[redacted]

22 November 2018

Ms Nicola Cusworth
Chair, Economic Regulation Authority
Level 4, Albert Facey House
469 Wellington Street
PERTH WA 6000

Dear Ms Cusworth

Re: Implementation of the Debt Risk Premium Estimation Process

Thank you for the opportunity to comment on the Implementation of the Debt Risk Premium Estimation Process published on 5 November 2018. This letter outlines a submission from ATCO Australia (ATCO).

As an owner and operator of energy and logistics infrastructure in Australia for over 55 years, ATCO is proud of its ongoing commitment to supporting the communities in which we operate. ATCO is a long-term investor with a clear vision of delivering customer value through sustainable growth, continuous investment, improvement and innovation.

The disruption of energy markets has highlighted the importance of consistent policy settings, regulatory certainty and appropriate investment signals to ensure that customers continue to receive safe, affordable and reliable energy.

Overarching comments

ATCO makes the following overarching comments in relation to the ERA's proposed process. The attached submission elaborates on these observations:

- ATCO commends the ERA on the detail that has been published to make the application of the bond yield approach more transparent and mechanical. However, having now seen in full the proposed process ATCO considers that it is very complex and that it still requires the exercise of discretion that will not be possible under the binding rate of return framework.
- ATCO considers that the adoption of the RBA, Bloomberg and Reuters curves will result in a more transparent and replicable estimate of the debt risk premium. The approach proposed by ATCO is simpler and will meet the requirement that estimation of the debt risk premium is achieved by a mechanistic process without the use of judgement or discretion. Analysis of data from past years also indicates the estimates of the debt risk premium will be very similar to those achieved under the ERAS's proposed process. Adoption of ATCO's proposed method will provide stakeholders with the surety that the service provider will have the reasonable opportunity to recover its efficient costs consistent with the revenue and pricing principles.

ATCO continues to seek the opportunity to comment on the ERA's draft decision on market risk premium before the publication of the final Guidelines. The draft Guidelines did not set out the ERA's draft decision under a binding instrument for market risk premium, instead the ERA's Explanatory Statement is seeking comments on a range of options to determine the market risk premium.

Providing an opportunity to comment on the ERA's draft decision for market risk premium will allow stakeholders to provide alternative points of view on whether the ERA's position on market risk premium meets the National Gas Objective and the Revenue and Pricing Principles.

About ATCO

ATCO is a customer-focussed global company that develops, builds, owns and operates a range of energy infrastructure assets, supporting residential, business and commercial consumers. ATCO has been proudly operating in Australia and providing employment opportunities for more than half a century. In Australia, ATCO:

- owns and maintains two non-regulated gas distribution networks in Albany and Kalgoorlie, together with the largest (Mid-West and South-West) gas distribution network in Western Australia, servicing over 750,000 connections through more than 14,000 km of natural gas pipelines and associated infrastructure;
- owns and operates two power generation facilities (a joint-owned facility in Adelaide and a wholly-owned facility in Karratha) with a combined capacity of 266 MW; and
- manufactures and delivers modular building solutions to a diverse group of customers.

ATCO's Australian businesses are part of the worldwide ATCO Group with approximately 7,000 employees and assets of $22 billion. ATCO is engaged in pipelines and liquids (natural gas transmission, distribution and infrastructure development, energy storage, and industrial water solutions); electricity (electricity generation, transmission, and distribution); retail energy; and structures and logistics.

If you have any questions or would like to discuss any of these issues further please contact me or Matthew Cronin, General Manager Strategy & Regulation.

Yours sincerely

[redacted]

J.D Patrick Creaghan
Managing Director & Chief Operating Officer

Attachment 1: ATCO Australia submission

Attachment 2: CEG - Report on ERA cost of debt estimation

ATTACHMENT 1: ATCO SUBMISSION

CONSULTATION ON IMPLEMENTATION OF THE DEBT RISK PREMIUM ESTIMATION PROCESS

PUBLIC

22 November 2018

An appropriate citation for this paper is:

Attachment 1: ATCO Submission

Our Ref: 97941615

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Table of Contents

1. Introduction

1. ATCO welcomes the opportunity to provide a submission on the Economic Regulation Authority's (ERA) technical debt risk premium (**DRP**) process documents and accompanying tools, which were published on 5 November 2018.
2. On 29 June 2018, the ERA published its Draft Rate of Return Guidelines for Gas Transmission and Distribution Networks ('**Guidelines**'). At the ERA's public forum and in submissions on the Guidelines, stakeholders requested that the ERA provide a detailed technical process to implement the Guidelines' DRP method.
3. On 28 September 2018, ATCO made a submission to the ERA that sought, amongst other things, for the Guidelines to be modified to include sufficient detail to allow for the mechanistic application of the ERA's revised bond yield approach to calculate the DRP.
4. On 5 November 2018, the ERA published technical DRP process documents and accompanying tools, consistent with the DRP method detailed in the Guidelines. These process documents and tools include:
   - DRP process for updating in R
   - DRP process for updating in Excel
   - DRP update Excel template
   - DRP update R code package
5. The ERA advise that these provide the technical steps and detail necessary for stakeholders to estimate the DRP.
6. ATCO commends the ERA on the detail that has been published to make the application of the bond yield approach more transparent and mechanical. However, having now seen in full the proposed process, ATCO considers that it is very complex and that it still requires the exercise of discretion that will not be possible under the binding rate of return framework.
7. ATCO has undertaken a review of the new documentation and tools. Our findings are summarised in Table 1.1:

Table 1.1: Summary of ATCO's review of the new documentation and tools

ISSUE	SUMMARY OF ATCO'S POSITION
Complexity of method versus accuracy of estimate	The proposed method using R provides more reliable estimates than the Excel method. However, a simpler method is available that historical analysis shows produces similar estimates.
Mechanistic process and outliers	It is not possible to pre-specify a set of rules that will allow a mechanistic approach to outliers in all contexts where those outliers produce unreasonable results. Therefore, the ERA's proposed approach cannot be mechanistic. The presence of outliers in the sample is a particularly pertinent example, since small movements in outliers can result in unpredictable changes in yield curve estimates. The ERA's proposed approach cannot be both mechanistic and reliable.
Potential volatility of BBB+ estimates	The proposed change to a BBB+ credit rating from broad BBB increases the likelihood of volatile estimates. The proposed ERA method could be improved in several ways to reduce potential volatility (refer to Section 3.4).

ISSUE	SUMMARY OF ATCO'S POSITION
Effectiveness of ERA contingency policies	Using simpler approaches such as applying the AER's method for averaging the RBA, Bloomberg and Reuters yield curves reduces the likelihood of the need for a contingency approach. Should the simpler method be adopted the R method could then be adopted as a contingent approach

8. Having reviewed the ERA's new documentation and tools, ATCO submits that it would still not result in a method for estimating the DRP that would be as reliable and transparent as using public or subscription data series, which remains the best approach as submitted by ATCO in August 2015.

9. ATCO submits that the ERA should adopt the AER's method for averaging the RBA, Bloomberg, and Reuters curves to estimate the DRP as this avoids the complexity of the ERA's proposed process while producing similar and unbiased results[1].

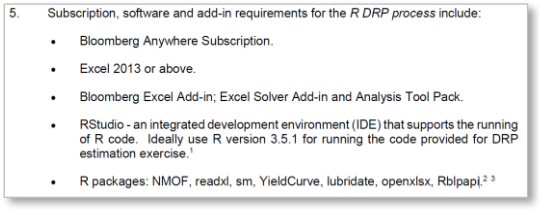
[1] In this submission, all references to averaging the RBA, Bloomberg and Reuters curves refer specifically to the AER's method for estimating the 10-year spread to swap, as set out in the AER's draft guidelines. The method includes procedures for extrapolating the RBA's Gaussian Kernel to a 10-year effective tenor, as well as extending the Bloomberg and Reuters curves to 10 years in the event that no 10-year estimate is published for those curves.

2. ATCO's Draft Guideline submission

10. In ATCO's 28 September 2018 submission to the ERA, ATCO submitted that the Guidelines could be improved by including additional information to allow for the mechanistic calculation of the DRP.

11. ATCO's submission provided a list of items that it sought to be included in the Guidelines. Table 2.1 summarises ATCO's feedback and how it has been addressed in the process documents and accompanying tools.

Table 2.1: Summary of ATCO feedback

ATCO FEEDBACK: ADDITIONAL INFORMATION TO INCLUDE IN PROCESS DOCUMENTATION	**FEEDBACK ADDRESSED**	**ATCO'S ASSESSMENT OF PROCESS DOCUMENTS AND ACCOMPANYING TOOLS[2]**
1. Any pre-requisites required to calculate the DRP, including any software or subscription requirements. For example: a) the required Bloomberg packages/subscriptions; b) the required settings for the Bloomberg terminal; and c) the required version of Excel and any add-in packages.	✓	• The process documents detail the subscription, software and add-in requirements in paragraph 5.  5. Subscription, software and add-in requirements for the *R DRP process* include: • Bloomberg Anywhere Subscription. • Excel 2013 or above. • Bloomberg Excel Add-in; Excel Solver Add-in and Analysis Tool Pack. • RStudio - an integrated development environment (IDE) that supports the running of R code. Ideally use R version 3.5.1 for running the code provided for DRP estimation exercise.[1] • R packages: NMOF, readxl, sm, YieldCurve, lubridate, openxlsx, Rblpapi.[2 3]
2. Definitions of the roles of the ERA and service providers in the annual calculation process. For example, the ERA's Final Decision for ATCO dated 10 September 2015[3] sets out the roles of the ERA and ATCO in the annual process.	–	• This item of feedback has not been addressed in the process documents. • ATCO considers that the process documents should be amended to detail the roles of the ERA and ATCO in the annual process.

2 Table and paragraph references refer to "Appendix 1: DRP process for updating R", published by the ERA in November 2018.

3 ERA, Final Decision on Proposed Revisions to the Access Arrangement for the Mid-West and South-West Gas Distribution Systems, 10 September 2015, pparagraph 1767

ATCO FEEDBACK: ADDITIONAL INFORMATION TO INCLUDE IN PROCESS DOCUMENTATION	**FEEDBACK ADDRESSED**	**ATCO'S ASSESSMENT OF PROCESS DOCUMENTS AND ACCOMPANYING TOOLS[2]**
3. The detailed criteria of the bonds to include in the calculation of the DRP must be specified in the Guidelines. a) The Guidelines should be explicit about the number of bonds required in order to derive a reliable estimate of the DRP in any given year. b) The Guidelines should remove any ambiguity in how the ERA will apply the BBB+ credit rating to the bonds sample and what will occur if the minimum numbers of BBB+ bonds required to estimate the DRP reliably are not available. c) The Guidelines must include all the information detailed in Table 13 of the Explanatory Statement (for example the Consolidate criteria is currently missing) and must specify what is to occur if no bonds match the criteria or a reliable estimate of the DRP is not available. If no bonds match the criteria, ATCO submits that the ERA should use the RBA's Aggregate Measures of Australian Corporate Bond Spreads and Yields data for the BBB band credit rating.[4]	✓	• The process documents detail: o the criteria of the bonds to include in the calculation of the DRP in Table 2; and o the contingency approach if there are an insufficient number of bonds, if there is an estimate divergence and if Bloomberg data is unavailable in Table 9. • If the RBA data is needed, the ERA have proposed to adopted blend of 1/3 A and 2/3 BBB. • ATCO notes that Table 2 does not include the 'Consolidate' feature and seeks for the ERA to confirm whether this is necessary.
4. The detailed step-by-step process and formulas required to convert foreign currency yields into Australian dollar equivalents. Appendix 5 from the ERA's Final Decision for ATCO dated 10 September 2015 is an example of the minimum level of detail required in the Guidelines.	✓	• The process documents detail the process to convert foreign currency yields into Australian dollar equivalents in Section 7.

[4] ERA, Final Decision on Proposed Revisions to the Access Arrangement for the Mid-West and South-West Gas Distribution Systems, 10 September 2015, Table 157

ATCO FEEDBACK: ADDITIONAL INFORMATION TO INCLUDE IN PROCESS DOCUMENTATION	**FEEDBACK ADDRESSED**	**ATCO'S ASSESSMENT OF PROCESS DOCUMENTS AND ACCOMPANYING TOOLS[2]**
5. The detailed step-by-step process and formulas required to calculate the DRP, including identifying whether any specific steps are required to occur on a particular day and at a particular time. Appendix 8 from the ERA's Final Decision for ATCO dated 10 September 2015 is an example of the minimum level of detail required in the Guidelines.	✓	• The process documents detail the process to calculate the DRP in sections 6 - 12. • Paragraph 24 details the requirement to wait 24 hours after the date identified as the final trading day in the averaging period before commencing the process.
6. Publishing an Excel spreadsheet that can be used to calculate the DRP in accordance with the mechanistic method detailed in the Guidelines.	✓	• The process documents and accompanying tools include a spreadsheet to calculate the debt risk premium. • ATCO considers that the ERA preference for the R implementation results in a process that is not transparent or replicable, requires an additional skillset and increases the complexity of the estimation process. However, ATCO acknowledges that where the simpler AER method (of averaging the RBA, Bloomberg, and Reuters curves) requires the use of a contingent method, the R method may produce reliable estimates subject to data availability

12. The following sections consider the ERA's proposed process in detail.

3. The ERA's proposed process

3.1 Context

13. ATCO (assisted by CEG) has completed a detailed review of the ERA's detailed process for updating in R[5]. CEG's detailed report can be found in Attachment 2.[6]

14. The ERA has detailed a process that uses three different systems:

    1. **Bloomberg**: The DRP process step 1 requires the use of the Bloomberg search SRCH <GO> facility to search for bonds. The search results are then exported into Microsoft Excel.

       The DRP process step 2 requires 'pricing source defaults' to be set in the Bloomberg terminal.

    2. **Microsoft Excel**: DRP process steps 1, 2 and 3 require the use of Microsoft Excel to download data from Bloomberg and to calculate the average yields over the averaging period.

    3. **R-studio**: DRP process steps 4, 5 and 6 require the use of R-studio to undertake the curve fitting process, estimate the cost of debt, and estimate the annual DRP.

3.2 Overarching comments

15. ATCO submits that the proposed process:

    - is complex;
    - lacks transparency;
    - may not be replicable;
    - will be difficult to resource; and
    - requires the exercise of discretion.

16. Much of the process remains manual and is therefore subject to error.

17. The interfaces between the systems are another potential source of failure. The ERA has recognised that the main weakness of the proposed process; *the connectivity between Excel and Bloomberg*, can result in requested data not downloading or being incomplete.[7]

18. The transparency of the outcomes from the proposed process is hindered by:

    - **Proprietary Bloomberg data**: ATCO understands Bloomberg data cannot be shared by the ERA with the network service providers. As a result, the network service provider is unable to review or audit the ERA's estimation of the annual DRP. In the context of a mechanistic approach, this is unsatisfactory given the possible errors that could arise in the process due to manual steps or the interfaces between the various systems. It is also unclear from the process what would occur if an error was identified. Although the proprietary data issue exists with any method that relies on the use of subscription data, a method that uses simple averages of yield curves provided by subscription data at a point in time is more likely to be replicated than if steps are required using multiple subscription data screens to calculate that yield.

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5 ERA, Appendix 1 DRP process for updating in R, 5 November 2018

6 CEG, Report on ERA cost of debt estimation November 2018

7 ERA, Appendix 1 DRP process for updating in R, 5 November 2018, Para 58-64

- **R and R-studio**: While it may be true that R is statistically more robust than Excel, R is not widely adopted in industry and is considered a niche skillset. ATCO does not have the internal resources that can understand the workings of the R Code and whether it is producing reasonable outcomes. The current implementation in Excel can be more widely understood given that Excel is commonly used in industry. ATCO submits that the use of R and R-studio should be carefully considered as there may be an additional cost to access the R skill-set.
- **R Packages**: The ERA requires certain R packages to be adopted, however it hasn't been specified *what version* of each package is required. Many R packages are open source software and subject to change at any time by anyone. ATCO considers that there is a risk that the ERA's proposed process could operate unexpectedly if the implementation of any of the packages is amended, however under the binding guidelines ATCO would be required to adopt the resultant DRP estimate. Should the R package be used the version to be used must be specified and quarantined from potential unauthorised change.
- **Access to experts to validate the DRP outcomes**: ATCO considers that validating the ERA's annual estimation of the DRP will become more challenging and costly. ATCO has previously sought the assistance of experts to verify the ERA's DRP calculation and expects that its ability to obtain competitive proposals for this work will be hindered by the requirement for the expert to have access to both a Bloomberg Anywhere subscription and the R skillset.
- **Ability to replicate results**: The NSS method use of the differential evolution algorithm, means that there is randomness each time that the program is run. This means that it cannot be assumed that the estimate will always be the same – even if the data used is exactly the same.[8]

19. ATCO considers that the proposed process cannot be applied without discretion. There are two areas that require the exercise of discretion:

1. **Failed data requests:** The proposed process requires that the use of visual inspection to confirm any failed data requests from Bloomberg. This requires the exercise of discretion and is likely to be error prone. ATCO submits that a mechanistic solution is needed to confirm that the data has correctly downloaded.
2. **Validity of the process outcomes:** It is not feasible to both:
   a) pre-specify a set of rules that can adequately anticipate all potential circumstances (e.g. combinations of bond yields in a sample) in which the ERA's three estimates will result in a biased estimate; and
   b) pre-specify the *context specific* adaptation of the method to the characteristics of that particular sample of bonds[9].

Therefore, it is not possible to specify a completely mechanistic and reliable method given the proposed ERA approach to estimating the DRP.

3.3 Review of proposed R process

20. ATCO has sought expert advice from CEG to review the ERA's proposed process in R.

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8 CEG, Report on ERA cost of debt estimation, November 2018, paragraph 50. The ERA could modify the approach so that this will not be an issue if the code is rewritten to use the same random seed each time

9 CEG, Report on ERA cost of debt estimation, November 2018, paragraph 14

21. CEG have run the proposed process to estimate the DRP for the last four calendar years.

22. CEG have not identified any errors in the R code that may impact the running and output of the code, except a minor mismatch in columns names between Excel and R. This can be corrected by changing cell A1 of the "Allowed trading days" sheet from "Date (Manual Entry)" to "Date"[10].

23. CEG make some observations as a result of running the proposed process to estimate the DRP for the last four calendar years[11].

- R estimates tend to have higher 10-year estimates with the full sample[12] – but more similar to Excel excluding long-term bonds.
- For this sample, the R estimates do not change materially when long-term bonds are removed – suggesting that the effect of the long-term bonds is most significant in Excel.
- The SSRs generated from R and Excel do not indicate that one method generates consistently lower SSR than the other. However, in cases where there is a large difference between the two SSR estimates, R generally produces lower SSRs

24. ATCO considers that the review undertaken by CEG demonstrates that the proposed process in R has been implemented in a manner consistent with the existing process, although there are issues with the transparency and repeatability of the process. (Refer to paragraph 18 above).

3.4 Amendments to the proposed R process

25. CEG have found that a number of improvements to the proposed process in R for the estimate of the 10-year DRP are possible by making it less dependent on a limited sample of bonds, or less subject to the influence of outliers or the particular estimation method used.

26. CEG have recommended the following changes[13]:

- **Outliers**: Bonds with longer maturities, say greater than 50 years, do not follow the same yield curve as bonds with shorter maturities around 10 years. CEG have discussed these bonds in section 4.1 of their report and note the difficulties in understanding if these bonds are correctly priced.[14] The longer maturity bonds included in the sample of bonds to calculate a 10 year debt risk premium may bias the estimate downwards. Therefore, consideration should be given to excluding these bonds from the sample.
- **Broadening the sample**: Assuming the adoption of a BBB+ credit rating, the bond sample should be widened to include both A- and BBB bonds. The stability of results would be improved as they are less likely to be influenced by outliers due to the increased number of bonds in the sample. Each A- and BBB observation should be weighted to ensure that the weighted average credit rating of A- and BBB+ bonds within each maturity range (zero to 7, 7 to 13 and 13+ years) is BBB+.

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10 CEG, Report on ERA cost of debt estimation, November 2018, paragraph 41

11 CEG, Report on ERA cost of debt estimation, November 2018, paragraph 33

12 "Full sample" refers to all bonds meeting the criteria set out in the ERA's Appendix 1 "DRP process for updating in R" for the credit ratings used in the CEG analysis described in the attached CEG report. No outliers have been removed from the "full sample"

13 CEG, Report on ERA cost of debt estimation, November 2018, paragraph 88

14 CEG, Report on ERA cost of debt estimation, paragraphs 65 to 68

- **Adopt a weighted average of the estimates:** Apply a 50% weight to the Gaussian Kernel (GK) and 25% each to the Nelson Siegel (NS) and Nelson Siegel Svensson (NSS) curves. The re-weighting of the NS and NSS curves is consistent with the fact that these two estimation methods are only slightly different (i.e. they are in the same class of estimates) and giving them equal weight to the GK estimate effectively overweights this class of estimates.

27. ATCO considers that the ERA should adopt CEG's recommended changes to the R process.

3.5 Amendments to the contingencies

28. CEG has also assisted ATCO in reviewing the contingencies defined in the proposed R-process[15] and has made the following recommendations:

- Number of bonds in the benchmark credit rating sample is too small (less than 15) to produce a reliable estimate.
  - Not only should the sample of bonds be expanded to include A- and BBB bonds but also the sample size contingency should be restricted by maturity. In particular, there should be at least 14 bonds from at least 10 different issuers with maturity between 5 and 15 years. What is important is the number of independent observations around 10 years, rather than the number of observations in total. When implementing the contingency, the weighting method described at paragraph 26 should also be used.
- The standard deviation of the three yield estimates proposed by the ERA is greater than or equal to 100 basis points.
  - If the methods disagree materially, this implies that there is an anomaly in the sample that is affecting the estimation methods differently. However, this could just as easily be due to the GK estimate being anomalous rather than the NS/NSS estimates being anomalous. Therefore, we do not consider that the ERA contingency to just rely on the GK estimate when the methods disagree is appropriate.
  - In CEG's view the appropriate contingency when the ERA methods are in material disagreement (signifying at least one of them is anomalous) is to rely on the AER method (i.e. the average of the RBA, Reuters and Bloomberg yields curves). This has the benefit that independent experts are relied on to interpret the problematic data in real time.

29. ATCO considers that the ERA should adopt CEG's recommended changes. ATCO has also identified that the following changes are needed to the contingencies:

- Bloomberg data is unavailable - an alternative would be to average the remaining available yield data from the RBA and Reuters using the AER's method.
- Annual yields – the formula to convert the yields to annual yields must be included in the contingency process to estimate yields.

3.6 Other amendments

30. ATCO has identified one other change that it considers necessary to the documentation of the R-process:

[15] CEG, Report on ERA cost of debt estimation paragraphs 102 -107

- **Eastern states trading days**: References to 'eastern states trading days' should be avoided due to different public holidays between the various states and instead 'Sydney trading days' should be adopted throughout the process documentation.

4. ATCO's proposed process

31. ATCO considers the proposed process in R to be very complex and that it still requires the exercise of discretion that will not be possible under the binding rate of return framework. ATCO submits that the complexity, transparency, and reliability issues of the proposed R process could be avoided by using simpler subscription and publicly available data series.

32. ATCO submits that the ERA should, in the first instance, adopt the average of the RBA, Bloomberg and Reuters curves to estimate the DRP.

33. CEG has stated that using the RBA, Bloomberg and Reuters curves has the following advantages over the proposed method in R:

- Over time, the results are materially the same and unbiased relative to the results achieved under the R method
- The data is sourced from independent expert third parties providing the advantage that;
  - those experts can exercise the necessary judgement and discretion to arrive at a reasonable and reliable estimate in the circumstances; while
  - the ERA's method can truly be mechanistic as judgement and discretion has effectively been outsourced to independent third parties.
- The wider sample of bonds used in the A and BBB 10 year yields reduces the likelihood of an insufficient sample of bonds being available

34. Additionally, practical issues around the use of R code and downloading data from Bloomberg via Excel are mostly avoided.

35. CEG has assessed the outcomes of the proposed R-process (with the recommended improvements suggested by CEG) against adopting an average of the RBA, Bloomberg and Reuters curves. A one third weighting has been applied to A rated bonds and two thirds weighting to the broad BBB rated bonds. The following table compares the results[16]:

Table 4.1: Comparison of CEG amended R method with ATCO proposed method

YEAR	AMENDED R PROCESS	AVERAGE OF RBA, BLOOMBERG AND REUTERS CURVES	DIFFERENCE
2015	5.27	5.03	0.24
2016	4.35	4.41	-0.06
2017	4.59	4.57	0.02
2018	4.56	4.56	0.00

Source: CEG, Report on ERA cost of debt estimation, Table 5-3

36. ATCO observes that there is little difference between the two techniques on average and that the difference is not biased as it favours consumers in some years and ATCO in other years.

37. ATCO considers that the adoption of the RBA, Bloomberg and Reuters yield curves will result in a more transparent and replicable estimate of the DRP. This will provide stakeholders with the surety that the

16 CEG, Report on the ERA cost of debt estimation, paragraph 109

service provider will have the reasonable opportunity to recover its efficient costs consistent with the revenue and pricing principles.

38. Although the ATCO proposed method still relies on data being downloaded from subscription services as well as access to published RBA data, the data can be accessed more simply from fewer screens with fewer searches.

39. ATCO has previously made similar observations to the ERA. In August 2015, ATCO made a submission to the ERA expressing concerns that the ERA's bond yield approach could not be applied without discretion or judgement. ATCO provided a copy of advice from CEG that detailed concerns with the ERA's application of the bond yield approach and concluded that the best approach to estimate the DRP, in a manner that is reliable and transparent, is to use the RBA data series.[17]

40. ATCO notes that the AER in its July 2018 draft rate of return guidelines has published a detailed method for estimating yields utilising the Thomson-Reuters, Bloomberg and RBA yield curves.

ATCO's proposed process

ATCO now considers that the DRP is best estimated in the first instance as the average of the RBA, Bloomberg and Reuters yield curves. ATCO considers that a BBB+ credit rating can be estimated using 1/3 A curve and 2/3 BBB curve from each of the third-party information providers.

The ERA's proposed process in R should only be adopted as a contingency in the event that:

- Two or more of the data series are no longer available
- The difference between the maximum and minimum estimates across the three curves exceed 100 basis points

[17] CEG, Automatic annual updating, August 2015

ATTACHMENT 2: REPORT ON ERA COST OF DEBT ESTIMATION

COMPETITION ECONOMISTS GROUP

EIM# 98026634

PUBLIC

22 November 2018

COMPETITION ECONOMISTS GROUP

Report on ERA cost of debt estimation

November 2018

1 Executive summary

1. This report evaluates if the proposed ERA method for estimating the cost of debt from Bloomberg bond yields, (including the shift from Excel to RStudio):

   - produces reasonable and reliable estimates;
   - provides an acceptable tradeoff of complexity versus accuracy;
   - meets the requirements of a binding rate of return guideline, in particular, the requirement for a mechanical process that does not require the use of judgement.

2. To support this evaluation ATCO has asked us to address three questions in this report:

   i. Would the proposed changes in the ERA method for estimating the cost of debt from Bloomberg bond yields, including the shift from Excel to RStudio, result in material changes in the cost of debt that would be estimated in past ATCO averaging periods?

   ii. What are the risks that the ERA's newly proposed method will result in an unreliable estimate of the BBB+ cost of debt in a future averaging period (including due to the inability to use circumstance specific discretion)?

   iii. What alternative estimation method would reduce the risks identified in the previous question?

1.1 Are the proposed changes material

3. The ERA's newly proposed method involves two elements. First, a narrowing of the sample from bonds with credit ratings between BBB- and BBB+ to a sample containing only BBB+ bonds. This change can be expected to reduce the estimated cost of debt. Second, a number of other methodological changes for which there is no a priori reason for them to systematically affect the estimated cost of debt.

1.1.1 Narrowing the sample to BBB+ bonds

4. As expected, the move from a broad BBB to a narrow BBB+ sample of bonds reduces the estimated cost of debt materially by an average of 24 bp over four years – with the largest impact being in 2018 (38 bp).

Table 1-1: 10 year cost of debt: Broad BBB less BBB+ estimates

Year	GK	NS	NSS^	Average
2018	0.31	0.46	0.37	**0.38**
2017	0.18	0.26	0.32	**0.26**
2016	-0.10	0.35	0.29	**0.18**
2015	-0.10	0.30	0.22	**0.14**

5. However, it is notable that the Gaussian Kernel (GK) estimate actually rose in 2015 and 2016. This occurs because a number of BBB- bonds with tenors close to 7 years were removed from the sample, which resulted in a lower 7-year GK estimate and raised the extrapolated 10-year estimate.

1.1.2 Other methodological changes

6. The other methodological changes proposed by the ERA are mainly associated with a change in computer program, from Excel to RStudio, to estimate the Nelson Siegel (NS) and Nelson Siegel Svensson (NSS) models. Our estimates suggest that this change can have a material effect on the estimated 10 year cost of debt from these models.

7. In particular, in 2018 the NS and NSS estimates would have been 20 and 21 bp higher (respectively) had the RStudio method been used rather than Excel. In 2017 the RStudio estimate for the NS curve would have been 20bp higher (and the NSS estimate only 4 bp higher). The RStudio estimates are superior in the sense that they result in a lower sum of squared residuals (SSR) than the Excel estimates.

8. Notably, the difference between RStudio and Excel estimates appear to be driven by the existence of very long term bonds in the sample (greater than 50 years maturity). When these are excluded from the sample the RStudio and Excel estimates are very similar as are the SSRs (with Excel SSR's being lower on average).

Table 1-2: Comparison of cost of debt estimates from Excel and R approaches using a broad BBB sample

	All bonds				Exclude long maturity bonds			
	R estimate less Excel estimate (bppa)				R estimate less Excel estimate (bppa)			
Year	**GK***	**NS**	**NSS^**	**Aver.**	**GK***	**NS**	**NSS^**	**Aver.**
2018	0.0	20.0	21.0	**13.9**	0.0	0.0	-1.0	**-0.2**
2017	0.0	22.0	4.0	**8.6**	0.0	0.0	0.0	**0.0**
2016	0.0	2.0	-1.0	**0.7**	0.0	0.0	12.0	**4.1**
2015	0.0	0.0	1.0	**0.2**	0.0	0.0	5.0	**1.7**
	SSR =(Excel SSR)/(R SSR) - 1							
2018		10%	7%			0%	0%	
2017		20%	-7%			0%	0%	
2016		0%	-5%			0%	-12%	
2015		0%	-1%			0%	-1%	

**The GK estimate has been extrapolated to 10 years; ^Excel NSS estimates were obtained by using the same λ_1 and λ_2 starting values as in previous determinations for ATCO.*

9. The differences between RStudio and Excel estimates are smaller when a BBB+ sample is used but the difference is still substantial for the NS estimate in 2017.

Table 1-3: Comparison of cost of debt estimates from Excel and R approaches using a BBB+ sample[1]

	All bonds				Exclude long maturity bonds			
	R estimate less Excel estimate (bppa)				R estimate less Excel estimate (bppa)			
Year	**GK***	**NS**	**NSS^**	**Aver.**	**GK***	**NS**	**NSS^**	**Aver.**
2018	0.0	-1.0	9.0	**2.7**	0.0	1.0	-5.0	**-1.1**
2017	0.0	23.0	-1.0	**7.1**	0.0	0.0	2.0	**0.6**
2016	0.0	1.0	-1.0	**-0.2**	0.0	-1.0	-2.0	**-1.0**
2015	0.0	0.0	2.0	**0.7**	0.0	0.0	3.0	**0.9**
	SSR =(Excel SSR)/(R SSR) - 1							
2018		-3%	3%			0%	0%	
2017		24%	0%			0%	-1%	
2016		0%	0%			0%	0%	
2015		0%	1%			0%	1%	

**The GK estimate has been extrapolated to 10 years; ^NSS estimates were obtained by using the same λ_1 and λ_2 starting values as in previous determinations for ATCO; # Calculated as [Excel SSR / R SSR -1].*

10. It is notable that the largest differences between NS and NSS estimates is typically associated with RStudio having the better (lower SSR) estimate. The only exception to this is for the NSS curve for 2016 using the Broad BBB sample excluding all bonds with maturity over 50 years.

11. On the basis of this evidence, we conclude that the move to RStudio would, on average, have improved the quality of the NS and NSS regressions in past averaging periods (using either a broad BBB of a narrow BBB+ sample).

1.2 Risks associated with future application of the ERA method

12. We understand that the ERA's method must, under the National Gas Rules, be fully specified in advance and that there is no scope for the use of judgement in implementing the method. For example, if an outlier bond was receiving a high weight in one or all of the estimates (especially with the NS and NSS curves) then there could be no ad hoc adjustment for this. Rather, the only way to deal with such an eventuality would be for the ERA to have pre-specified a method for identifying

[1] We note that this implementation of the Excel approach for the NSS curve assumes the same set of λ1 and λ2 starting values as those generated from ATCO's previous determinations. Such an assumption may not be appropriate when the underlying sample has been modified.

outliers and also for the method for adjusting the estimate in the presence of any such outliers.

13. The ERA's proposed new focus on a narrow BBB+ sample makes such effects more likely due to the smaller sample size (especially around and above 10 years to maturity). Section 4.2 of this report illustrates plausible scenarios in which such effects are material.

1.3 Alternative estimation methods that reduce volatility/sensitivity of ERA estimates

14. In our view, it is not feasible to both:

    - pre-specify a set of rules that can adequately anticipate all potential circumstances (i.e., combinations of bond yields in a sample) in which the ERA's three estimates will result in a biased estimate; and
    - pre-specify the context specific adaptation of the method to the characteristics of that particular sample of bonds.

15. Rather, the best estimate will be arrived at when expert judgement is used to determine the context specific best adjustment to the method. As a result, a method that relies on estimates published by independent third party experts has a material advantage over the ERA method in that:

    - Those experts can exercise the necessary judgement and discretion that they believe is appropriate in that context; while
    - The ERA's method can itself be pre-specified (i.e., the exercise of context specific judgment is effectively outsourced to independent third parties).

16. In this regard, simply adopting the AER's proposed method for estimating the BBB+ cost of debt would materially reduce the above risks.[2] The AER proposes to rely on the average of Bloomberg, Reuters and RBA estimates of the 10 year cost of debt (weighted 2/3 to each expert's broad BBB estimate and 1/3 to their broad A estimate).

17. These experts can, and do, adjust their sample for known anomalies. For example, for a period before 2016 where there were a number of Coca-Cola Amatil BBB+ bonds with very low yields that were omitted by Bloomberg, on the basis that these bond yields were not consistent with a BBB+ credit rating. Both Bloomberg and the RBA excluded these bonds from their BBB+ sample at that time.[3]

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2 AER, Draft rate of return guideline, 10 July 2018.

3 As quoted by ACCC Regulatory Unit, Return on debt estimation: a review of the alternative third party data series, August 2014, p.32:

18. We have examined the difference between the RStudio BBB+ estimates in ATCO's previous averaging period and the AER method and found that, on average, they have been the same but this disguises materially offsetting differences in 2015 and 2018.

Table 1-4: AER approach minus new ERA BBB+ method as currently specified (bppa)

	2015	2016	2017	2018	Average
AER (BBB/A) minus ERA BBB+	-0.24	0.02	0.01	0.22	0.00

Source: AER, Bloomberg, RBA, Reuters, ERA, CEG analysis

19. If, for whatever reason, the ERA were not minded to adopt the AER method then there are a number of amendments to the ERA method that we would recommend be implemented. These include:

- Widening the sample to include both A-s and BBB bonds;
  - This materially increases the number of bonds in the sample – with the effect that it is less likely that a small number of outliers can materially affect the results;
- Weighting each A- and BBB observation to ensure that the weighted average credit rating of A- and BBB+ bonds within each maturity range (zero to 7, 7 to 13 and 13+ years) is BBB+.
- Taking the average of the NS and NSS estimates and averaging these with the GK estimate (i.e., giving the NS and NSS estimates 25% weight each and the GK estimate 50%);
  - The re-weighting of the NS and NSS curves is consistent with the fact that these two estimation methods are only slightly different (i.e., they are in the same class of estimates) and giving them equal weight to the GK estimate effectively overweights this class of estimates. It is also consistent with the GK estimate having been adopted by the RBA while, to the best of our knowledge, no other independent expert that publishes Australian corporate cost of debt benchmarks (including the independent experts relied on by the AER) uses either the NS or the NSS curves for that purpose

The reason that some coca cola bonds appeared in the AUD BBB curve in April but not anymore is because of internal changes we made. We assessed the AUD BBB curve and, whilst these coca cola bonds are indeed BBB rated, they were much richer than other BBB rated AUD bonds (see attached file). As such, we decided that the A rated curve (BVSC0160 Index) is more appropriate for these bonds and better represents their yields, which is where you will be able to find them now.

- Altering the current ERA contingencies (in the event of too small a sample size or disagreement amongst the measures) to be that the ERA adopt the AER method in the event that these contingencies are triggered.

20. Our recommended alternative approach would have resulted in an average cost of debt estimate that was, over the last 4 years of ATCO averaging periods, very similar to the estimates derived from application of ERA's newly proposed method (4 bp different). This effect is largely due to the de-weighting of the NS and NSS estimates. If the only adjustment to the ERA's method was for the proposed re-weighting of the NS and NSS curves then the two methods would have resulted in identical (0 bp) average estimates over the last 4 years of ATCO averaging periods.[4]

21. However, the pattern of our proposed estimates over the last four years would have been more similar to the average of the three independent experts relied on by the AER. This is summarised in the below table ("CEG 1" refers to our proposed method without the re-weighting of the NS and NSS curves while "CEG 2" includes the impact of the proposed re-weighting).

Table 1-5: Comparison of ERA BBB+, BBB to A- and BBB to A- with weighting methods for arriving at a BBB+ estimate

	BBB+ only ("ERA")			BBB to A- ("CEG")			Averages			
Year	**GK***	**NS**	**NSS**	**GK***	**NS**	**NSS**	**ERA**	**CEG 1**	**CEG 2**	**AER**
2018	4.46	4.23	4.33	4.64	4.36	4.51	4.34	4.50	4.54	4.56
2017	4.64	4.50	4.54	4.62	4.39	4.58	4.56	4.53	4.55	4.57
2016	4.62	4.28	4.29	4.41	4.27	4.32	4.39	4.33	4.35	4.41
2015	5.52	5.13	5.15	5.36	5.18	5.17	5.27	5.24	5.27	5.03
Ave.	**4.81**	**4.54**	**4.58**	**4.76**	**4.55**	**4.65**	**4.64**	**4.65**	**4.68**	**4.64**
Change in average cost of debt compared to ERA							**-**	**0.01**	**0.04**	**0.00**

**The GK estimate has been extrapolated to 10 years;*

22. There is no material average impact on the estimated cost of debt adopting our proposed approach relative to the ERA or AER methods. However, our proposed amendments to the ERA method result in the advantages set out in paragraph 19.

4 See the last row of the table below.

2 Introduction

23. This report evaluates if the proposed ERA method for estimating the cost of debt from Bloomberg bond yields, (including the shift from Excel to RStudio):

    - produces reasonable and reliable estimates;
    - provides an acceptable tradeoff of complexity versus accuracy;
    - meets the requirements of a binding rate of return guideline, in particular, the requirement for a mechanical process that does not require eh use of judgement.

24. To support this evaluation ATCO has asked CEG to address three questions in this report:

    i. Would the proposed changes in the ERA method for estimating the cost of debt from Bloomberg bond yields, including the shift from Excel to RStudio, result in material changes in the cost of debt that would be estimated in past ATCO averaging periods?

    ii. What are the risks that the ERA's newly proposed method will result in an unreliable estimate of the BBB+ cost of debt in a future averaging period (including due to the inability to use circumstance specific discretion)?

    iii. What alternative estimation method would reduce the risks identified in the previous question?

25. The remainder of this report has the following structure:

    - Section 3 examines the impact of the ERA's proposed changes in method on the cost of debt estimated in each of ATCO's previous four regulatory periods.
    - Section 4 analyses the potential for the ERA's new method to result in unreliable estimates;
    - Section 5 suggests amendments to the ERA method that mitigate the risks described in section 4.

3 Impact of changes in the ERA method

26. The ERA's newly proposed method involves two elements. First, a narrowing of the sample from bonds with credit ratings between BBB- and BBB+ to a sample containing only BBB+ bonds. This change can be expected to reduce the estimated cost of debt. Second, a number of other methodological changes for which there is no a priori reason for them to systematically affect the estimated cost of debt.

3.1 Narrowing the sample to BBB+ bonds

27. As expected, the move from a broad BBB to a narrow BBB+ sample of bonds reduces the estimated cost of debt materially by an average of 24 bp over four years – with the largest impact being in 2018 (38 bp).

Table 3-1: 10 year cost of debt: Broad BBB less BBB+ estimates

Year	GK	NS	NSS^	Average
2018	0.31	0.46	0.37	**0.38**
2017	0.18	0.26	0.32	**0.26**
2016	-0.10	0.35	0.29	**0.18**
2015	-0.10	0.30	0.22	**0.14**

Source: Bloomberg, ERA, CEG analysis; Curve estimates obtained using the ERA's R code

28. However, it is notable that the Gaussian Kernel (GK) estimate actually rose in 2015 and 2016. This occurs because a number of BBB- bonds with tenors close to 7 years were removed from the sample, which resulted in a lower 7-year GK estimate and raised the extrapolated 10-year estimate. The un-extrapolated 10-year GK estimates were 5.32% and 5.26% for the broad BBB and BBB+ samples respectively, while the 7-year estimates were 5.08% and 4.58%, resulting in extrapolated 10-year estimates of 5.42% and 5.52% respectively.

29. The individual cost of debt estimates from which Table 3-1 is derived are provided in each of the following two tables.

Table 3-2: 10-year cost of debt estimates for the broad BBB sample

Year	GK	NS	NSS^	Average
2018	4.77	4.69	4.70	**4.72**
2017	4.82	4.76	4.86	**4.81**
2016	4.52	4.63	4.58	**4.58**
2015	5.42	5.43	5.37	**5.41**

Source: Bloomberg, ERA, CEG analysis; Curve estimates obtained using the ERA's R code

Table 3-3: 10-year cost of debt estimates for the BBB+ sample

Year	GK	NS	NSS^	Average
2018	4.46	4.23	4.33	**4.34**
2017	4.64	4.50	4.54	**4.56**
2016	4.62	4.28	4.29	**4.39**
2015	5.52	5.13	5.15	**5.27**

Source: Bloomberg, ERA, CEG analysis; Curve estimates obtained using the ERA's R code

3.1.1 Other methodological changes

30. The other methodological changes proposed by the ERA are mainly associated with a change in computer program, from Excel to RStudio, to estimate the Nelson Siegel (NS) and Nelson Siegel Svensson (NSS) models. In this context the ERA has also proposed to apply constraints to the parameters of the NSS model.

31. Our estimates suggest that these changes, in total, can have a material impact on the estimated 10 year cost of debt from these models.

32. In particular, in 2018 the NS and NSS estimates would have been 20 and 21 bp higher (respectively) had the RStudio method been used rather than Excel. In 2017 the RStudio estimate for the NS curve would have been 20bp higher (and the NSS estimate only 4 bp higher). The RStudio estimates are superior in the sense that they result in a lower sum of squared residuals (SSR) than the Excel estimates.

33. Notably, the difference between RStudio and Excel estimates appear to be driven by the existence of very long term bonds in the sample (greater than 50 years maturity). When these are excluded from the sample the RStudio and Excel estimates are very similar as are the SSRs (with Excel SSR's being lower on average).

Table 3-4: Comparison of cost of debt estimates from Excel and R approaches using a broad BBB sample

	All bonds				Exclude long maturity bonds			
	R estimate less Excel estimate (bppa)				R estimate less Excel estimate (bppa)			
Year	**GK***	**NS**	**NSS^**	**Aver.**	**GK***	**NS**	**NSS^**	**Aver.**
2018	0.0	20.0	21.0	**13.9**	0.0	0.0	-1.0	**-0.2**
2017	0.0	22.0	4.0	**8.6**	0.0	0.0	0.0	**0.0**
2016	0.0	2.0	-1.0	**0.7**	0.0	0.0	12.0	**4.1**
2015	0.0	0.0	1.0	**0.2**	0.0	0.0	5.0	**1.7**
	SSR =(Excel SSR)/(R SSR) - 1							
2018		10%	7%			0%	0%	
2017		20%	-7%			0%	0%	
2016		0%	-5%			0%	-12%	
2015		0%	-1%			0%	-1%	

**The GK estimate has been extrapolated to 10 years; ^Excel NSS estimates were obtained by using the same λ_1 and λ_2 starting values as in previous determinations for ATCO.*

34. The difference between RStudio and Excel estimates are smaller when a BBB+ sample is used but the difference is still substantial for the NS estimate in 2017.

Table 3-5: Comparison of cost of debt estimates from Excel and R approaches using a BBB+ sample[5]

	All bonds				Exclude long maturity bonds			
	R estimate less Excel estimate (bppa)				R estimate less Excel estimate (bppa)			
Year	**GK***	**NS**	**NSS^**	**Aver.**	**GK***	**NS**	**NSS^**	**Aver.**
2018	0.0	-1.0	9.0	**2.7**	0.0	1.0	-5.0	**-1.1**
2017	0.0	23.0	-1.0	**7.1**	0.0	0.0	2.0	**0.6**
2016	0.0	1.0	-1.0	**-0.2**	0.0	-1.0	-2.0	**-1.0**
2015	0.0	0.0	2.0	**0.7**	0.0	0.0	3.0	**0.9**
	SSR =(Excel SSR)/(R SSR) - 1							
2018		-3%	3%			0%	0%	
2017		24%	0%			0%	-1%	
2016		0%	0%			0%	0%	
2015		0%	1%			0%	1%	

**The GK estimate has been extrapolated to 10 years; ^NSS estimates were obtained by using the same λ_1 and λ_2 starting values as in previous determinations for ATCO; # Calculated as [Excel SSR / R SSR -1].*

35. It is notable that the largest differences between NS and NSS estimates is typically associated with RStudio having the better (lower SSR) estimate. The only exception to this is for the NSS curve for 2016 using the Broad BBB sample excluding all bonds with maturity over 50 years.

36. On the basis of this evidence, we conclude that the move to RStudio would, on average, have improved the quality of the NS and NSS regressions in past averaging periods (using either a broad BBB of a narrow BBB+ sample).

37. The individual cost of debt estimates from which Table 3-4 and Table 3-5Table 3-1 are derived are provided in the following four tables.

5 We note that this implementation of the Excel approach for the NSS curve assumes the same set of λ1 and λ2 starting values as those generated from ATCO's previous determinations. Such an assumption may not be appropriate when the underlying sample has been modified.

Table 3-6: Cost of debt estimates from Excel approach using a broad BBB sample

	All bonds				Exclude long maturity bonds			
	Excel estimate (bppa)				Excel estimate (bppa)			
Year	**GK***	**NS**	**NSS^**	**Aver.**	**GK***	**NS**	**NSS^**	**Aver.**
2018	4.77	4.49	4.49	**4.58**	4.77	4.68	4.69	**4.71**
2017	4.82	4.54	4.82	**4.73**	4.82	4.79	4.82	**4.81**
2016	4.52	4.61	4.59	**4.57**	4.52	4.52	4.39	**4.48**
2015	5.42	5.43	5.36	**5.40**	5.42	5.44	5.34	**5.40**
	SSR							
2018		23.93	23.93			19.44	19.36	
2017		29.80	23.67			22.26	22.15	
2016		64.03	59.99			57.68	49.76	
2015		52.81	52.43			52.79	52.23	

Table 3-7: Cost of debt estimates from R approach using a broad BBB sample

	All bonds				Exclude long maturity bonds			
	R estimate (bppa)				R estimate (bppa)			
Year	**GK***	**NS**	**NSS^**	**Aver.**	**GK***	**NS**	**NSS^**	**Aver.**
2018	4.77	4.69	4.70	**4.72**	4.77	4.68	4.68	**4.71**
2017	4.82	4.76	4.86	**4.81**	4.82	4.79	4.82	**4.81**
2016	4.52	4.63	4.58	**4.58**	4.52	4.52	4.51	**4.52**
2015	5.42	5.43	5.37	**5.41**	5.42	5.44	5.39	**5.42**
	SSR							
2018		21.73	22.27			19.44	19.36	
2017		24.79	25.42			22.26	22.15	
2016		64.01	63.21			57.68	56.23	
2015		52.81	52.99			52.80	52.66	

Table 3-8: Cost of debt estimates from Excel approach using a BBB+ sample

	All bonds				Exclude long maturity bonds			
	Excel estimate (bppa)				Excel estimate (bppa)			
Year	**GK***	**NS**	**NSS^**	**Aver.**	**GK***	**NS**	**NSS^**	**Aver.**
2018	4.46	4.24	4.24	**4.31**	4.46	4.36	4.36	**4.39**
2017	4.64	4.27	4.55	**4.49**	4.64	4.58	4.58	**4.60**
2016	4.62	4.27	4.30	**4.40**	4.62	4.35	4.38	**4.45**
2015	5.52	5.13	5.13	**5.26**	5.52	5.13	5.13	**5.26**
	SSR							
2018		4.11	4.11			2.32	2.32	
2017		3.76	2.89			1.79	1.76	
2016		5.05	5.03			4.18	4.17	
2015		7.56	7.56			7.56	7.56	

Table 3-9: Cost of debt estimates from R approach using a BBB+ sample

	All bonds				Exclude long maturity bonds			
	R estimate (bppa)				R estimate (bppa)			
Year	**GK***	**NS**	**NSS^**	**Aver.**	**GK***	**NS**	**NSS^**	**Aver.**
2018	4.46	4.23	4.33	**4.34**	4.46	4.37	4.31	**4.38**
2017	4.64	4.50	4.54	**4.56**	4.64	4.58	4.60	**4.61**
2016	4.62	4.28	4.29	**4.39**	4.62	4.34	4.36	**4.44**
2015	5.52	5.13	5.15	**5.27**	5.52	5.13	5.16	**5.27**
	SSR							
2018		4.26	4.00			2.32	2.31	
2017		3.04	2.90			1.79	1.78	
2016		5.05	5.04			4.19	4.17	
2015		7.56	7.51			7.56	7.52	

3.2 R code and programming constraints

38. The ERA's R programming code consists of two components:

    a. Commands and functions written by Pink Lake Analytics on behalf of the ERA; and

b. Functions written in publicly available R packages.[6]

39. The programming code written by Pink Lake Analytics can be scrutinised line by line, while the programming code in R packages can only be inspected if made available by the author of the package. Usage of R packages is therefore reliant on peer review, whereby any errors in the packages will be raised by other users.[7]

3.2.1 Code written by Pink Lake Analytics on behalf of the ERA

40. The ERA's programming code is written in two files:

- `drp_bloomberg_automation.R`, which loads the required packages, calls several functions, and extracts their outputs to be constructed into an Excel workbook; and
- `drp_functions.R`, which contains the following functions:
  - `extractYield`: extracts data from the Excel template;
  - `estimateCostOfDebt`: verifies the integrity of the data, defines constraints for the optimisation algorithms, and fits the yield curves (NS and NSS curves are fitted using R packages);
  - `penalty`: defines the penalty function, which is used to ensure that the solution of the differential evolution algorithm remains within the stipulated constraints;
  - `OF`: defines the objective function that the differential evolution algorithm seeks to minimise, which in this context is the sum of squared residuals;
  - `measureSupport`: measures the Gaussian kernel density for a target tenor;
  - `annualiseCOD`: converts semi-annual yields to annualised yields; and
  - `calcKernel10yrExtapolation` [sic]: extrapolates GK estimates to a 10-year effective tenor.

41. We have carried out a high-level assessment of the ERA's programming code, and have not identified any errors except for some minor typos:

- line 191 of `drp_functions.R` refers to a column name that does not match with the corresponding name in the "Allowed trading days" sheet of the Excel

6 The optimisation algorithms used to fit the NS and NSS curves are obtained from R packages.

7 We note that Economic Insights has – in a separate matter before the ACCC – previously criticised the use of R packages for regulatory analysis, on the basis that there may not be sufficient accountability in the uploading of packages by the public.

template. To fix this, cell A1 of the "Allowed trading days" sheet must be changed from "Date (Manual Entry)" to "Date";

- lines 23 and 24 of `drp_functions.R` assign limits for **seven** constraints, even though the NS and NSS curves only require four and six constraints to be estimated respectively. The last constraint in these two lines are redundant and can therefore be removed.[8] We note that the inclusion of the last constraint does not change the final results, since our analysis suggests that the `DEopt()` function that the ERA uses to estimate the NSS model is able to ignore redundant variables; and
- There appears to be an error in Table 1 of the two Appendix 1 documents, in that the ERA references a sheet named "10_year_IRS_Rate", and states that the sheet calculates an annualised 10-year IRS rate. No such sheet exists in the template provided to us, and we assume that this sheet will not be used for cost of debt and DRP calculations.

42. Notwithstanding the above typos, the rest of the code runs smoothly and generates the final cost of debt estimates fairly smoothly. In particular, our annualised extrapolated GK estimates from Excel are virtually identical to those generated from the ERA's R programming code, which confirms that the code loads the data correctly and fits the GK using the same method used under the current Guidelines.

43. One possible amendment to the code is to include the sum of squared residuals of the fitted NS and NSS curves. Doing so will allow for easy comparison against the fit of the Excel curves, and thus provides an added cross-check to establish the veracity of the estimates.

3.2.2 R packages

44. The ERA's programming functions make use of several R packages to carry out a number of tasks, such as importing and exporting data, data wrangling, and fitting the curves.

45. Two particularly important packages are the `YieldCurve` package, which is used to estimate the NS curve, and the `NMOF` package, which is used to estimate the NSS curve.

46. The `YieldCurve` package estimates the NS curve using a grid search, whereby the algorithm restricts λ to a certain range, fits an NS curve for each λ, and then chooses the curve that has the best fit (lowest sum of squared residuals).[9] Thus, the ERA's

[8] If this change is made, then line 103 of `drp_bloomberg_automation.R` will need to be changed to: `outputDF[17:22,9] <- costDebt$NSSparameters`

[9] Specifically, the algorithm chooses tenors in increments of 0.5 years over the range of tenors observed from the bond sample. The algorithm then generates λ estimates for each tenor by maximising the last

code estimates the NS curve without requiring the user to set starting values or to specify constraints.

47. The `NMOF` package estimates the NSS curve using a differential evolution algorithm, which specifies several possible starting points and then uses random numbers to shift those starting points during each iteration. The algorithm requires a set of constraints to be specified, and the ERA uses a set of constraints obtained from Gilli, Große and Schumann (2010).[10]

48. We note, however, that Gilli, Große and Schumann (2010) estimated the NSS curve on the yields of German government bonds as an illustrative example that applies the differential evolution algorithm. They did not include any justification for their choice of constraints, and did not suggest that their choice of constraints were applicable to other NSS curves.

49. It may therefore be inappropriate for the constraints from Gilli, Große and Schumann (2010) to be applied directly to the ERA's sample of corporate bonds, which could exhibit very different shapes compared to the dataset studied in the paper. In particular, if the NSS optimisation algorithm regularly obtains a solution that is very close to the constraints, then it would suggest that the constraints used by the ERA may need to be shifted.

50. It is also important to understand that since the differential evolution algorithm arrives at its final value using random numbers, running the R code multiple times will result in different NSS estimates. It may therefore be advisable for the ERA to set the same seed to be used in its differential evolution algorithm, as this will ensure that the same result is obtained each time the algorithm is run.

3.2.3 Optimisation constraints when estimating NS and NSS curves

51. We carry out sensitivity analysis by shifting the optimisation constraints used in estimating the NS and NSS curves.

52. Table 3-10 sets out the constraints used by the ERA and the ones used in our sensitivity analysis. Specifically, we modified the constraints for the two λ parameters, since our analysis for the earlier sections suggests that these two are sometimes binding constraints, while the other constraints tend to be non-binding.

term of the Nelson-Siegel equation, before using linear regressions to estimate the NS curve conditional on each λ.

[10] Gilli, Große and Schumann, Calibrating the Nelson-Siegel-Svensson model, Comisef Working Papers Series, WPS-031, March 2010, p. 20.

Table 3-10: Modifications to the ERA's NS and NSS parameter constraints

Parameter	NS-ERA	NS v1	NS v2	NSS-ERA	NSS v1	NSS v2
β_0		0 to 15			0 to 15	
β_1		-15 to 30			-15 to 30	
β_2		-30 to 30			-30 to 30	
β_3		-			-30 to 30	
λ_1	0 to 2.5	0 to 5	0 to 10	0 to 2.5	0 to 5	0 to 10
λ_2		-		2.5 to 5.5	5 to 10	0 to 10
Redundant	0 to 30	-	-	0 to 30	-	-

53. Table 3-11 provides a comparison of the 10-year cost of debt estimates under the different optimisation constraints. We observe small changes in the average cost of debt, with the difference being less than 2 bp over the 2015-2018 period.

54. We also observe that the estimates only change for the NSS curve, since it is the only curve that had binding constraints. The NS curve did not change since none of its constraints were binding, while the GK is a weighted average of bond yields and does not feature constraints.

55. Finally, we observe that some of the λ constraints of the NSS curve remain binding under constraints v1, while the v2 constraints are no longer binding.

Table 3-11: Comparison of ERA BBB+ estimates under different optimisation constraints

	BBB+ only (ERA constraint)				BBB+ only (constraint v1)				BBB+ only (constraint v2)			
Year	GK*	NS	GK*	Aver.	GK*	NS	NSS	Aver.	GK*	NS	NSS	Aver.
2018	4.46	4.23	4.46	**4.341**	4.46	4.23	4.34	**4.344**	4.46	4.23	4.33	**4.340**
2017	4.64	4.50	4.64	**4.558**	4.64	4.50	4.55	**4.562**	4.64	4.50	4.55	**4.561**
2016	4.62	4.28	4.62	**4.394**	4.62	4.28	4.30	**4.399**	4.62	4.28	4.30	**4.399**
2015	5.52	5.13	5.52	**5.267**	5.52	5.13	5.11	**5.254**	5.52	5.13	5.11	**5.254**

**The GK estimate has been extrapolated to 10 years;*

3.3 Analysis and recommendation

3.3.1 Excel vs R

56. The Excel and R packages agree on the GK 10 year estimate. Where the R package results in a better fit (lower sum of squared errors) for the NS and NSS curves. This also is associated with a typically higher estimate at 10 years. However, when very long term bonds are removed this difference tends to disappear.

57. We believe that this is most likely due to the fact that:

    - The iterative algorithm used in the R packages is better at seeking out a global minimum (for the sum of squared errors). While the Excel model is more likely to get 'stuck' at a local minimum (for the sum of squared errors) that is close to the parameters used previously (which form the starting point under the Excel model);[11]
    - It just so happens that the starting values that have evolved using the Excel model have resulted in a local minimum (for the sum of squared errors) that has also been associated with a lower estimate for the 10 year cost of debt than would have been achieved had a wider variety of starting points been used.

58. There is no reason to believe that this will always be the case. However, given that it has been the case in both 2017 and 2018 for the BBB+ sample then it is (slightly) more likely than not that the R estimates will continue to be higher in 2019.

59. It is also relevant to consider the impact using the BBB to A- dataset. With this dataset the differences were larger in 2018 and, assuming that the 2019 data is most likely to resemble the 2018 data, we consider it more likely that the R estimates will be higher than the Excel estimates in 2019.

60. This analysis supports accepting the move to the R package as both: more likely to result in a better fit to the data and (slightly) more likely to result in a higher 10 year estimate in the near future.

3.3.2 Long term bonds

61. In the BBB+ sample, the presence of very long term (50+ years) bonds tends to consistently depress the estimated 10 year yields using R (and even more so using Excel). This is an issue that is investigated further in subsequent sections.

[11] Indeed, the starting parameters are either random or based on a grid search in the R packages – which means that previous parameters play no role in determining future parameters.

4 Risks associated with future application of the ERA method

62. We understand that the ERA's method must, under the National Gas Rules, be fully specified in advance and that there is no scope for the use of judgement in implementing the method. For example, if an outlier bond was receiving a high weight in one or all of the estimates then there could be no ad hoc adjustment for this. Rather, the only way to deal with such an eventuality would be for the ERA to have pre-specified a method for identifying outliers and also for the method for adjusting the estimate in the presence of any such outliers.

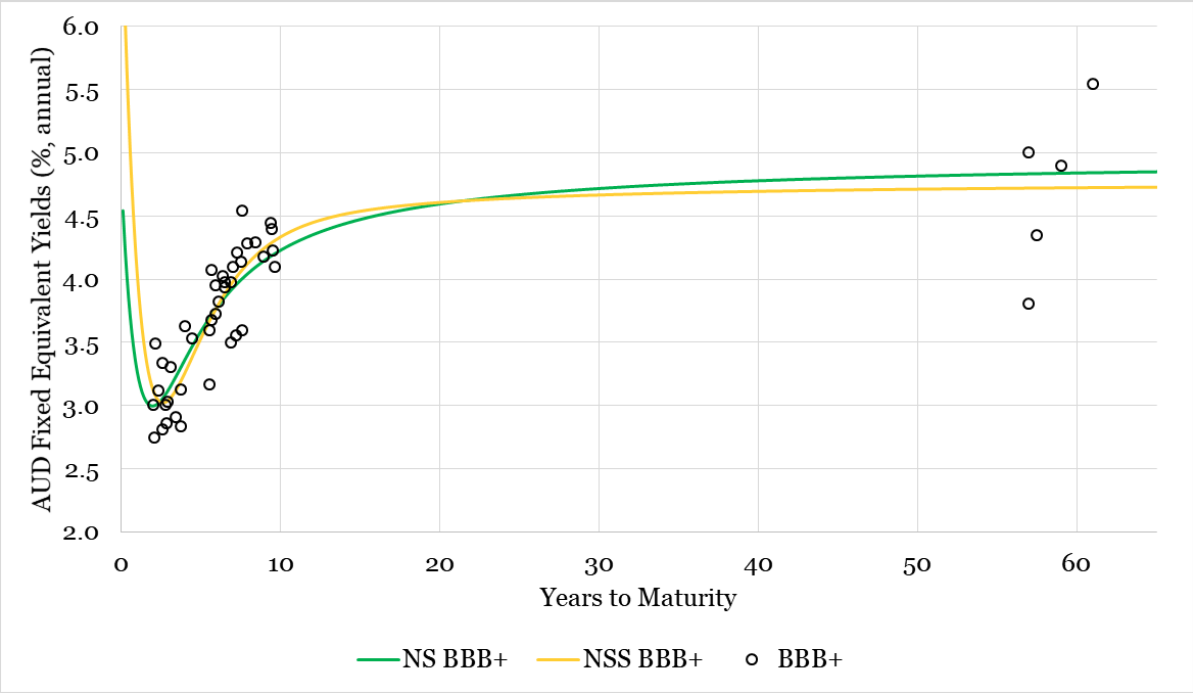
63. The ERA's proposed new focus on a narrow BBB+ sample makes such effects more likely due to the smaller sample size (especially around and above 10 years to maturity). This section illustrates the potential for these problems to arise.

4.1 Unreliable Bloomberg data

64. The first point to note is that not all Bloomberg bond yield data are equally reliable. Independent experts can take account of this but it is difficult to pre-specify a method for doing so without actually seeing the data.

65. Notably, in ATCO's 2018 averaging period there are five BHP bonds with long maturities (>50 years) as can be seen in Figure 4-1 below and these are the only bonds with maturity greater than 10 years.

Figure 4-1: 2018 BBB+ sample and regressions (using RStudio)



66. All of these bonds are described as having 'variable' interest rates (which is different from 'floating' and suggests that the yield will change in response to pre-specified events such as credit rating downgrades) and all are callable.

67. Given these bonds are all from the same issuer and all have similar maturity it is notable that they have such a wide distribution of yields. Absent peculiarities about these bonds meaning that they really do have dramatically different risks attached to them, this distribution should not be observed if the debt markets are efficient and the Bloomberg OAS function was working effectively. In our view, it is likely that the Bloomberg OAS function is not working effectively at these maturities (that is the cross currency and interest rate swap estimates that underpin these yields are unreliable).

68. It can also be seen that the slope of the yield curve is strongly positive within the data set of shorter term bonds (less than 6 years) but this slope flattens out between 6 and 10 years. This flattening out is in order for the regression to be able to better fit the bonds with maturity at 50 years. The flattening out is 'worse' for the NS curve because it does not have the flexibility of the NSS curve. It is not obvious at all that these characteristic of the estimated curves reflects true debt market conditions for a 10 year BBB+ issuer.

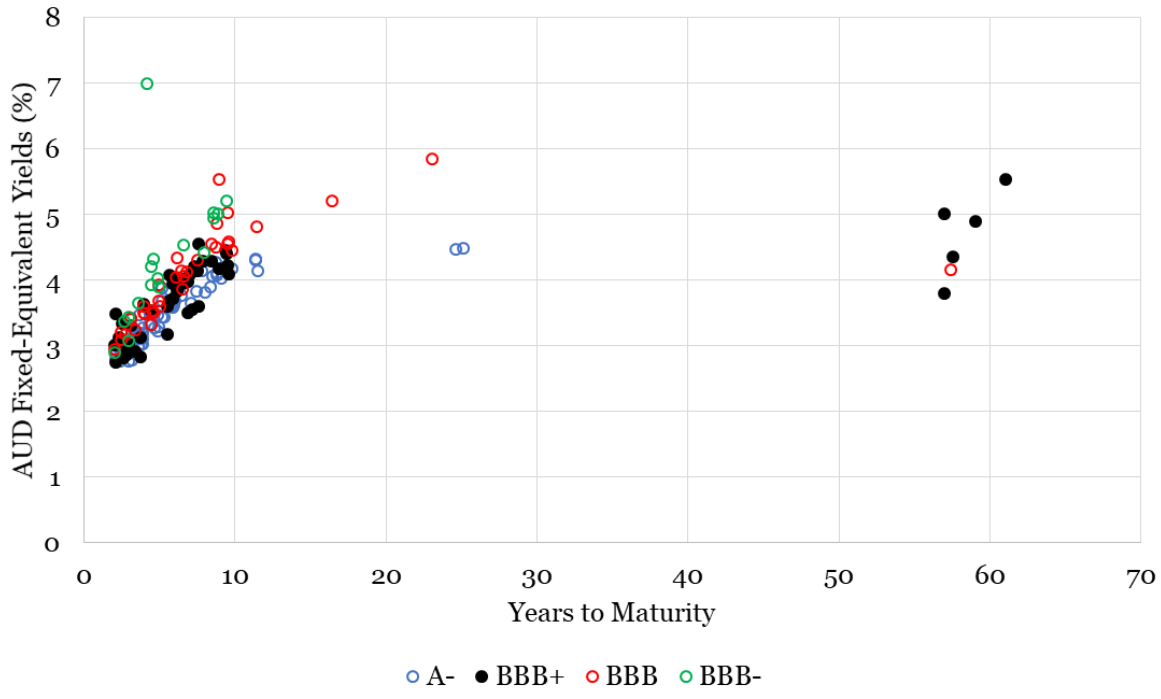
4.2 Sensitivity illustrations

69. Restricting the sample to only BBB+ bonds results in a sample size that is relatively small compared to the previous approach that used the broad-BBB credit ratings. Specifically, the samples that included broad-BBB credit ratings have historically featured 90-100 bonds for averaging periods from 2015 to 2018, of which only 30-50 had BBB+ credit ratings.

70. In addition, the BBB+ samples for 2015 to 2018 have featured samples with most of their bonds having maturities between 2 and 11 years, coupled with a few long-maturity bonds beyond 50 years. This can be seen with by examining a bond sample for the 2018 averaging period of all BBB- to A- bonds shown in Figure 4-2. There are three BBB bonds and four A- bonds with residual maturities between 10 and 30 years. There are no BBB+ bonds in that maturity horizon.

71. Furthermore, all five BBB+ bonds with residual maturities exceeding 50 years are callable bonds issued by BHP.

Figure 4-2: Bonds with ratings from A- to BBB- in the 2018 averaging period



Source: Bloomberg, CEG analysis

72. Looking forward, the lack of BBB+ bonds between 10 and 50 years could result in ATCO's 10-year DRP estimates becoming very volatile.

73. We demonstrate the above observation using the following empirical framework for evaluating the possible scenarios that may affect the bond sample for 2019:

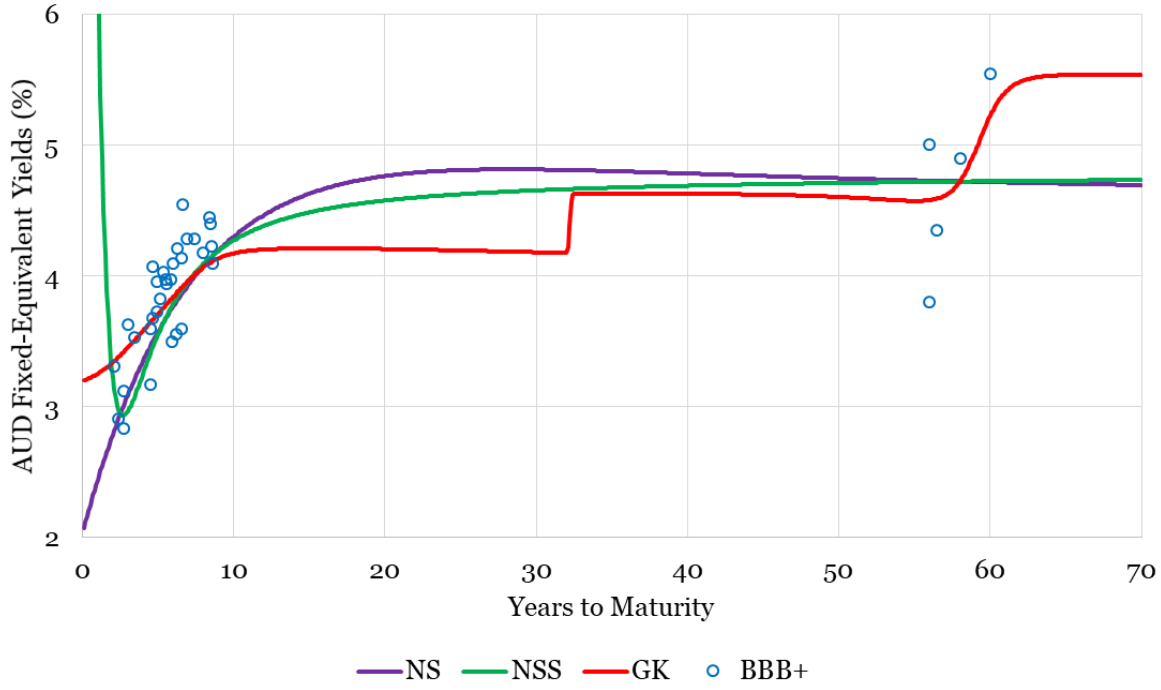
- Reduce the residual maturities of the 2018 bond sample by one year (consistent with the passage of time) and remove all bonds with resulting residual maturities less than 2 years (consistent with ERA method); and
- Reduce the yields of all bonds using the shape of the NS curve estimated for the 2018 sample (consistent with that curve being the 'true' corporate BBB+ yield curve).[12]

74. This generates a hypothetical bond sample for 2019, assuming that no new bonds have been added or removed, and assuming for simplicity that the 2018 NS curve correctly estimates the yield curve for 2018 that also remains unchanged in 2019. We then apply the ERA's draft Guideline method to the hypothetical sample, and investigate how its cost of debt estimate responds to changes to the bond sample.

75. The hypothetical bond sample for 2019 is shown in Figure 4-3, along with the fitted curves estimated using the ERA's R code. The 10-year cost of debt estimates for the extrapolated GK, NS, and NSS curves are 4.46%, 4.30%, and 4.27% respectively, resulting in 4.34% average cost of debt.

[12] For example, if a bond has a residual maturity of 6.5 years in the 2018 sample, we first reduce its residual maturity to 5.5 years. We then reduce its yield by the difference between the 6.5-year and 5.5-year costs of debt from the NS curve estimated for the 2018 sample using the ERA's R code.

Figure 4-3: Hypothetical bond sample for 2019



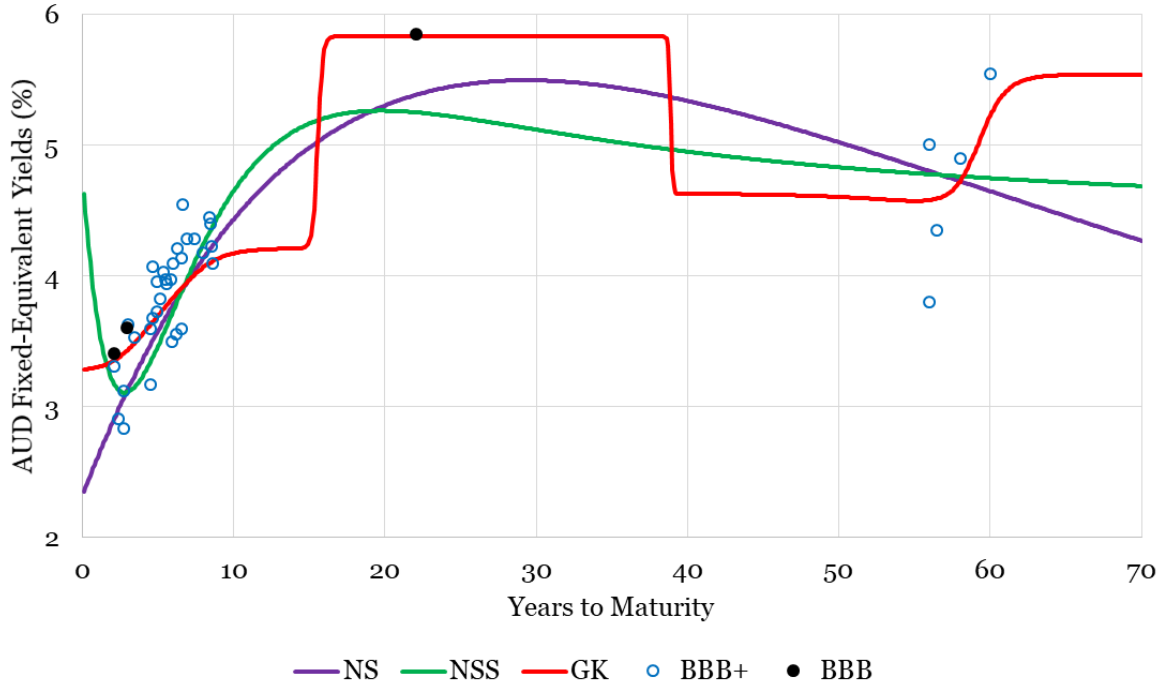
Source: Bloomberg, ERA, CEG analysis

4.2.1 Scenario 1: The NS and NSS curves will have materially higher estimates if the credit rating for Newcrest Finance is upgraded from BBB to BBB+

76. If the three BBB bonds issued by Newcrest Finance are upgraded to BBB+ credit ratings, then this will have a material impact on the resulting cost of debt estimates.

77. As shown in Figure 4-4, this occurs because Newcrest Finance would then have one bond with a residual maturity of 22 years, which would have a substantial impact on the shapes of the NS and NSS curves, as the BBB+ sample does not contain any other bonds with residual maturities between 10 and 50 years.

Figure 4-4: Hypothetical 2019 sample with Newcrest Finance added



Source: Bloomberg, ERA, CEG analysis

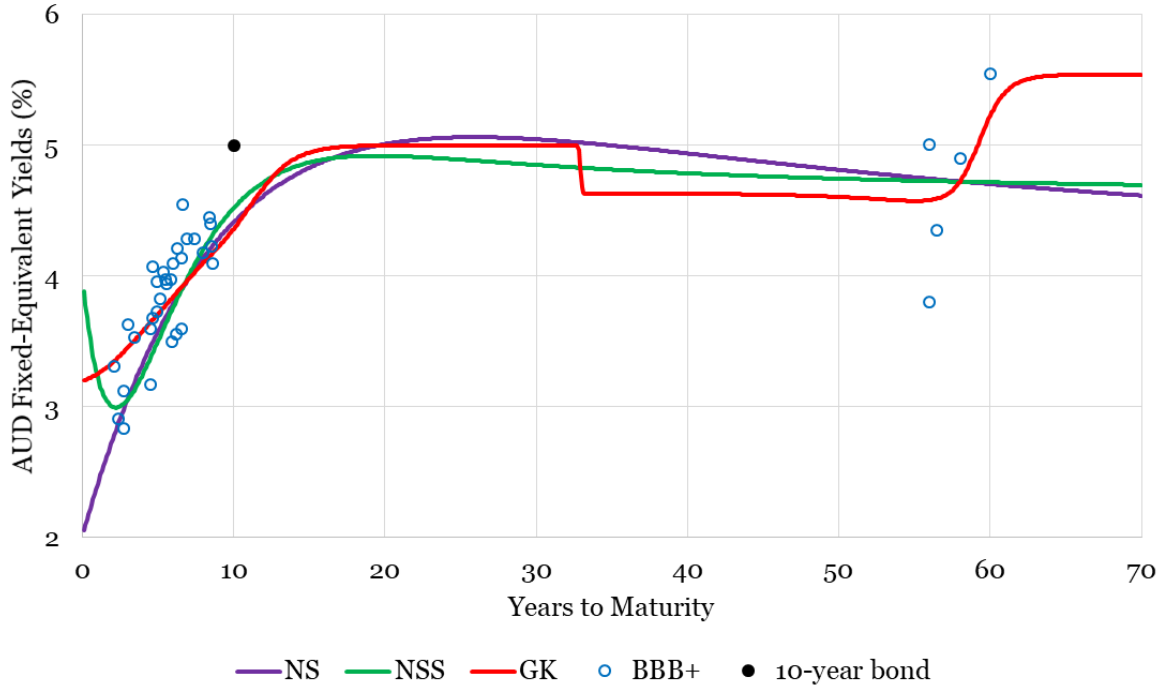
78. The resulting 10-year cost of debt estimate increases by 13 bp and 38 bp for the NS and NSS curves respectively. These correspond to 9% and 22% increases in the estimated DRP respectively. These are very large changes due to a single company (with three bonds) changing its credit rating and reflects the relatively small sample size of the BBB+ sample. The next scenario will show that the GK estimate is also sensitive to the addition of a single bond.

4.2.2 Scenario 2: Adding a 10-year bond with 5% (4%) cost of debt will increase (decrease) the 10-year cost of debt estimate materially

79. In this scenario we add a 10-year bond with 5% annualised cost of debt and AUD 700 million issue amount. Doing so causes the 10-year cost of debt estimates for the extrapolated GK, NS, and NSS curves to increase by 22 bp, 11 bp, and 25 bp respectively, resulting in an average increase of 19 bp.

80. The fitted curves are shown in Figure 4-5, and it can be seen that the shape of the GK curve has changed substantially at the 10-year tenor, compared to the GK curves in Figure 4-3 and Figure 4-4.

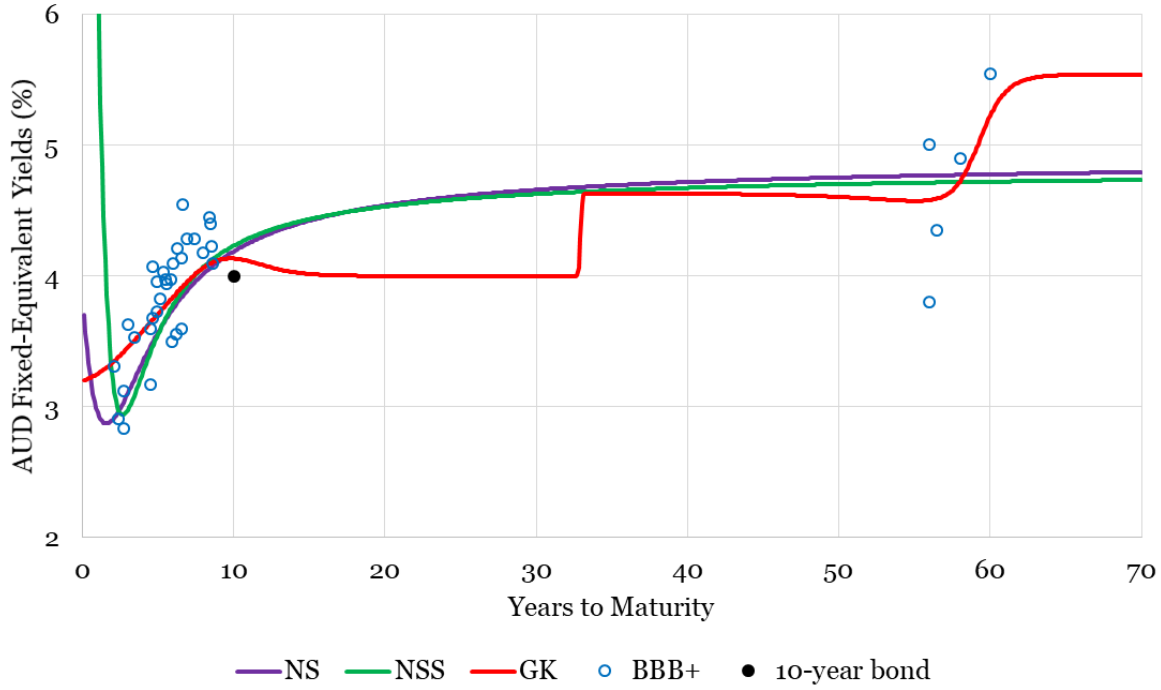
Figure 4-5: Hypothetical 2019 sample with 10-year 5% yield bond added



Source: Bloomberg, ERA, CEG analysis

81. Conversely, if a 10-year bond with 4% annualised cost of debt and AUD 700 million issue amount is added to the sample, then the 10-year cost of debt estimates for the extrapolated GK, NS, and NSS curves will decrease by 19 bp, 11 bp, and 4 bp respectively, resulting in an average decrease of 11 bp. This is shown in Figure 4-6.

Figure 4-6: Hypothetical 2019 sample with 10-year 4% yield bond added



Source: Bloomberg, ERA, CEG analysis

82. This example suggests that the 10-year cost of debt estimates of all three curves can be heavily influenced by the issuance of a single 10-year bond just before the beginning of the averaging period. If that bond turns out to be a high-yield bond, then the resulting cost of debt will increase materially, and vice-versa.

5 Proposed amendments to the ERA method

5.1 Adopting the AER method

83. In our view, it is not feasible to both:

- pre-specify a set of rules that can adequately anticipate all potential circumstances (i.e., combinations of bond yields in a sample) in which the ERA's three estimates will result in a biased estimate; and
- pre-specify the context-specific adaptation of the method to the characteristics of that particular sample of bonds.

84. Rather, the best estimate will be arrived at when expert judgement is used to determine the context-specific best adjustment to the method. As a result, a method that relies on estimates published by independent third-party experts has a material advantage over the ERA method in that:

- Those experts can exercise the necessary judgement and discretion that they believe is appropriate in that context; while
- The ERA's method can itself be pre-specified (i.e., the exercise of context-specific judgment is effectively outsourced to independent third parties).

85. In this regard, simply adopting the AER's proposed method for estimating the BBB+ cost of debt would materially reduce the above risks.[13] The AER proposes to rely on the simple average of Bloomberg, Reuters and RBA estimates of the 10 year cost of debt (weighted 2/3 to each expert's broad BBB estimate and 1/3 to their broad A estimate).

86. These experts can, and do, adjust their sample for known anomalies. For example, for a period before 2016 there were a number of Coca-Cola Amatil BBB+ bonds with very low yields that were omitted by Bloomberg, on the basis that these bond yields were not consistent with a BBB+ credit rating. Both Bloomberg and the RBA excluded these bonds from their BBB+ sample at that time.[14]

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13 AER, Draft rate of return guideline, 10 July 2018.

14 As quoted by ACCC Regulatory Unit, Return on debt estimation: a review of the alternative third party data series, August 2014, p.32:

> *The reason that some coca cola bonds appeared in the AUD BBB curve in April but not anymore is because of internal changes we made. We assessed the AUD BBB curve and, whilst these coca cola bonds are indeed BBB rated, they were much richer than other BBB rated AUD bonds (see attached file). As such, we decided that the A rated curve (BVSC0160 Index) is more appropriate*

87. We have examined the difference between the RStudio BBB+ estimates in ATCO's previous averaging period and the AER method and found that, on average, they have been the same but this disguises materially offsetting differences in 2015 and 2018.

Table 5-1: AER approach minus new ERA BBB+ method as currently specified (bppa)

	2015	2016	2017	2018	Average
AER (BBB/A) minus ERA BBB+	-0.24	0.02	0.01	0.22	0.00

Source: AER, Bloomberg, RBA, Reuters, ERA, CEG analysis

5.2 Adjusting the ERA sample

88. If, for whatever reason, the ERA were not minded to adopt the AER method then there are a number of alterations to the ERA method that we would recommend to be implemented. These include:

- Widening the sample to include both A- and BBB bonds;
- Weighting each A- and BBB observation to ensure that the weighted average credit rating of A- and BBB+ bonds within each maturity range (zero to 7, 7 to 13 and 13+ years) is BBB+.
- Taking the average of the NS and NSS estimates and averaging these with the GK estimate (i.e., giving the NS and NSS estimates 25% weight each and the GK estimate 50%);
- Removing bonds with maturities greater than 30 years; and
- Altering the current ERA contingencies (in the event of too small a sample size or disagreement amongst the measures) to be that the ERA adopt the AER method in the event that these contingencies are triggered.

89. These suggestions are discussed in sections 5.2.1 to 5.2.5, and will be applied in section 5.3.

5.2.1 Introduce A- and BBB bonds

90. Including A- and BBB bonds has the effect of adding additional bonds to the sample, making it more robust to individual outliers. In the 2018 averaging period, including

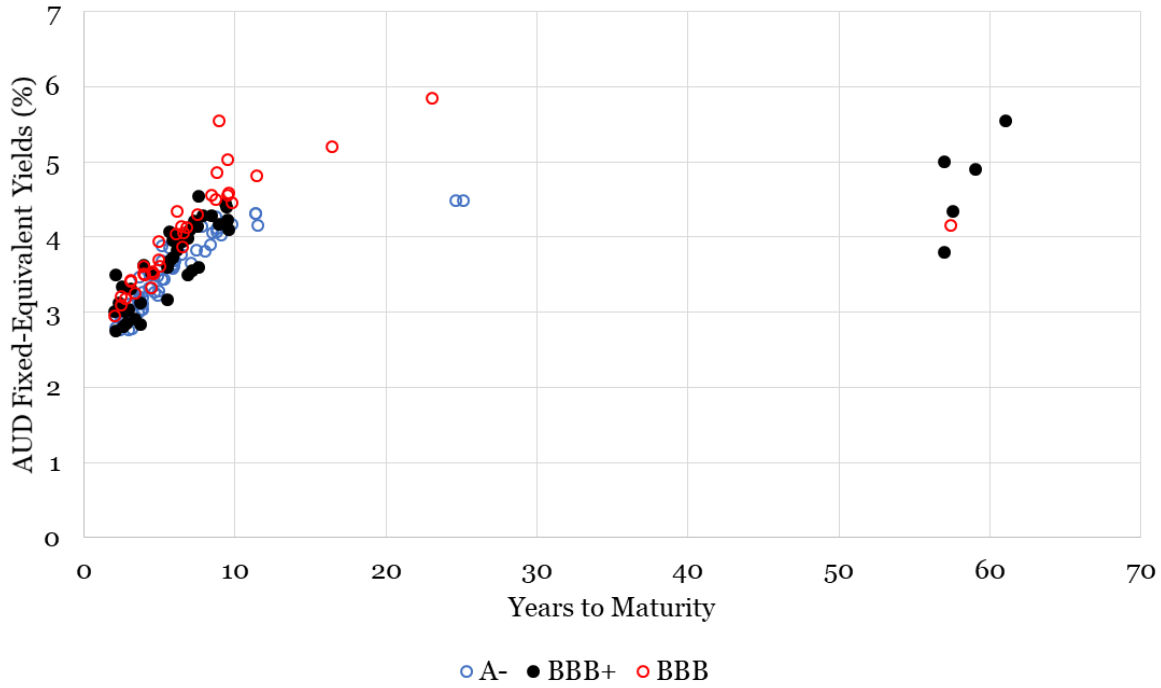
for these bonds and better represents their yields, which is where you will be able to find them now.

A- and BBB bonds results in 8 additional bonds with maturity greater than 10 years and less than 30 years. All of these are fixed rate bonds and only one is callable.

91. This is clearly seen in Figure 5-1, which shows the sample of A-, BBB+, and BBB bonds in the 2018 averaging period. When the sample is restricted to BBB+ bonds, there are no bonds with residual maturities between 10 and 50 years. Fitting the curves across this restricted sample could therefore result in a wide range of shapes between 10 and 50 year maturities, and is also likely to result in estimates that are volatile to the introduction of even a single bond between those maturities, as discussed in section Figure 4-2.

92. Including the A- and BBB bonds will likely result in curves that are more robust to variations in single bonds, in that the presence of bonds with 10-to-50-year residual maturities is likely to reduce the leverage or impact that an individual bond will have on the overall shapes of the curves.

Figure 5-1: Sample of A-, BBB+, and BBB bonds in the 2018 averaging period



Source: Bloomberg, CEG analysis

93. Table 5-2 shows the maturities of bonds for each of the 2015 to 2018 averaging periods. It can be seen that the BBB+ sample does not feature any bonds with 10-to-30-year residual maturities in 2015 and 2018, while the 2016 and 2017 averaging periods only featured one and two such bonds respectively.

94. Expanding the sample to also include A- and BBB bonds results in at least four bonds being included in the 10-to-30-year timeframe over the 2015 to 2018 averaging periods.

Table 5-2: Maturities of bonds in the 2015 to 2018 averaging periods

Residual maturities	0-10			10-30			30-60		
	A-	BBB+	BBB	A-	BBB+	BBB	A-	BBB+	BBB
2018	51	40	31	5	0	3	0	5	1
2017	36	34	38	0	2	2	0	5	1
2016	31	29	32	1	1	3	0	5	1
2015	22	38	31	1	0	3	0	0	0

Source: Bloomberg, CEG analysis

5.2.2 Weighting BBB and A- observations to ensure equivalence

95. Simply adding A- and BBB bonds to the sample provides no guarantee that the average credit rating in the sample will be BBB+ if, for example, more/fewer A- bonds are added than BBB bonds. In order to deal with this problem it is relatively simple to adjust the weights for each observation to ensure that similar maturity A- and BBB bonds receive the same weight –such that the average credit rating of the (weighted) observations in the sample is always BBB+. We have done this for different maturity profiles from 0 to 7 years, 7 years to 13 years and 13+ years.[15]

5.2.3 Removing bonds with greater than 30 years maturity

96. For the reasons set out in section 4.1, very long term bond yield estimates from Bloomberg can be presumed to be reliable estimates of actual yields. Moreover, even if these 30+ year observations were reliable, it is unlikely that fitting a regression to them will, absent an even spread of observations at shorter maturities between 10 and 30 years, result in a more accurate estimate of the yield at 10 years. That is, the yield of bonds at 50 years tell us very little about the best estimate of the yield at 10 years

97. For these reasons we recommend that bonds with greater than 30 years to maturity be excluded from the sample. In practice this can be expected to have an effectively zero impact on the GK estimate and only a small impact on the NS and NSS samples

[15] This is because we are focussed on the 10 year estimates and having, for example, 3 BBB bonds at 2 years maturity do not offset having 3 A- bonds at 10 years maturity when it comes to their impact on the 10 year yield estimate..

(provided that the wider BBB to A- sample is used which tends to include bonds with between 10 and 30 years maturity).

5.2.4 Averaging the NS and NSS curves

98. We propose taking the average of the NS and NSS estimates and averaging these with the GK estimate (i.e., giving the NS and NSS estimates 25% weight each and the GK estimate 50%).

99. The re-weighting of the NS and NSS curves is consistent with the fact that these two estimation methods are only slightly different (i.e., they are in the same class of estimates) and giving them equal weight to the GK estimate effectively overweights this class of estimates. As a case in point, we note that the formula for the NSS curve collapses to the formula for an NS curve when the two λ parameters of the NSS curve are equal. This was the case with the ERA's NSS curve estimates for ATCO's averaging periods in 2016 and 2017. The average 10-year cost of debt estimates for 2016 and 2017 thus effectively consisted of 1/3 weighting to the GK and 2/3 weighting to the same NS curve.

100. Re-weighting the NS and NSS curves to each receive 25% weight is also consistent with the GK estimate having been adopted by the RBA while, to the best of our knowledge, no other independent expert that publishes Australian corporate cost of debt benchmarks (including the independent experts relied on by the AER) uses either the NS or the NSS method for that purpose.

101. Nonetheless, in what follows at Table 5-3 we provide estimates of the impact of our proposed method with ("CEG 2") and without ("CEG 1") the reduced weighting to the NS/NSS estimates. The effect is only 2 bp per annum averaged over the last four years.

5.2.5 ERA contingencies

102. The current ERA contingencies (in the event of too small a sample size or disagreement amongst the measures) involve solutions that are problematic.

5.2.5.1 Small sample size

103. First, the ERA contingency that if the number of bonds in the sample falls below 14 then A- and BBB+ bonds should be added is already included in our default method – so provides no solution to a small sample under our proposal. We also consider that the sample size contingency should be restricted by maturity. In particular, that there should be at least 14 bonds from at least 10 different issuers with maturity between 5 and 15 years. That is, what is important is the number of (independent) observations around 10 years – not the number of observations in total.

104. That said, having a small sample would be much less likely given A- and BBB bonds would already be added to our sample. Nonetheless, should this contingency be triggered we consider that defaulting to the AER method would be the best solution.

105. To the extent that the ERA continued to rely on a default sample of only BBB+ bonds and rejected the use of the AER method as a contingency, then we consider that appropriate contingency for a small sample would be including A- and BBB bonds with our proposed weighting scheme to ensure a weighted average BBB+ sample.

5.2.5.2 Disagreement contingency

106. If the methods disagree materially this implies that there is an anomaly in the sample that is affecting the estimation methods differently. However, as discussed in section 4.2.2 this could just as easily be due to the GK estimate being anomalous rather than the NS/NSS estimates being anomalous. Therefore, we do not consider that the ERA contingency to just rely on the GK estimate when the methods disagree is appropriate.

107. In our view the appropriate contingency when the ERA methods are in material disagreement (signifying at least one of them is anomalous) is to rely on the AER method. This has the benefit that independent experts are relied on to interpret the problematic data in real time.

5.3 Results

108. Over the last 4 years of ATCO's averaging periods our primary recommended approach (the AER method) would have resulted in an average cost of debt that was identical to the ERA's newly proposed method.[16] Our alternative recommended approach which retains but modifies the ERA method would have resulted in an average cost of debt estimate that was only 5bp different to the estimates derived from application of ERA's newly proposed method. This difference is partly due due to the de-weighting of the NS and NSS estimates. If this de-weighting was not implemented then the average cost of debt estimate would be just 3 bp different to the ERA's newly proposed method.

109. This is summarised in the below table ("CEG 1" refers to our proposed method without the re-weighting of the NS and NSS curves while "CEG 2" includes the impact of the proposed re-weighting).

[16] Over this period, none of the contingencies are triggered.

Table 5-3: Comparison of ERA BBB+, BBB to A- and BBB to A- with weighting methods for arriving at a BBB+ estimate

	BBB+ only ("ERA")			BBB to A- ("CEG 2")			Averages			
Year	**GK***	**NS**	**NSS**	**GK***	**NS**	**NSS**	**ERA**	**CEG 1**	**CEG 2**	**AER**
2018	4.46	4.23	4.33	4.64	4.46	4.5	4.34	4.53	4.56	4.56
2017	4.64	4.50	4.54	4.62	4.56	4.57	4.56	4.58	4.59	4.57
2016	4.62	4.28	4.29	4.41	4.29	4.29	4.39	4.33	4.35	4.41
2015	5.52	5.13	5.15	5.36	5.18	5.18	5.27	5.24	5.27	5.03
Ave.	**4.81**	**4.54**	**4.58**	**4.76**	**4.62**	**4.64**	**4.64**	**4.67**	**4.69**	**4.64**
Change in average cost of debt compared to ERA							**-**	**0.03**	**0.05**	**0.00**

**The GK estimate has been extrapolated to 10 years;*

110. There is no material impact on the average estimated cost of debt adopting our proposed approach relative to the ERA or AER methods. However, our proposed amendments to the ERA method have the advantage that they are less likely to be unduly influenced by future anomalous samples of bonds (either because third party experts can use their judgement (AER method) or because the number of bonds in the ERA sample is materially increased ("CEG 1 and 2" methods) with the effect that it is less likely that a small number of outliers can materially affect the results.