necessarily result in a DRP estimate that is itself consistent with a 5 year assumption.

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5.2.3.2 The ERA's methodology does not control for credit rating

105. Under the ERA's methodology as applied for both the Western Power average period and for February 2013, the bond sample is overwhelmingly weighted towards bonds that are rated A-. A- bonds account for:

- 24 of the 36 bonds in the sample formed for the ERA's final decision; and
- 43 of the 63 bonds in the sample formed in February 2013.

106. The average credit rating of bonds in both these samples is located very close to halfway between BBB+ and A-.

107. As described above, the ERA has not clearly defined the credit rating of its benchmark bond. In this context, it is unclear whether the ERA is intending its methodology to be an estimate for a BBB+ rated benchmark bond. However, to the extent that this methodology would be used to estimate the DRP on a benchmark bond with a BBB+ credit rating, the weighting of bonds within the sample suggests that its DRP estimate would be biased down towards an estimate of the DRP for an A- rated bond.

5.2.3.3 Weighting by issue amount is inappropriate

108. The ERA calculates an average DRP weighted by time to maturity and issue amount. In my view, the use of issue amount to weight different DRP observations is not appropriate in determining a benchmark DRP.

109. There are specific circumstances under which it would be appropriate to weight by issue amount. If the task faced were to estimate the expected DRP on a random dollar of corporate debt rated between BBB and A- issued by Australian companies, this would be consistent with weighting by amounts issued. However, the effect of this is to give by far the most weight to the largest Australian companies that issue in this ratings range (the banks and mining companies). As is the case with Rio Tinto above, these companies issue single bonds in excess of $1bn.

110. This results in the ERA method giving most weight to the largest businesses in the sample. If anything, less weight should be given to these businesses given the average regulated business in Australia is much smaller than the likes of the big four banks and large mining companies such as Rio Tinto.

111. The basis upon which the ERA considers that a DRP observation from a bond issue of $500 million should receive five times the weight of another DRP from a bond issue of $100 million is unclear.

5.2.3.4 The ERA's method excludes relevant information

112. The ERA's methodology for estimating DRP forms a bond sample that excludes a great deal of relevant information. By design, its bond sample excludes:

- bond yield data available from alternatives to Bloomberg, such as UBS; and
- bond yield data from Australian firms, for debt instruments issued in foreign currencies, with the yields then swapped back into Australian dollar terms.

113. I have not seen a compelling argument made by the ERA in favour of setting aside these sources of information.

5.3 IPART's DRP methodology

114. I have reviewed IPART's methodology for estimating the DRP as set out in its final decision on the issue.[20]

5.3.1 Methodology used by IPART

115. Similar to the ERA's methodology, IPART determines the DRP by:

- forming a sample of bonds with features similar to the benchmark bond; and
- estimating a representative DRP based on an average from that sample.

116. There are some differences in the composition of its sample and in the methodology used to calculate the final DRP estimate that distinguish IPART's methodology from the ERA's methodology.

117. IPART's benchmark bond has a 5 year maturity and is rated either BBB or BBB+ with Standard & Poor's.[21] For bonds with these credit ratings, IPART includes in its sample:

- Australian and United States dollar bonds issued by Australian firms;
- bonds with at least two years to maturity;
- bonds that are fixed only, unwrapped[22] and have no embedded options;

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[20] IPART, *Developing the approach to estimate the debt margin, Other industries – Final decision*, April 2011

[21] Ibid, p. 18

[22] I have not been able to assess the basis upon which IPART decides that a bond is wrapped or not. This criterion does not seem to have affected the selection of bonds in IPART's averaging period, and I have not attempted to apply it in the February 2013 averaging period.

- bonds that are issued by a company that is unaffected by factors such as mergers and acquisition activity; and
- bonds with yield data from Bloomberg only.

118. With respect to the Bloomberg data source, IPART states that it uses BGN yields where a continuous stream of data is available. Otherwise, BVAL is used.[23]

119. Finally, IPART also includes the DRP calculated on the Bloomberg 5 year fair value as an observation in its bond sample.

120. IPART calculates the DRP on each observation in its sample as the yield less the interpolated 5 year yield on CGS. This is in contrast to the practice of the AER and ERA that calculate a DRP on a bond by reference to CGS yields interpolated to the same maturity as the bond itself. Alternatively this methodology can be understood as conducting all the analysis to determine a benchmark 5 year yield before calculating the DRP at that maturity. Similarly, IPART also calculates cross-currency swaps assuming that the maturity of each bond swapped is exactly 5 years.[24]

121. Finally, IPART's debt risk premium is calculated as the median of this sample (including the Bloomberg DRP observation).

5.3.2 Results of IPART's methodology

122. In April 2011, IPART applied this methodology and formed a sample of 21 bonds plus the Bloomberg fair value. These observations had an average maturity of 6.6 years.[25] The median DRP it calculated from this sample was approximately 2.9%.[26] Of the 21 bonds sampled by IPART, 15 were rated BBB.

123. Applied over February 2013, I have formed a sample of 37 bonds plus the Bloomberg fair value. Of these 37 bonds, 23 are rated BBB and the remaining 14 rated BBB+.

124. The average maturity of these bonds is 6.38 years. The median DRP (as calculated using IPART's method) is 2.48%. I have also examined the results when the median is taken over DRPs calculated for the maturity of each observation in the sample. In other words, the tenor of the Commonwealth Government bonds used matched the

23 Ibid, p. 43

24 This is an aspect of IPART's methodology that I have not attempted to replicate. It is unclear to me what basis there is for this simplifying assumption.

25 Ibid, p. 34

26 Ibid, Figure 1.1, p. 4

tenor of the individual debt instrument. The assessed DRP was slightly lower, at 2.41%.

125. Table 5 below examines the results of IPART's methodology applied to the same 32 scenarios examined in section 3 above. As with the table showing the results of applying the ERA's methodology, I consider alternatives with:

- bonds of greater than 2 years maturity, reflecting IPART's desire to estimate a DRP associated with a benchmark maturity of 5 years; and
- bonds of greater than 7 years maturity, reflecting an alternative objective to estimate a DRP associated with a benchmark maturity of 10 years.

126. In implementing the second scenario, I have used the 7 year Bloomberg fair value curve yield as an observation instead of the 5 year value. This avoids the need to make assumptions about how IPART might consider extrapolating the Bloomberg fair value curve.

127. These sensitivities have been produced using IPART's methodology for calculating the DRP on individual bonds. For the scenarios with bonds of maturities greater than 7 years, I have used CGS at a maturity of 10 years to estimate these DRPs, consistent with the alternative objective to estimate a DRP associated with a benchmark maturity of 10 years.

Table 7: Results of IPART methodology applied to different samples

Ratings	Currency	Type	Source	Country	Bonds > 2 years	DRP	Bonds > 7 years	DRP
All	All	All	BB	All	212	2.28	63	3.05
All	All	All	BB	AU	184	2.33	61	3.05
All	All	All	BB & UBS	All	247	2.29	74	3.05
All	All	All	BB & UBS	AU	211	2.40	72	3.05
All	All	No options	BB	All	141	2.18	24	2.75
All	All	No options	BB	AU	114	2.27	23	2.77
All	All	No options	BB & UBS	All	161	2.17	26	2.75
All	All	No options	BB & UBS	AU	126	2.28	25	2.80
All	AUD	All	BB	All	91	1.85	11	2.13
All	AUD	All	BB	AU	63	1.84	9	2.13
All	AUD	All	BB & UBS	All	126	2.00	22	2.20
All	AUD	All	BB & UBS	AU	90	2.05	20	2.20
All	AUD	No options	BB	All	79	1.85	8	2.12
All	AUD	No options	BB	AU	52	1.84	7	2.25
All	AUD	No options	BB & UBS	All	99	1.93	10	2.38
All	AUD	No options	BB & UBS	AU	64	1.93	9	2.45
BBB+	All	All	BB	All	35	2.87	17	3.20
BBB+	All	All	BB	AU	34	2.87	17	3.20
BBB+	All	All	BB & UBS	All	40	2.87	19	3.32
BBB+	All	All	BB & UBS	AU	38	2.87	19	3.32
BBB+	All	No options	BB	All	17	2.06	4	3.35
BBB+	All	No options	BB	AU	16	2.18	4	3.35
BBB+	All	No options	BB & UBS	All	19	2.04	4	3.35
BBB+	All	No options	BB & UBS	AU	17	2.06	4	3.35
BBB+	AUD	All	BB	All	7	2.29	-	-
BBB+	AUD	All	BB	AU	6	2.32	-	-
BBB+	AUD	All	BB & UBS	All	12	2.29	2	3.29
BBB+	AUD	All	BB & UBS	AU	10	2.43	2	3.29
BBB+	AUD	No options	BB	All	6	2.27	-	-
BBB+	AUD	No options	BB	AU	5	2.29	-	-
BBB+	AUD	No options	BB & UBS	All	8	2.16	-	-
BBB+	AUD	No options	BB & UBS	AU	6	2.27	-	-

Source: Bloomberg and RBA data, CEG analysis

128. There is wide variability in the results of IPART's methodology depending upon the range of bonds sampled. I note that the result of IPART's methodology using the widest range of bonds is just above 3.00%. This is consistent with the lower bound of extrapolated Bloomberg BBB fair values and also with some of the empirical results that I derive at section 3 above.

5.3.3 Critique of IPART's methodology

129. IPART's methodology shares many of its defining characteristics with the ERA's methodology. Like the ERA's methodology, it is not sophisticated enough to be able to provide reliable estimates for a given benchmark term and credit rating. Key failings of IPART's methodology are that:

- it proposes no method by which to ensure that the benchmark DRP that it derives from the application of its methodology is commensurate with a 5 year maturity; and
- a large amount of relevant yield information is excluded by the IPART's bond selection criteria.

130. I also note that IPART's methodology appears to sample from bonds that have credit ratings that are on average below BBB+.

131. These issues are set out in more detail below.

5.3.3.1 IPART's method does not control for maturity

132. IPART's methodology shares with the ERA a relatively unsophisticated approach to assessing the effect of sampling different maturities on how the bond data can be used to inform the DRP for a bond of benchmark maturity.

133. This issue is exacerbated in the case of IPART's methodology because it conducts its analysis on bond yield data, rather than DRP data as the ERA does.[27] Other things being equal, the potential for bias would be expected to be greater when analysing yield data because one would expect the slope (and the concavity) of the yield curve to be greater than the slope (and concavity) of the DRP curve.

5.3.3.2 IPART's methodology does not control for credit rating

134. I note that IPART defines its benchmark credit rating to be "BBB or BBB+". The weighting towards BBB bonds in its sample is not a material issue in this context.

135. However, IPART's methodology appears to sample from bonds that have credit ratings that are on average below BBB+. This means that, abstracting from other concerns raised in this section, it is likely to give rise to a DRP benchmark that is too high relative to a pure BBB+ benchmark as sought by the AER. It should be noted that these other concerns are potentially very important to the results of IPART's DRP methodology.

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[27] Although IPART's commentary on its methodology suggests that it is calculating DRPs, in fact it calculates all DRPs by subtracting the same 5 year CGS yield from them. This is more accurately described as an analysis on bond yield data.

5.3.3.3 IPART's method excludes relevant information

136. The bond sample formed by IPARTs methodology, as it is applied February 2013, consists of 37 bonds.[28] This appears significantly smaller again than the sample formed using the ERA's methodology (63 bonds). However, of the ERA's sample, only 20 bonds were consistent with IPART's selection criterion (rated BBB or BBB+).

137. IPART's method is able to source more BBB or BBB+ bonds than the ERA's because it includes bonds issued by Australian firms in United States dollars. However, in other aspects it is more restrictive than the ERA because:

- it excludes bonds with embedded options or that are credit wrapped; and
- it excludes floating rate notes (although the ERA's inclusion of these bonds has no effect since it cannot locate yield data for them in Bloomberg).

138. I consider that IPART's method excludes bond yield data from a variety of sources that could usefully inform the benchmark DRP. In particular, I do not believe that excluding floating rate notes from analysis of the DRP is reasonable or consistent with normal regulatory practice in Australia. I also note that IPART's exclusion of bonds with options and wrappers is not based on any assessment or reasoning of the effect of this choice on the estimated cost of debt and its interaction with the cost of equity. Finally, although IPART has included United States dollar bonds in its sample, Australian firms also issue bonds in other currencies that IPART has not considered, such as Euros.

[28] This precise sample size cannot be observed in Table 7 since none of the sub-samples analysed in that table precisely match the range of credit ratings relied upon by IPART.

Appendix A Nelson-Siegel analysis

139. I have applied a yield curve functional form based on the method introduced by Nelson and Siegel. Nelson and Siegel first used their technique to approximate yield curves for US Treasury bills. This functional form is widely used in the empirical finance literature on yield curves. For example, Christensen et al. state:[29]

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

140. The Nelson Siegel functional form is used by academics and practitioners alike including in Australia.[30]

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

142. It is important to distinguish the Nelson-Siegel functional form from other methods of fitting curves that use methods of interpolation such as splines. Because Nelson-Siegel curves only have a small number of parameters, the fitted curve will not necessarily pass through or close to every observation. Interpolation methods are likely to be better at producing a curve which tracks the individual observations closely. As Nelson and Siegel put it: [31]

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

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

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

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

143. More recently Diebold and Li have made empirical findings that appear to support these statements.[32]

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

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

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

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

147. I use this specification in order to estimate the yield curve for bonds that all have the same credit rating. However, by allowing $\beta_{1,rank}$ to vary across credit ratings, I effectively assume that the shape of the curve is the same for all credit ratings but the level of the curve is different.

148. I consider that this is a reasonable assumption - especially for credit ratings that are similar to each other. That is, I consider that it is reasonable to assume that the underlying shape of the A- and BBB fair value curves is very similar to that of the BBB+ curve. By fitting a different value for $\beta_{1,rank}$ for each credit rating, I am able to use data from A- to BBB in order to inform the shape of the BBB+ yield curve.

149. I estimate β_0, $\beta_{1,rank}$, β_2 and β_3 to define a single Nelson-Siegel yield curve by minimising the sum of squared errors between the fair yield curve and the reported yield data over February 2013. The regression is non-linear due to the inclusion of the speed-of-decay parameter β_0.

150. In previous implementations of this methodology I have estimated a separate curve for each day of the averaging period and then averaged resulting fair yield curves. Daily analysis over February 2013 gives stable results except for 18 February 2013,

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

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where a large amount of bond data is missing due to a public holiday in the United States. I have found that the implementation used in this report is more resistant to isolated outlier values and is a more consistent way of estimating a single Nelson-Siegel yield curve to represent the entire averaging period.[33]

151. It would also be possible to place restrictions on β_(1,rank) to ensure that the BBB curve lies above the BBB+ curve, which lies above the A- curve respectively. In practice, it has proved unnecessary to implement such constraints because the results already reflect these expected relativities.

152. I calculate DRPs on each day and over the period by subtracting from the Nelson-Siegel yield estimates CGS yields calculated as the interpolated yield sourced from RBA data. The average 5 year and 10 year CGS yields averaged over February 2013 are 3.04% and 3.51% respectively.

33 I note however that differences in results between the methods are minor. For one of my preferred samples, involving UBA and Bloomberg data on all AUD and foreign currency bonds issued by Australian companies, the 10 year DRP estimated in Table 1 is 2.96%. For the average across curves estimated on each of 20 days it is 2.98%, or 2.96% if February 18 is excluded.

Appendix B Cross currency swaps

153. Bloomberg's SWPM function estimates cross-currency swap rates between any pair of currencies for given characteristics, such as maturity, coupon payments and payment frequency.

154. Given the number of foreign currency bonds issued it is not practicable to use this function to convert each bond on each day because each historical conversion is a manual process. To resolve this practical difficulty, I establish a mapping between foreign currency bond yields and Australian dollar bond yields for each currency using a cross-section of conversions obtained from Bloomberg at different maturity-yield pairs. Given the maturity and yield of the foreign currency bond to be swapped, I use interpolation across these points to identify the equivalent Australian dollar yield at that maturity.

155. It is convenient to establish this mapping on a common set of Australian dollar maturity-yield pairs. The following table of Australian dollar yields was swapped into equivalent foreign currency terms for the eight currencies for which bonds rated BBB to A- were found. These currencies were CAD, CHF, EUR, GBP, HKD, JPY, NZD and USD. I performed this calculation for two dates: at 1 February 2013 and at 28 February 2013. The final swapped yields are the average of those calculated using these mappings.

156. It is important to note that the yields in Table 8 below have been chosen based on typical yields observed at each maturity in Australian dollar terms in order to establish a range that will encompass the majority of bond yields. However, the selection of these yields only forms a 'mesh' of points at which cross-currency conversions are made and then used to inform conversions at other points. The results of the methodology do not turn on the selection of these particular points.

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Table 8: Australian dollar yield-maturity pairs used for cross-currency swap calculations

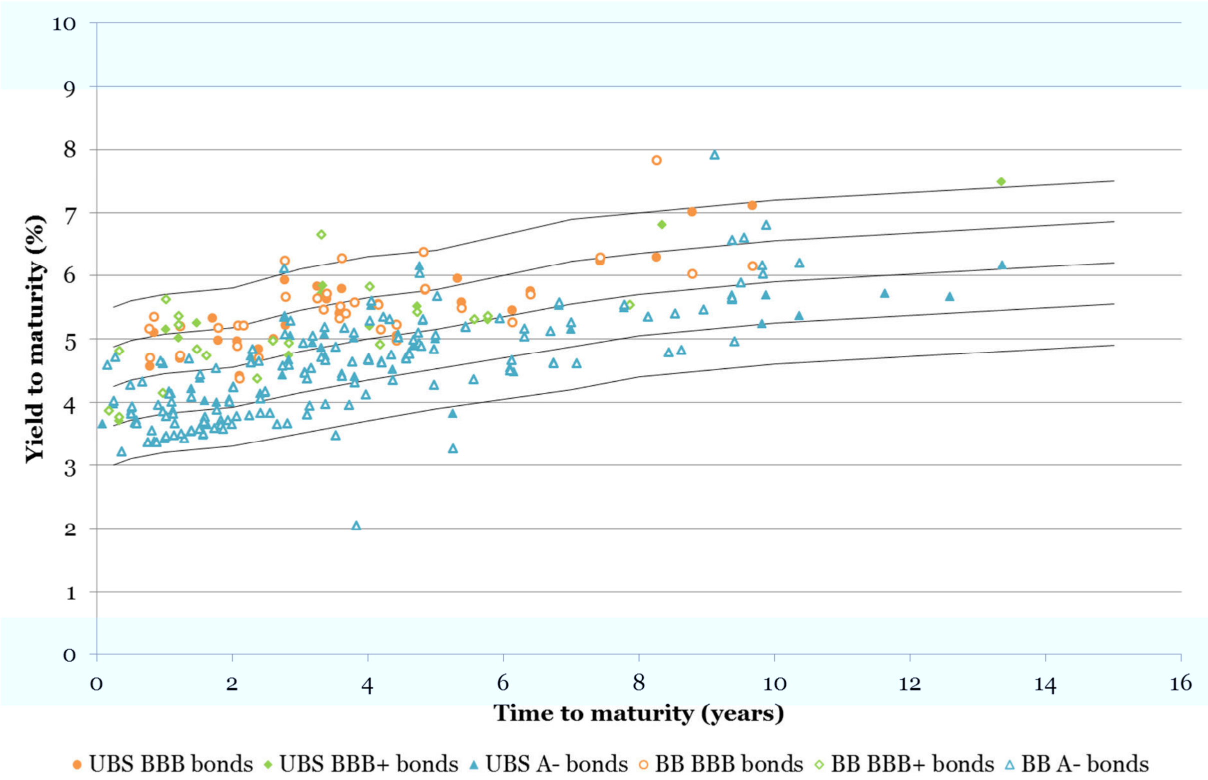
Maturity	Yield (1)	Yield (2)	Yield (3)	Yield (4)	Yield (5)
0.25	3.000	3.625	4.250	4.875	5.500
0.5	3.100	3.725	4.350	4.975	5.600
1	3.200	3.825	4.450	5.075	5.700
2	3.300	3.925	4.550	5.175	5.800
3	3.500	4.150	4.800	5.450	6.100
4	3.700	4.350	5.000	5.650	6.300
5	3.900	4.525	5.150	5.775	6.400
7	4.200	4.875	5.550	6.225	6.900
8	4.400	5.050	5.700	6.350	7.000
10	4.600	5.250	5.900	6.550	7.200
15	4.900	5.550	6.200	6.850	7.500

Source: CEG analysis

157. Figure 7 below shows the yield-maturity pairs from Table 8 charted against the yields on the population of Australian dollar bonds rated BBB to A- shown at .

158. As Figure 7 indicates, these yield-maturity pairs have been chosen to reflect the range of likely outcomes from the swapping process, with only a small number of outlying bond yields not captured within their bounds.

Figure 7: Cross-currency yield-maturity pair matrix against BBB to A- Australian dollar bond yields



Source: Bloomberg, UBS and RBA date, CEG analysis
Note: Data sourced as an average over 21 November 2011 to 16 December 2011

159. I note that the precision of the approximation obtained could be improved by collecting more maturity-yield pairs. However, given the very time-consuming nature of this exercise, I consider that the pairs in Table 8 above are sufficient to provide a reasonable approximation of the swapped yield.

160. Table 9 below summarises the results sourced from Bloomberg swapping the Australian yields shown in Table 8 above into United States dollar terms. The yields shown are the average of the United States dollar yields calculated for 1 February 2013 and 28 February 2013 respectively.[34]

[34] Table 9 is provided for illustrative purposes to demonstrate a typical swap calculation because in implementing the swap calculations I perform these separately using foreign currency yields calculated for 1 February 2013 and 28 February 2013 and average the Australia yield results of these swap calculations, rather than averaging the foreign currency yields first.

Table 9: United States dollar yield-maturity pairs used for cross-currency swap calculations

Maturity	Yield (1)	Yield (2)	Yield (3)	Yield (4)	Yield (5)
0.25	0.232	0.838	1.443	2.049	2.654
0.5	0.395	1.007	1.619	2.230	2.842
1	0.543	1.155	1.768	2.381	2.993
2	0.538	1.142	1.746	2.351	2.955
3	0.667	1.287	1.907	2.526	3.146
4	0.874	1.485	2.097	2.708	3.319
5	1.132	1.712	2.292	2.872	3.452
7	1.606	2.218	2.830	3.442	4.053
8	1.872	2.454	3.037	3.620	4.202
10	2.215	2.787	3.358	3.930	4.501
15	2.475	3.131	3.788	4.444	5.101

Source: Bloomberg

161. Similar tables of swapped Australian yields are produced for the other seven currencies for which bond yield data was found.

162. In order to swap bonds from foreign currency yields into Australian dollar yields, the tables are used to interpolate five foreign currency yields and five equivalent Australian dollar yields at the maturity of the bond. Then the foreign currency yield is used to interpolate across the five Australian dollar yields to give the resulting estimate in Australian dollar yield terms.

163. For example, the following table of foreign currency and Australian dollar yields can be constructed for a United States dollar bond with maturity of 9 years.

Table 10: Example of swap calculation

	Yield (1)	Yield (2)	Yield (3)	Yield (4)	Yield (5)
AUD	4.500	5.150	5.800	6.450	7.100
USD	2.043	2.621	3.198	3.775	4.352

Source: CEG analysis

164. If the bond in question has a yield in United States dollars of 3.00%, then by interpolating between the second and third columns in the table above it is possible to show that the approximately equivalent Australian dollar yield is 5.58%. Yields for other foreign currency bonds are converted into Australian dollar yields in the same way.[35]

35 All cross-currency swaps from Bloomberg have been calculated in semi-annual terms, so annualisation is applied after the swap is performed.

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Appendix C Consistency of swapped foreign yields with domestic yields

165. Rule 87(1) of the NGR requires that the rate of return on capital is to be commensurate with prevailing conditions in the market for funds and the risks involved in providing reference services. The obvious question is whether a strategy that involves an Australian company issuing foreign currency bonds and swapping them back into Australian dollars using market swap rates constitutes a source of funding that is within 'the market for funds' as per 87(1).

166. In my opinion, the answer is that the cost of funding using such a strategy should be considered either part of the market for funds, or relevant to the cost in the market for funds, to the extent that:

- Australian businesses, including regulated businesses, engage in such funding strategies for a significant portion of their debt; and/or
- the existence of such a strategy for both borrowers and lenders constrains the yields that can exist on bonds issued in Australian dollars.

167. Australian businesses do engage in foreign currency bond issues which are swapped back into Australian dollars. More generally, the fact that I identify many bonds issued by Australian companies in foreign currencies supports the conclusion that this is an important source of funding for Australian companies.

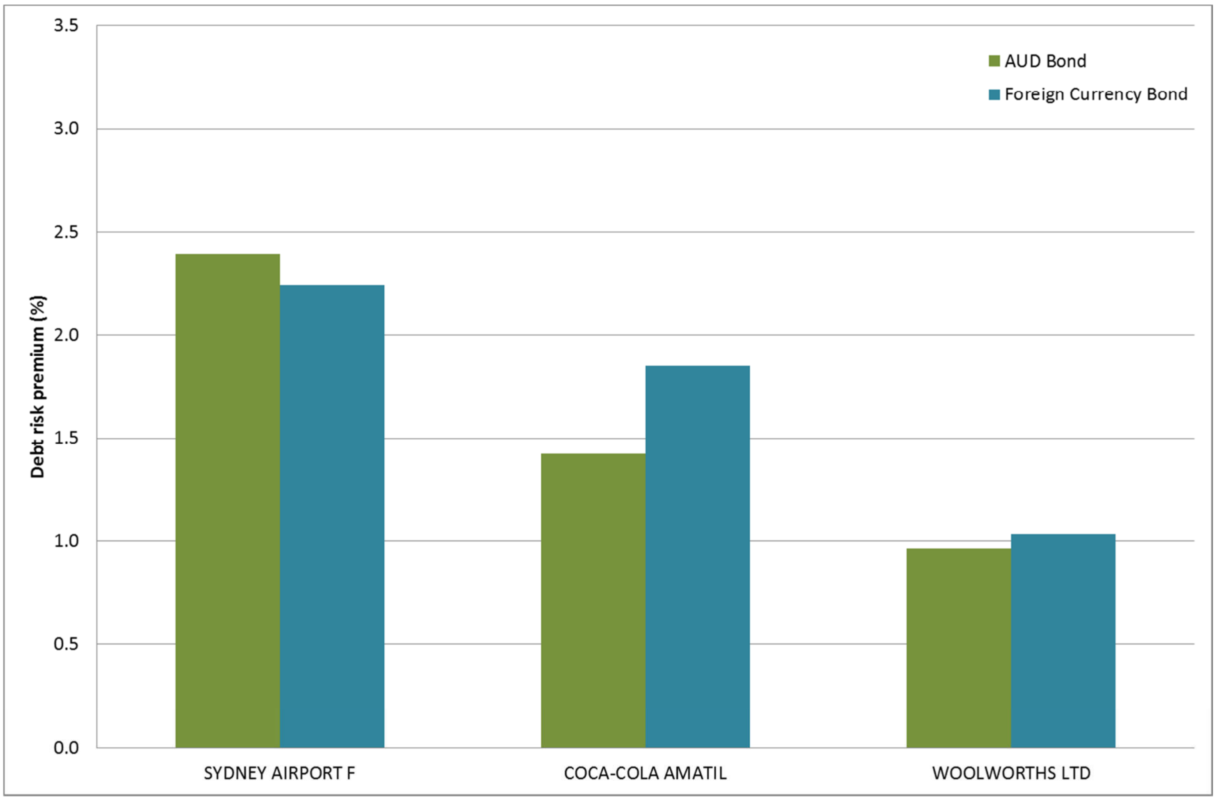
168. However, even if very few Australian companies issued foreign currency bonds, the potential for an Australian company to do so would place a cap on the interest rate that it was prepared to pay on a bond issued in Australia. Similarly, the potential for a lender to buy a bond denominated in a foreign currency and swap it back into Australian dollars places a floor under the yield that they will accept for lending to a similarly risky entity in Australia.

169. For these reasons, it is my view that the yields on foreign currency bonds issued by Australian companies are at least relevant to an assessment of the conditions in the market for funds from which Australian companies raise debt. As such, the cost of funding using such a strategy can, at the minimum, be used as a cross-check on the analysis of Section 3 where I restrict analysis to bonds issued in Australian dollars.

170. I have compared the swapped yield on the foreign currency bonds relied upon in this report (i.e. those issued by Australian firms rated BBB- to A) with the yields on Australian dollar bonds issued by the same firm, with the same rating and with a term to maturity that is within half a year of the foreign currency bond. I have only compared bonds with the same characteristics other than currency of issue (e.g., fixed bonds are compared with fixed bonds and non-callable bonds are compared

with non-callable bonds). This comparison captures only three pairs of bonds which are shown in Figure 8 below.

Figure 8: Comparison of yields on swapped foreign currency bonds and AUD bonds by the same issuer with maturity within 0.5 years



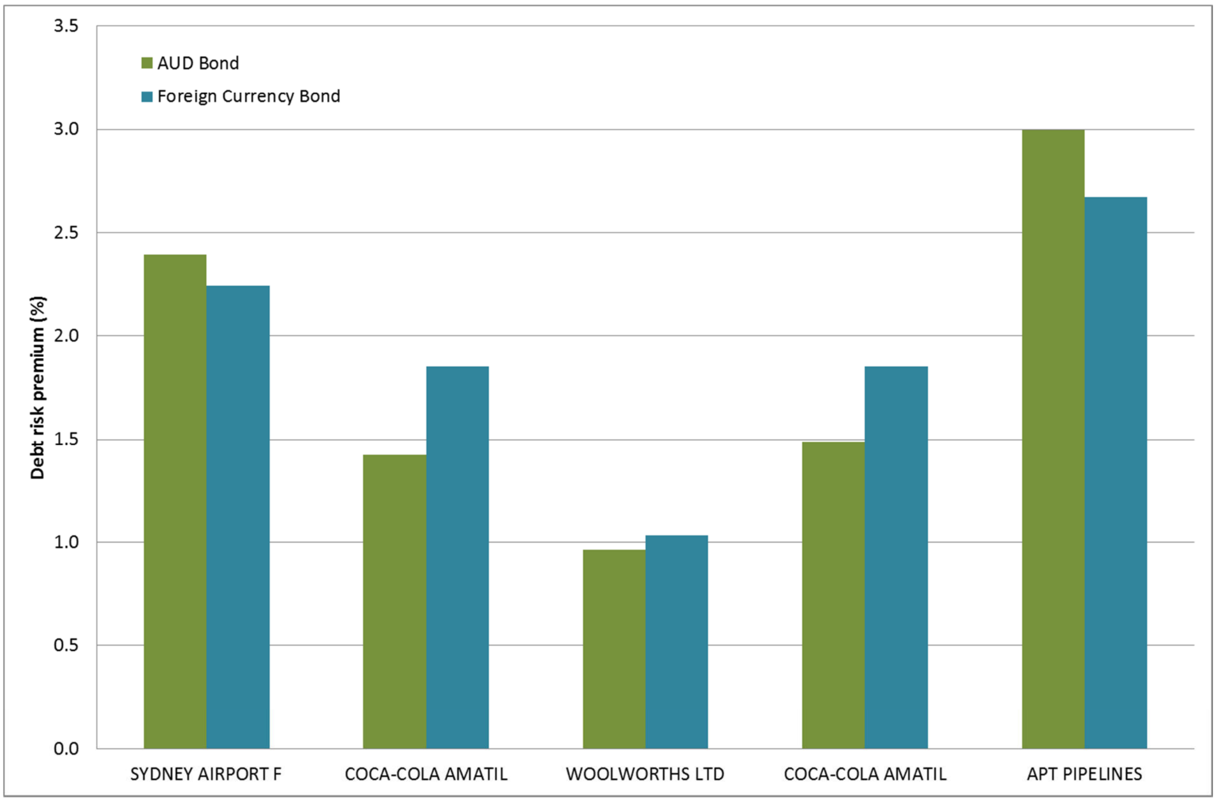
Source: Bloomberg and RBA data, CEG analysis

171. The comparison in Figure 8 does not suggest wide divergences in DRP for Sydney Airport and Woolworths, but there is a difference of about 0.4% for Coca-Cola Amatil.

172. Figure 9 attempts to elicit a wider sample of bonds by extending the bounds for selection so that the bond pair can have a maturity of within one year of each other. This increases the sample of bond pairs to five, with an additional Coca-Cola pair and an APT Pipelines pair.

173. Once again, these comparisons do not suggest wide divergences. Although the DRPs differ by up to 0.4%, the differences go in both directions, suggesting that there is no systematic bias in the swapped yields.

Figure 9: Comparison of yields on swapped foreign currency bonds and AUD bonds by the same issuer with maturity within 1 year



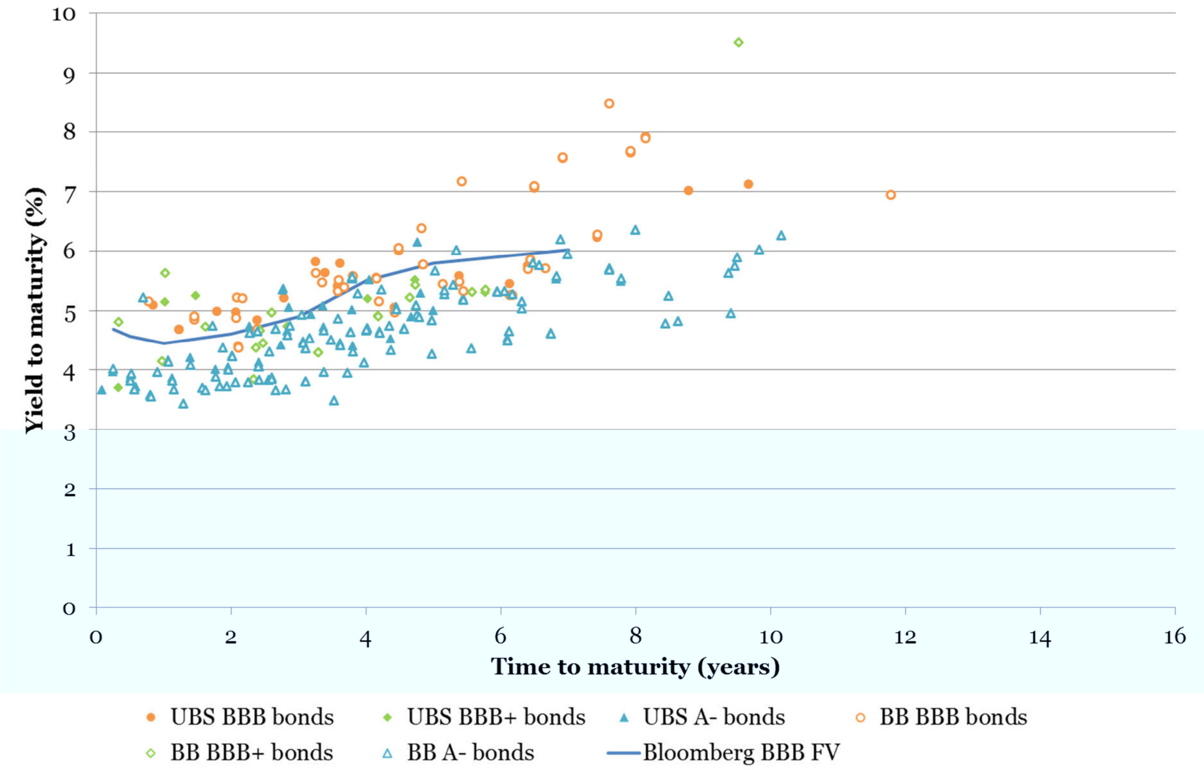
Source: Bloomberg and RBA data, CEG analysis

Appendix D Supplementary to Section 3 – different subsamples of bonds

174. Figure 10 and Figure 16 provide the results of curve fitting applied to other sub-samples of the wider data set, additional to section 3.2.2. The Bloomberg fair value curve remains a good fit to the data in these subsamples.

175. Figure 10 illustrates BBB to A- bonds issued in Australian dollars by any company and in any foreign currency by Australian domiciled companies, excluding bonds with optionality features. This sample contains 197 bonds. Figure 10 contains a subset of the bonds in Figure 1 in section 3.2.2, excluding all bonds which have optionality features other than make-whole callable bonds.

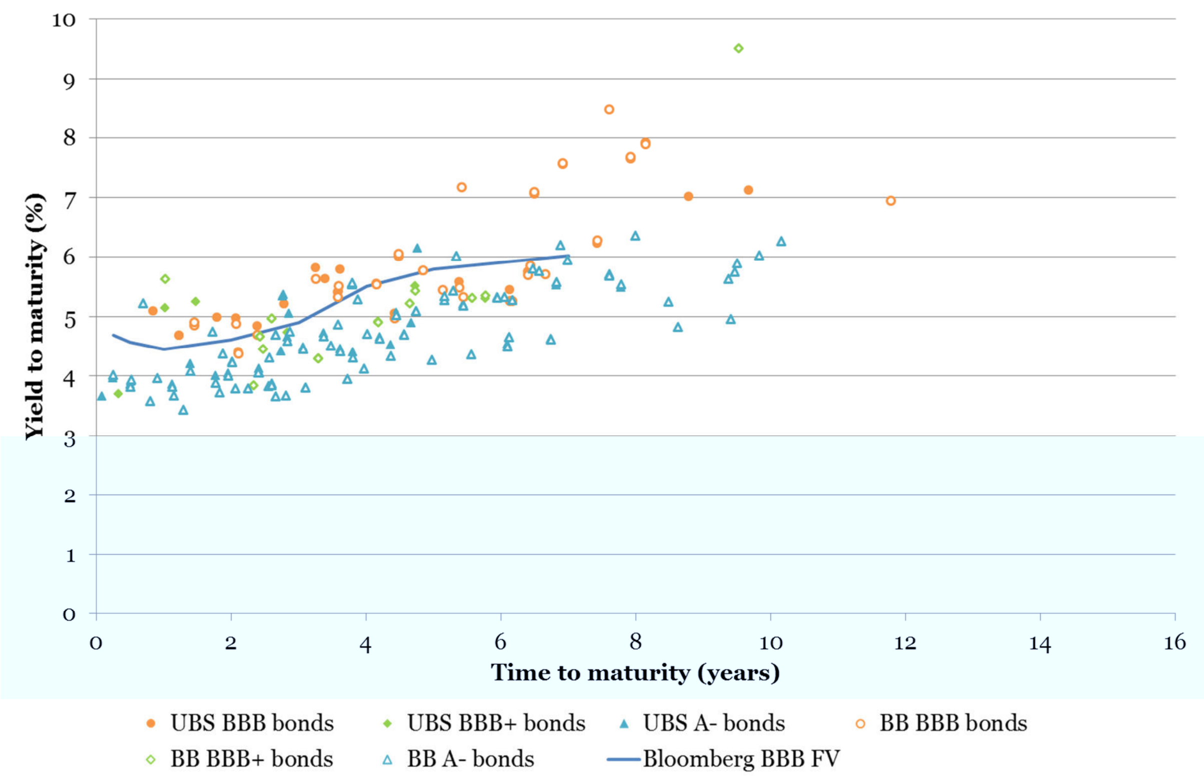
Figure 10: BBB to A- bonds issued in AUD by any company or in any currency by Australian companies, excluding bonds with optionality features



Source: Bloomberg and UBS data, CEG analysis

176. Figure 11 illustrates BBB to A- bonds issued in any currency by Australian domiciled companies, excluding bonds with optionality features. This sample contains 151 bonds. Figure 11 contains a subset of the bonds in Figure 2 in section 3.2.2, excluding all bonds which have optionality features other than make-whole callable bonds.

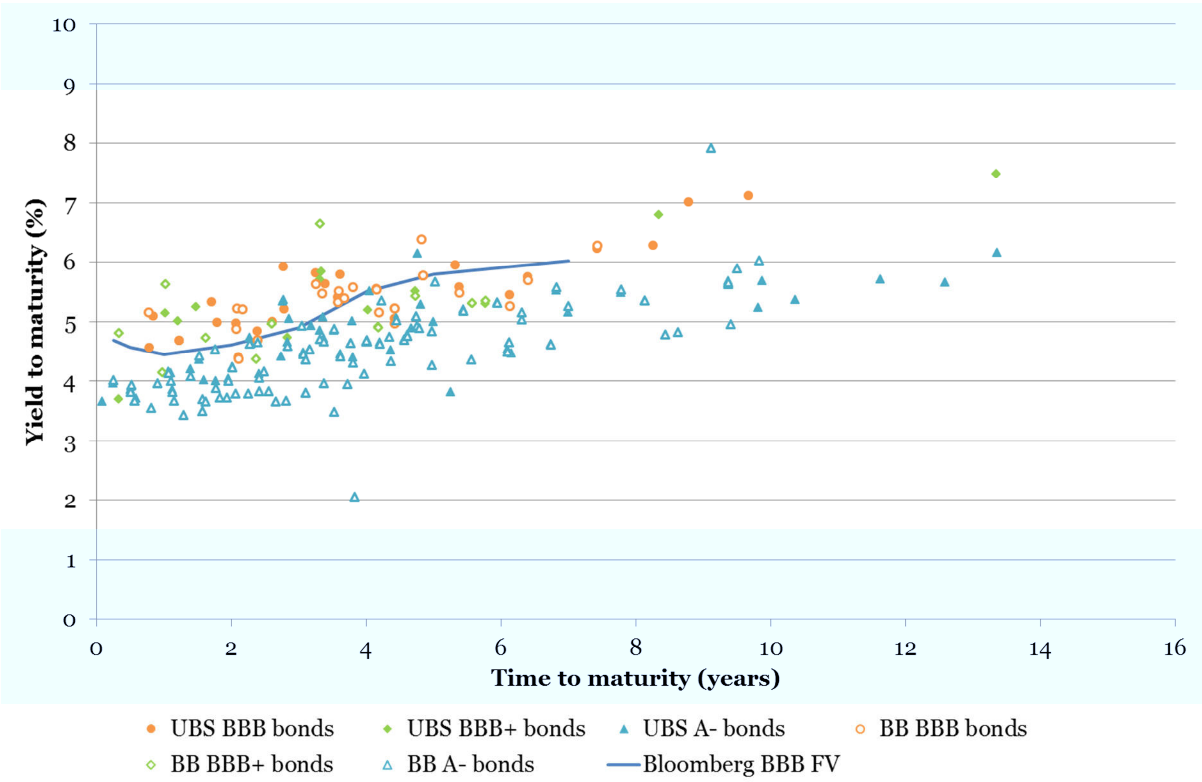
Figure 11: BBB to A- bonds issued in any currency by Australian companies, excluding bonds with optionality features



Source: Bloomberg and UBS data, CEG analysis

177. Figure 12 illustrates BBB to A- bonds issued in Australian dollars by companies domiciled in any jurisdiction. This sample contains 164 bonds. Figure 12 contains a subset of the bonds in Figure 1 in section 3.2.2, excluding bonds which have been issued in foreign currencies by Australian domiciled companies.

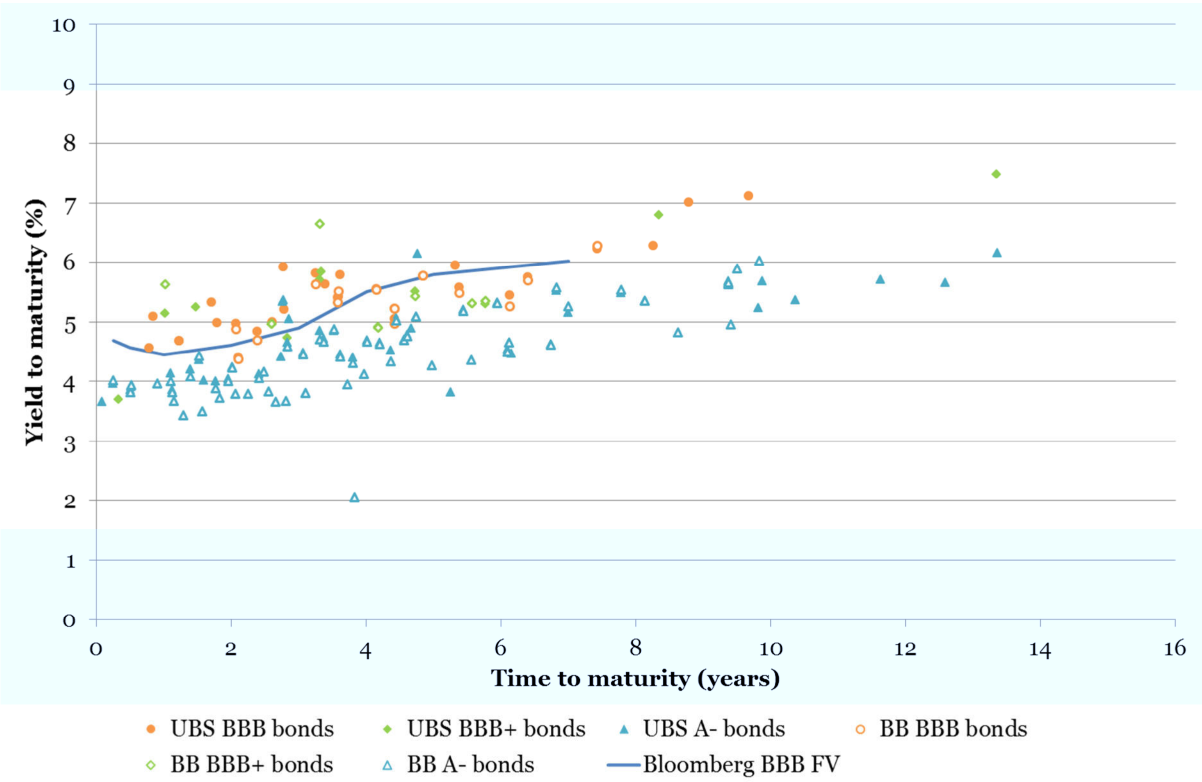
Figure 12: BBB to A- bonds issued in AUD by any company



Source: Bloomberg and UBS data, CEG analysis

178. Figure 13 illustrates BBB to A- bonds issued in Australian dollars by Australian domiciled companies. This sample contains 115 bonds. Figure 13 contains a subset of the bonds in Figure 2 in section 3.2.2, excluding bonds which have been issued in foreign currencies by Australian domiciled companies.

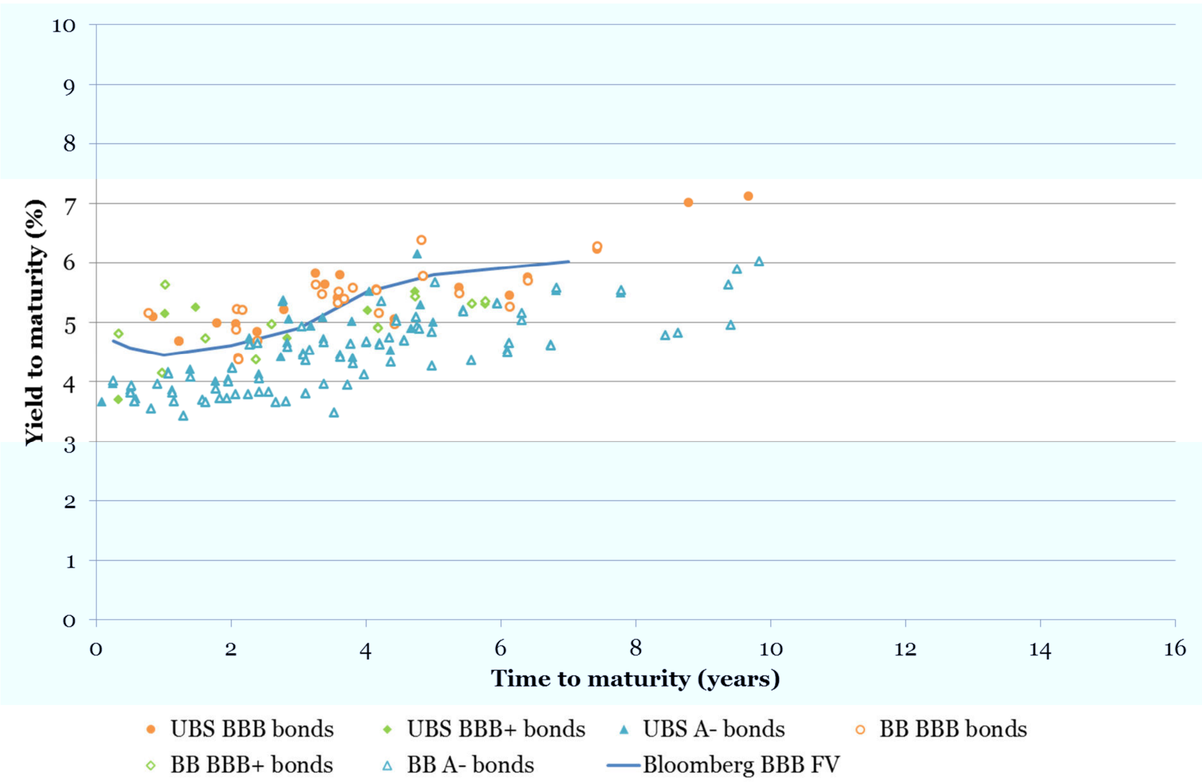
Figure 13: BBB to A- bonds issued in AUD in Australia



Source: Bloomberg and UBS data, CEG analysis

179. Figure 14 illustrates BBB to A- issued in Australian dollars by companies domiciled in any jurisdiction, excluding bonds with optionality features. This sample contains 129 bonds. Figure 14 contains a subset of the bonds in Figure 12 above, excluding bonds with optionality features other than make-whole callable bonds.

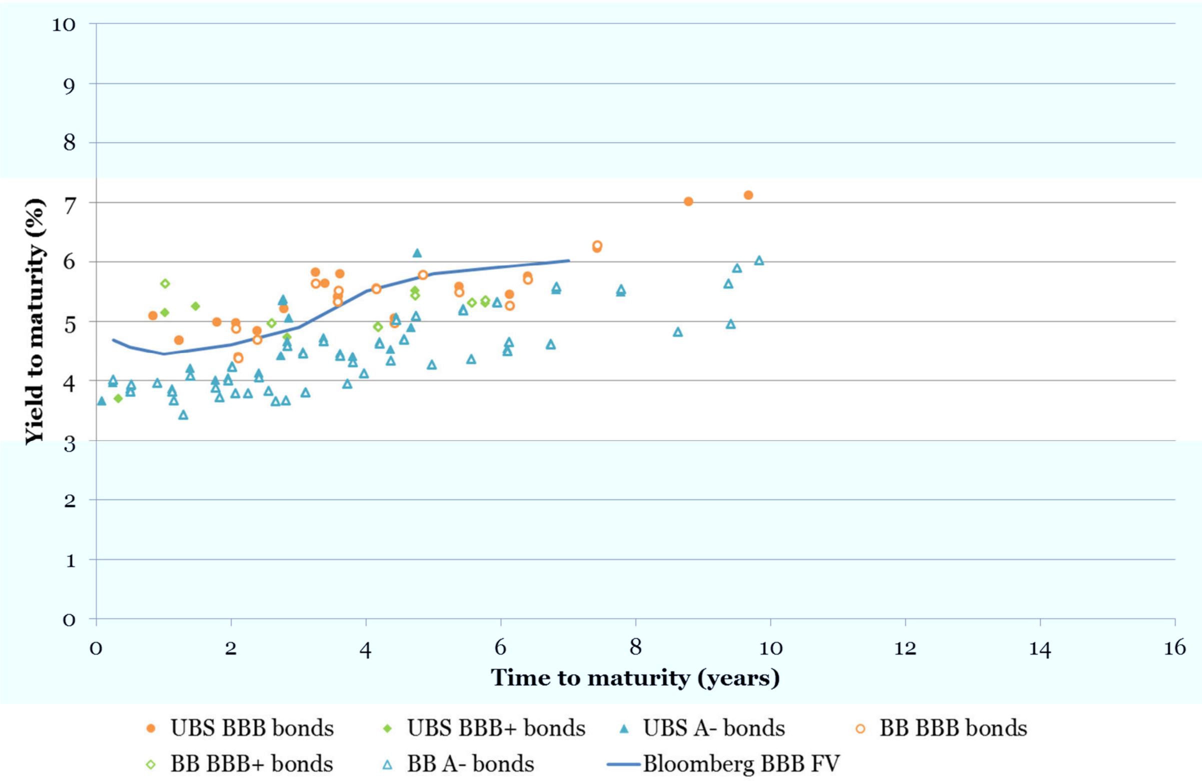
Figure 14: BBB to A- bonds issued in AUD by any company, excluding bonds with optionality features



Source: Bloomberg and UBS data, CEG analysis

180. Figure 15 illustrates BBB to A- bonds issued in Australian dollars by Australian domiciled companies, excluding bonds with optionality features. This sample contains 83 bonds. Figure 15 contains a subset of the bonds in Figure 13 above, excluding bonds with optionality features other than make-whole callable bonds.

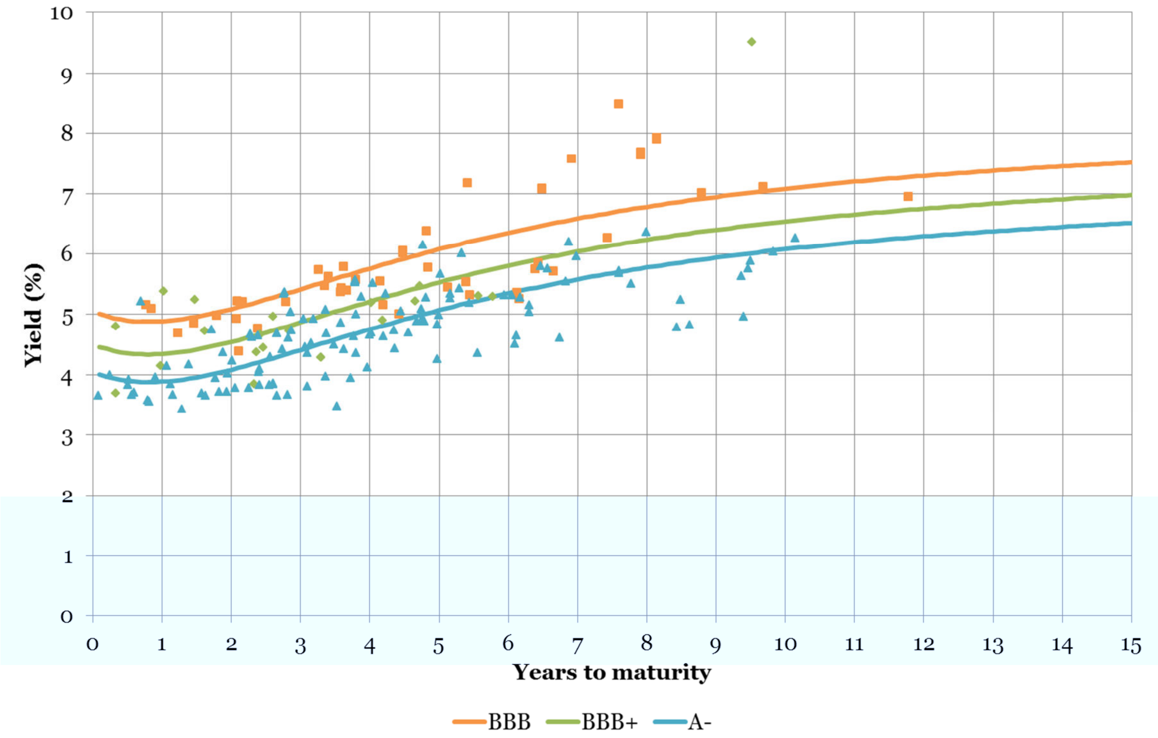
Figure 15: BBB to A- bonds issued in AUD in Australia, excluding bonds with optionality features



Source: Bloomberg and UBS data, CEG analysis

181. Figure 16 illustrates the result of curve fitting the average Bloomberg and UBS yields for BBB to A- bonds issued in Australian dollars by any company or in any foreign currency by Australian domiciled companies, but excluding bonds with optionality features other than make-whole callable bonds. This figure is based on the bonds in Figure 10 in the previous section. The BBB+ 10 year yield is 6.54%, and the corresponding DRP is 3.03%.

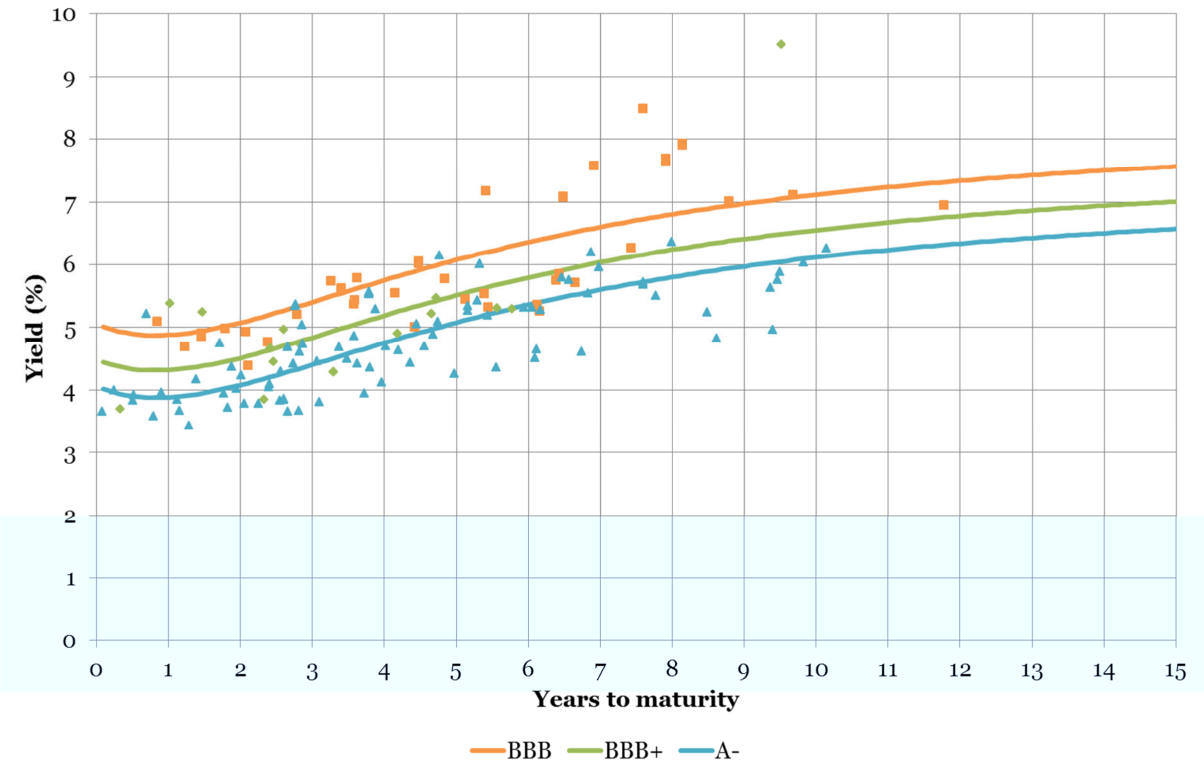
Figure 16: BBB to A- bonds issued in AUD in any country or in any currency in Australia, excluding bonds with optionality features



Source: Bloomberg and UBS data, CEG analysis

182. Figure 17 illustrates the result of curve fitting the average Bloomberg and UBS yields for BBB to A- bonds issued in any currency by Australian domiciled companies, excluding bonds which have optionality features other than make-whole callable bonds. This figure is based on the bonds in Figure 11. The BBB+ 10 year yield is 6.55%, and the corresponding DRP is 3.04%.

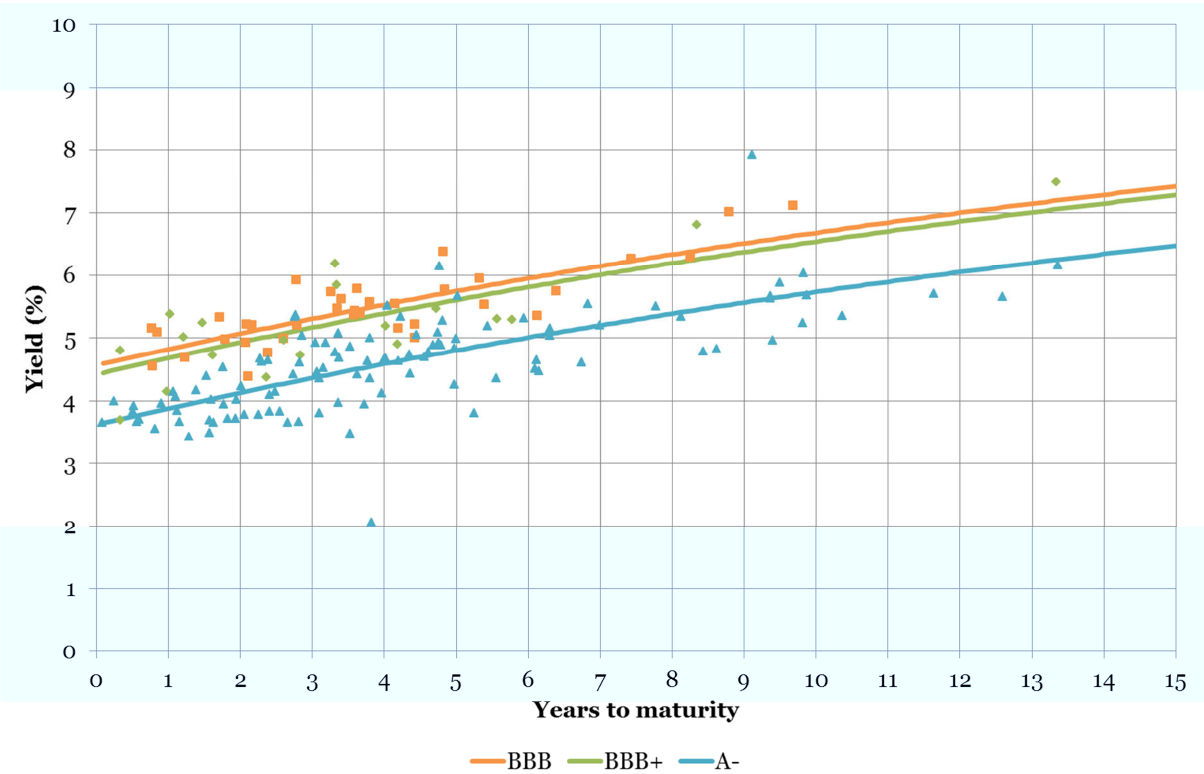
Figure 17: BBB to A- bonds issued in any currency by Australian companies, excluding bonds with optionality features



Source: Bloomberg and UBS data, CEG analysis

183. Figure 18 illustrates the result of curve fitting the average Bloomberg and UBS yields for BBB to A- bonds issued in Australian dollars by any company. This figure is based on the bonds in Figure 12. The BBB+ 10 year yield is 6.54%, and the corresponding DRP is 3.03%.

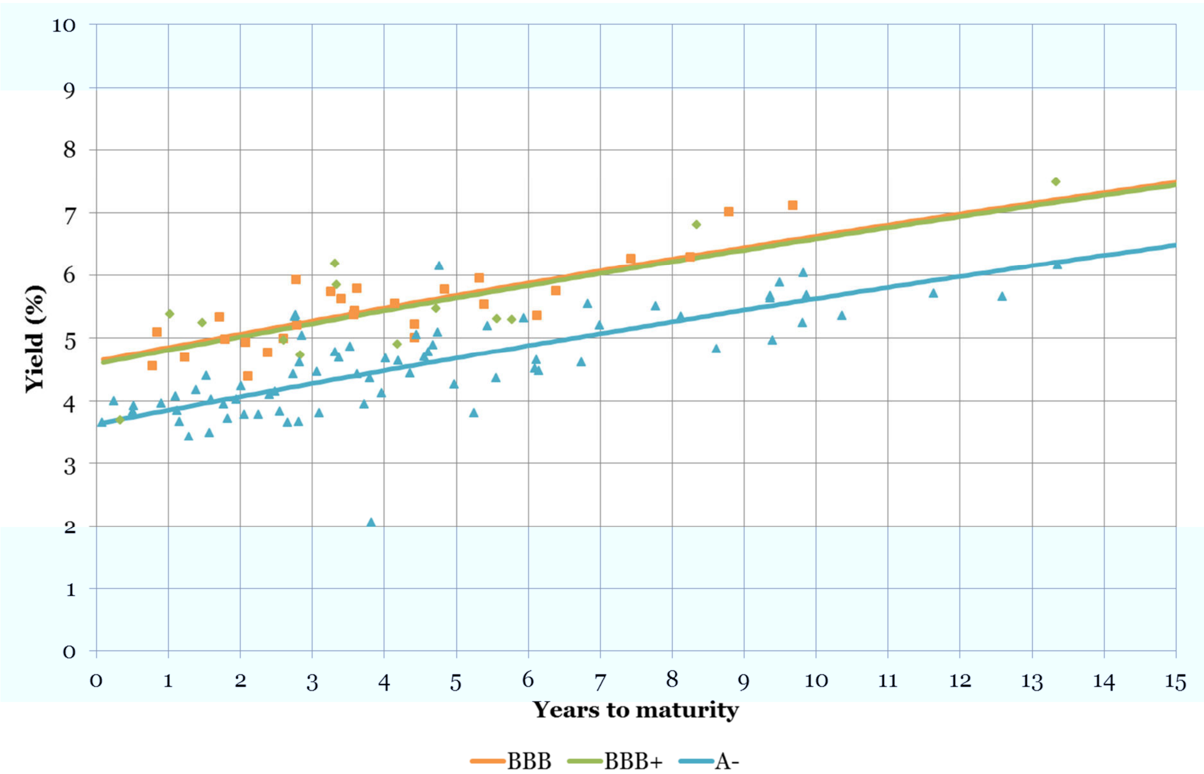
Figure 18: BBB to A- bonds issued in AUD by any company



Source: Bloomberg and UBS data, CEG analysis

184. Figure 19 illustrates the result of curve fitting the average Bloomberg and UBS yields for BBB to A- bonds issued in Australian dollars by Australian domiciled companies. This figure is based on the bonds in Figure 13. The BBB+ 10 year yield is 6.58%, and the corresponding DRP is 3.07%.

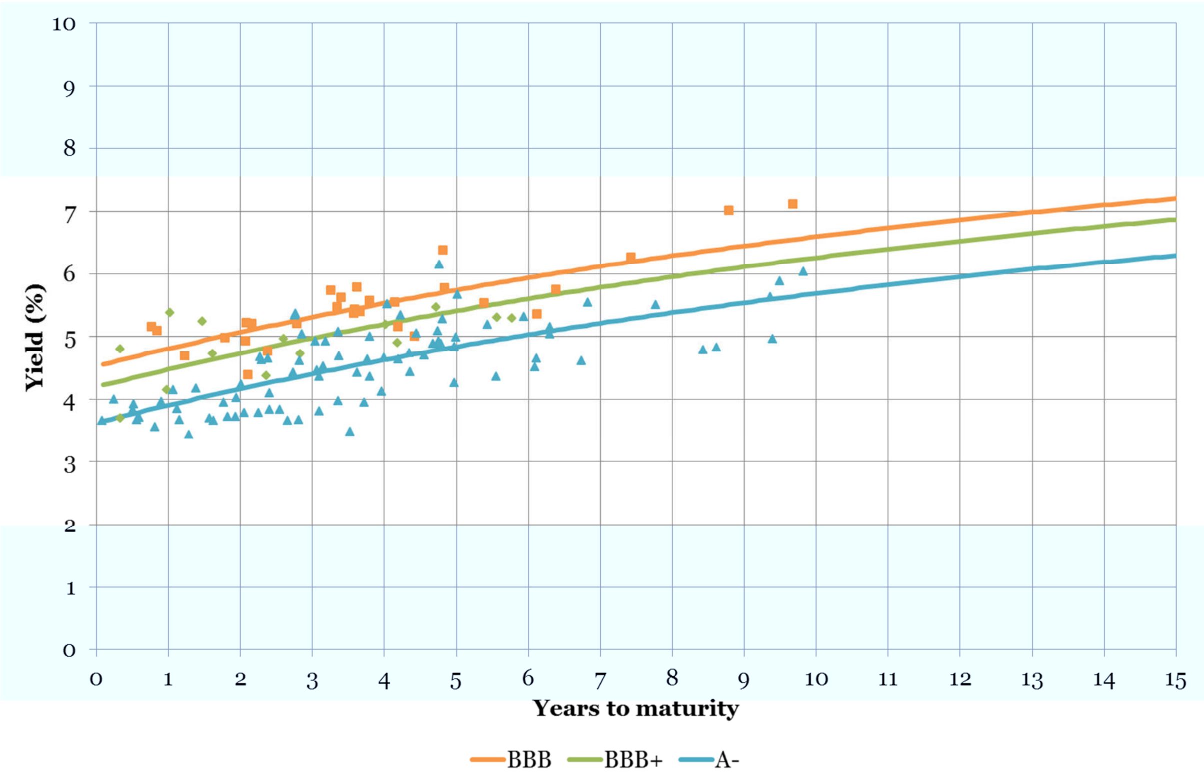
Figure 19: BBB to A- bonds issued in AUD by Australian companies



Source: Bloomberg and UBS data, CEG analysis

185. Figure 20 illustrates the result of curve fitting the average Bloomberg and UBS yields for BBB to A- bonds issued in Australian dollars by any company including those domiciled outside Australia, excluding bonds which have optionality features other than make-whole callable bonds. This figure is based on the bonds in Figure 14. The BBB+ 10 year yield is 6.26%, and the corresponding DRP is 2.75%.

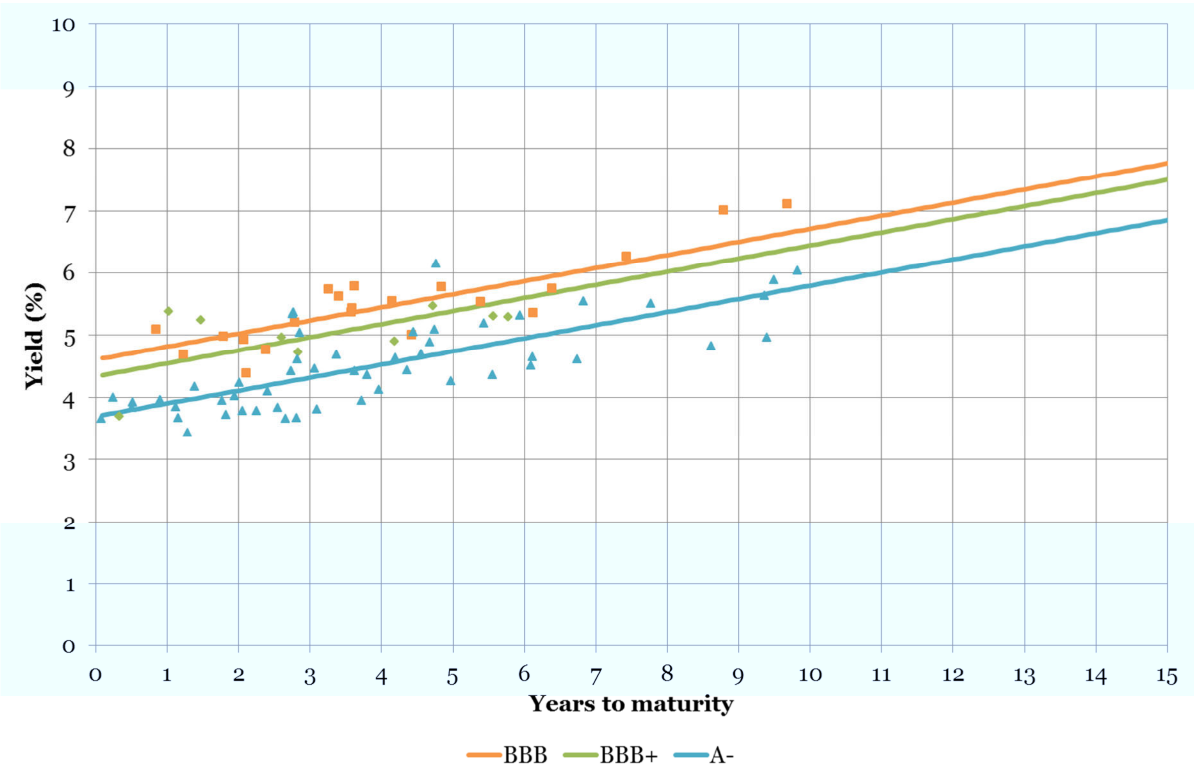
Figure 20: BBB to A- bonds issued in AUD by any company, excluding bonds with optionality features



Source: Bloomberg and UBS data, CEG analysis

186. Figure 21 illustrates the result of curve fitting the average Bloomberg and UBS yields for BBB to A- bonds issued in Australian dollars by Australian domiciled companies, excluding bonds with optionality features other than make-whole callable bonds. This figure is based on the bonds in Figure 15. The BBB+ 10 year yield is 6.44%, and the corresponding DRP is 2.93%.

Figure 21: BBB to A- bonds issued in AUD by Australian firms, excluding bonds with optionality features



Source: Bloomberg and UBS data, CEG analysis

Appendix E Curriculum vitae

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Economics of competition, regulation and damages

Curriculum Vitae

Dr Tom Hird / Director

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Key Practice Areas

Tom Hird is a founding Director of CEG's Australian operations. In the six years since its inception CEG has been recognised by Global Competition Review (GCR) as one of the top 20 worldwide economics consultancies with focus on competition law. Tom has a Ph.D. in Economics from Monash University. Tom is also an Honorary Fellow of the Faculty of Economics at Monash University and is named by GCR in its list of top individual competition economists.

Tom's clients include private businesses and government agencies. Tom has advised clients on matters pertaining to: cost modeling, valuation and cost of capital.

In terms of geographical coverage, Tom's clients have included businesses and government agencies in Australia, Japan, Korea, the UK, France, Belgium, the Netherlands, New Zealand, Macau, Singapore and the Philippines. Selected assignments include:

Selected Projects

- Advice to Chorus New Zealand on the estimation of the cost of capital;
- Advice to Wellington Airport on the estimation of the cost of capital;
- Advice to Vector on appeal of the New Zealand Commerce Commission decision on the cost of capital.
- Expert evidence in relation to the cost of capital for Victorian gas transport businesses.
- Advice to Everything Everywhere in relation to the cost of capital for UK mobile operators - including appearance before the UK Commerce Commission.
- Expert evidence to the Australian Competition Tribunal on the cost of debt for Jemena Electricity Networks.
- Advice to Integral Energy on optimal capital structure.
- Advice to ActewAGL on estimation of the cost of debt
- Advising NSW, ACT and Tasmanian electricity transmission and distribution businesses on the cost of capital generally and how to estimate it in the light of the global financial crisis.
- Advice in relation to the appeal by the above businesses of the Australian Energy Regulator (AER) determination.

- Expert testimony to the Federal Court of Australia on alleged errors made by the Australian Competition and Consumer Commission (ACCC) in estimating the cost of capital for Telstra.
- Advice to T-Mobile (Deutsche Telekom) on the cost of capital for mobile operators operating in Western Europe.
- Advising Vivendi on the correct cost of capital to use in a discounted cash flow analysis in a damages case being brought by Deutsche Telekom.
- Advising the AER on the cost capital issues in relation to the RBP pipeline access arrangement.
- Advising the ENA on the relative merits of CBASpectrum and Bloomberg's methodology for estimating the debt margin for long dated low rated corporate bonds.
- Advising the Australian Competition and Consumer Commission, Australia on the correct discount rate to use when valuing future expenditure streams on gas pipelines.