COMPETITION ECONOMISTS GROUP

Review of the proposed TCSD calculations - Update report

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August 2016


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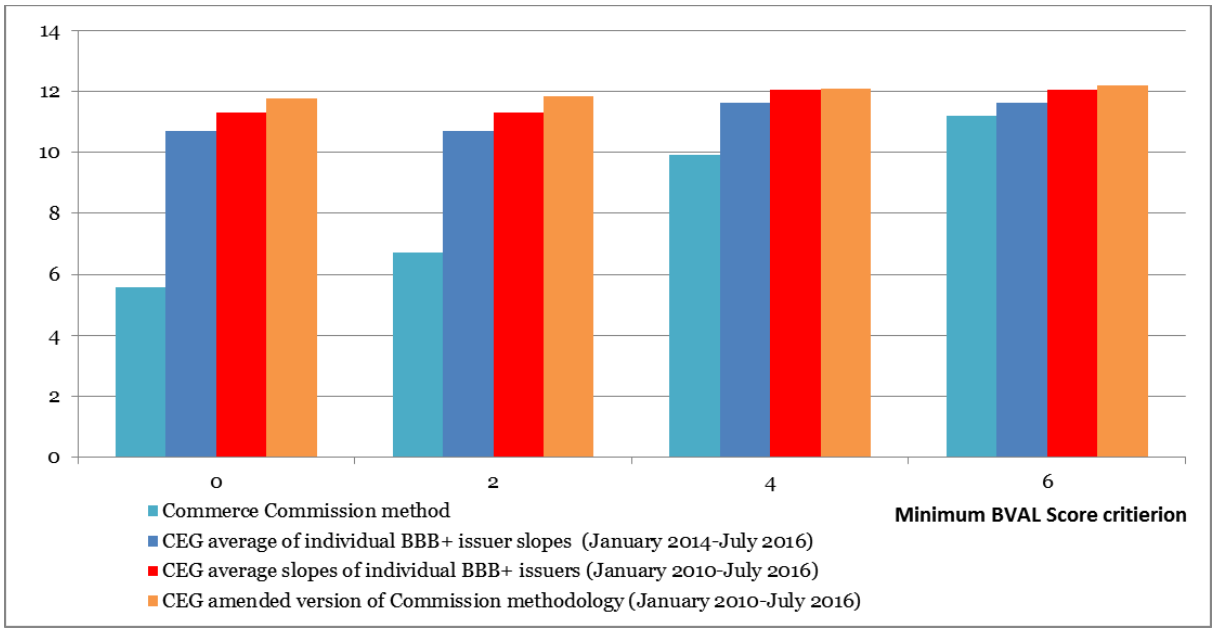
1 Executive Summary

1. In response to the submission by Wellington Electricity[1] we seek to improve the robustness of both our own, and the Commission's unadulterated, analysis by applying a minimum BVAL score criterion for the inclusion of bonds in the analysis. We adopt this criterion on the basis that the BVAL score provides a proxy for the reliability of the data. This is important to ensure the robustness of final estimates.

2. The application of a minimum BVAL score criteria to the Commission's own methodology causes its average slope estimate to rise and be consistent with the average slope we have estimated using our proposed methodologies. Our own estimates are not materially affected by the application of a BVAL score criteria. That is, removing low quality observations as identified by Bloomberg, while leaving the rest of the Commission's methodology unchanged results in the Commission's estimate rising to be more or less the same as our estimates (derived from amendments to the Commission methodology and also from examination of individual issuer slopes). This is illustrated in Figure 1 below.

Figure 1: Impact of minimum BVAL Score criterion on estimated slope (bppa)



[1] Wellington Electricity, 4th August, p. 7.

3. Note that Bloomberg does not assign a 0 BVAL Score. We refer to data having a 0 BVAL Score where BVAL Scores are not available (commonly the case in the first weeks after a bond was issued).

4. Applying a restriction of a minimum BVAL Score of 6, consistent with the BVAL Score adopted by Bloomberg in constructing their BVAL curve,[2] gives rise to the results in Table 1. Table 1 reports our original results as well as the updated results for each method. Although the upper limits in the range across the methods do not substantially increase, the lower limit increases by excluding those bonds with insufficiently reliable data.

Table 1: Results summary

Methodology	Original Report Estimate (bppa)	Update Report Estimate with min BVAL Score of 6 (bppa)
Commerce Commission Estimate	5.56	11.19
CEG estimates since January 2014 as per modified Commission method (Table 23 in original report)	9.8 (2014) to 14.9 (2016)	10.5 (2014) to 14.5 (2016)
CEG estimates since January 2014 averaged across individual issuers (Table 25 in original report)	8.6 (2014) to 14.4 (2016)	11.1 (2014) to 14.4 (2016)
CEG Monthly NSS estimate January 2010-July 2016 (Table 11 in original report)	9.4 to 12.1 (average since 2010)	10.7 to 13.1 (average since 2010)
CEG Monthly average slopes of individual BBB+ issuers January 2010-July 2016 (Table 13 in original report)	10.5 to 12.5 (average since 2010)	11.8 to 12.6 (average since 2010)

[2] ACCC, Regulatory Economic Unit, Return on debt estimation: a review of the alternative third party data series, Report for the AER, August 2014, available at <https://www.aer.gov.au/system/files/ACCC%20Regulatory%20Economic%20Unit,%20Return%20on%20debt%20estimation,%20a%20review%20of%20the%20alternative%20third%20party%20data%20series%20-%20Report%20for%20the%20AER,%20August%202014.pdf> p.41

2 Restrictions on the minimum BVAL Score criteria

5. BVAL Scores have been used in analysis by Bloomberg, AER and QTC in assessing the reliability and quality of the data. For example, Bloomberg states that it derives a Final BVAL Price using a two-pronged approach based on a sequence of proprietary BVAL algorithms[3]:

   - Direct observations – uses trades, indicative quotes and executable levels on the target security (maximum BVAL Score of 10)
   - Observed Comparables – uses direct observations on comparable bonds to derive a relative value price when direct market observations on the Target Bond are insufficient (maximum BVAL Score of 5)

6. Bloomberg then explains:

   > *"All securities are run through all three steps of the algorithm regardless of the quality of the data achieved at the first step. The results are then appropriately weighted and aggregated based on the relative strength of the information in each category. The more observable data, the higher the final BVAL price. The BVAL score is an innovative metric designed to gauge the level of market data used in constructing the final BVAL price. The BVAL Score measures the amount and consistency of market data used in our models. A BVAL Score is calculated for each algorithm – Direct Observations and Observed Comparables – which are then appropriately weighted to derive a Final BVAL Score."*

7. BVAL Scores can be interpreted in the following way[4]:

   - A bond can achieve a score of 7 without having indicative quotes, however a score of 8 or higher requires at least indicative price data from contributors
   - Even where a security has a rating of 8 or more, this can be achieved based on indicative quotes only (rather than executable quotes or actual trades)
   - A score of 10 does not infer that it is a true price which is based on deep, liquid trading in the bond.

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3 Bloomberg, BVAL Pricing Overview for Government, Supranational, Agency & Investment-Grade Corporate Bonds

4 *QTC - Debt Risk Premium Analysis*, Appendix C, January 2012, available at <https://www.aer.gov.au/system/files/Appendix%20C%20-%20QTC%20-%20Debt%20Risk%20Premium%20Analysis%20-%20Revised%20Revenue%20Proposal.pdf>p.41

8. There are different views on what BVAL Score is necessary to have sufficient confidence in the quoted price. QTC view a score of 8 or more is necessary, based on the view that "*the rating scale of one to ten should not be regarded as a linear scale*"[5] and "*for this reason, a score of 7 should not be viewed as being 'nearly as good as' a score of 8*"[6]. On the other hand Bloomberg, in constructing the BVAL curve, only uses data with a BVAL score of 6 or higher. The AER uses the BVAL curve as a third party data series in estimating the return on debt of the benchmark efficient entity[7].

9. The AER has also commented on the efficacy of BVAL Scores in dealing with the problem of pricing data quality, in comparison with minimum issue size restrictions imposed by the RBA[8]. In the AER's view, the restriction on the BVAL score is a more direct and effective way in dealing with pricing data quality issues. The AER also comments that it is more consistent with the AER WACC criteria (2) and (5), in that it is better fit for purpose and the market data used is comparable and timely.[9]

10. We note that applying a BVAL restriction will have the effect of not only improving the quality of the data observations and also the internal consistency of these observations. For example, it may be that, other things equal, a higher BVAL score is associated with higher liquidity, lower liquidity premium and, therefore, lower spread to CGS. If this is the case then a BVAL restriction will, in addition to improving data quality, also result in a better 'like for like' estimate of the slope. That is, the quality of the slope estimate will be improved by improving the quality of the individual bond data and also the comparability across bonds – allowing a more accurate estimate of the impact of maturity on DRP for similar bonds.[10]

11. The overall effect of the BVAL score restriction on the resulting estimate depends on the proportion of bonds with low BVAL scores in the samples at any particular time, and after the restriction is imposed, whether there are sufficient estimates (for our analysis, at least 3 bonds) to run a regression.

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5 *QTC - Debt Risk Premium Analysis*, Appendix C, January 2012, available here p.41

6 *QTC - Debt Risk Premium Analysis, Appendix C, January 2012,* available here *p.41*

7 Final Decision, Jemena Gas Networks (NSW) Ltd, Access Arrangement 2015-20, Attachment 3 - Rate of Return, June 2015, p.191

8 ACCC, Regulatory Economic Unit, Return on debt estimation: a review of the alternative third party data series, Report for the AER, August 2014, available here.

9 ACCC, Regulatory Economic Unit, Return on debt estimation: a review of the alternative third party data series, Report for the AER, August 2014, available at p.11

10 If the objective was to estimate the level of the DRP then one may have to be more careful about imposing a BVAL score restriction. Such a restriction may be problematic if a regulated business's debt was itself likely to be illiquid and therefore have a low BVAL score (or have a DRP more similar to bonds with low BVAL scores).

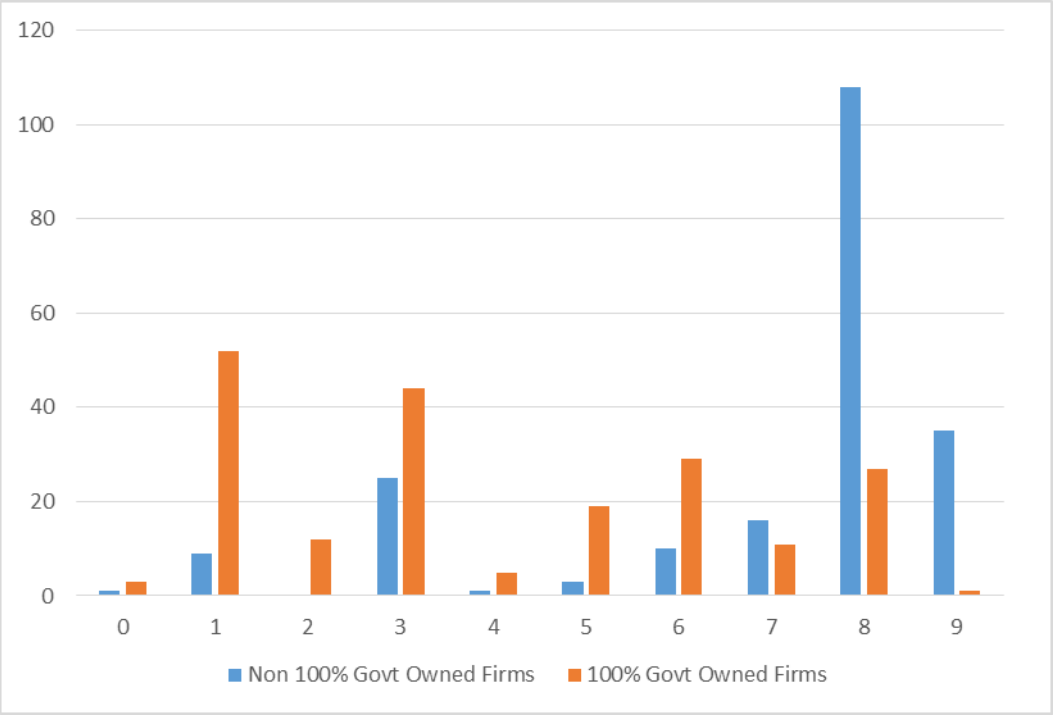
3 Using the Commission method (and our proposed amendments)

3.1 Applying a BVAL criteria to otherwise unamended Commerce Commission method

12. Figure 2 shows the distribution of BVAL scores amongst the observations used to calculate the TCSD by the Commerce Commission[11]. There are many observations for firms that are 100% owned by the federal government that have very low BVAL scores. There are also several observations whose BVAL scores cannot be obtained. Due to problems with the reliability of observations with low BVAL scores, we report sensitivities for when these observations are removed. It is notable that applying a BVAL Score restriction mostly excluded observations for bonds who, at the relevant time, were issued by a 100% government owned entity. Consequently, it is not surprising that applying this restriction leads to similar results as not applying a BVAL restriction but nonetheless excluding 100% government owned bonds from the analysis.

[11] *Commerce Commission, Input methodologies review draft decisions Response to TCSD data requests 15-July-2016, http://www.comcom.govt.nz/dmsdocument/14494*

Figure 2: Distribution of BVAL scores in TCSD calculation



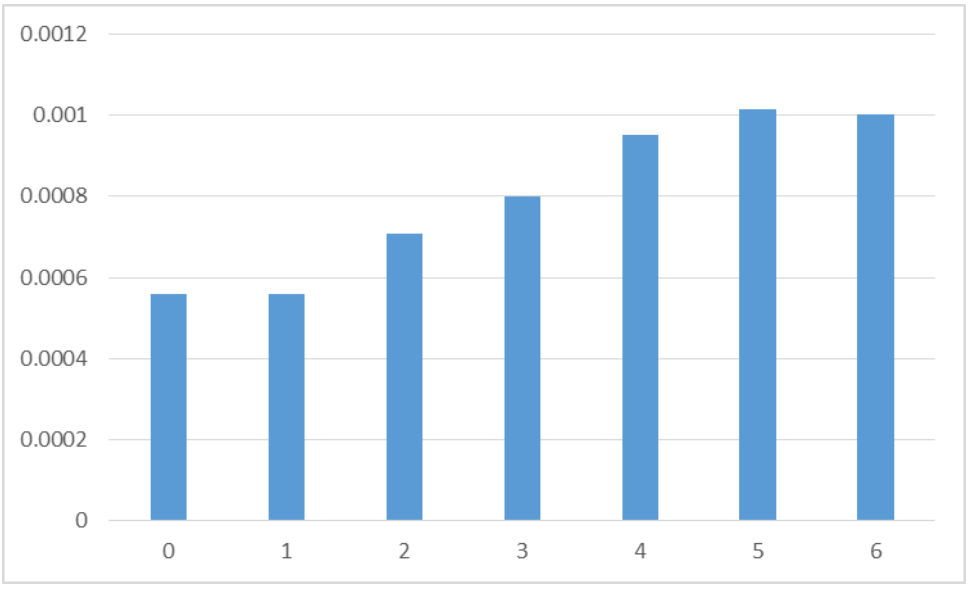
Source: CEG analysis using data from the Commerce Commission and Bloomberg

13. In the simplest approach, the original 5 year debt risk premium (DRP) of 1.69% from the Commerce Commission NSS regression is retained and only the linear slope is re-calculated based on the adjusted sample. Figure 3 shows the result of the adjustment on the spread premium slope. The first column reports the original spread premium slope. The remaining 6 columns show the change in spread premium slope as the minimum BVAL score is increased from 1 to 6.

14. When observations with no BVAL scores are removed from the sample, they have no effect on the result. However as the minimum BVAL score increases, the spread premium slope increases from less than 0.006 to 0.01, almost double of the original slope. This indicates that observations with low BVAL scores have a significant impact on the result. When a minimum BVAL Score of 6 is applied data the spread premium equation becomes

$$debt\ premium = 0.001003 \times (tenor\ remaining - 5\ years)$$

Figure 3: TCDS adjustment only

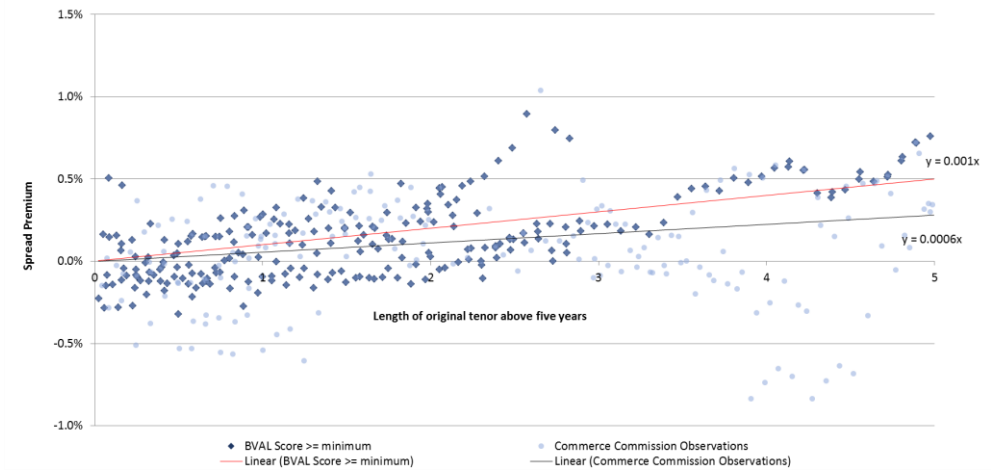


Source: CEG analysis using data from the Commerce Commission and Bloomberg

15. Figure 4 replicates the figure produced in the Input Methodology Review Draft Decisions paper[12] taking into account the minimum BVAL scores. The light dots are the original draft decision observations and the highlighted dots are observations that have BVAL scores equal or above 6. The black line is the linear trend for the original sample. When observations with low BVAL scores are removed, all the remaining observations with tenor above 8.5 years (3.5 years on the horizontal axis where zero signifies 5 years) lie above the original trend line. The red line shows the trend line when the sample is restricted to a BVAL score that is 6 or above, with a slope of 0.001.

[12] *Commerce Commission, Input methodologies review draft decisions- Topic paper 4 – Cost of capital issues – 16 June 2016, pg 210, Figure 23, http://www.comcom.govt.nz/dmsdocument/14333*

Figure 4: Spread premium slope with minimum BVAL score at 6



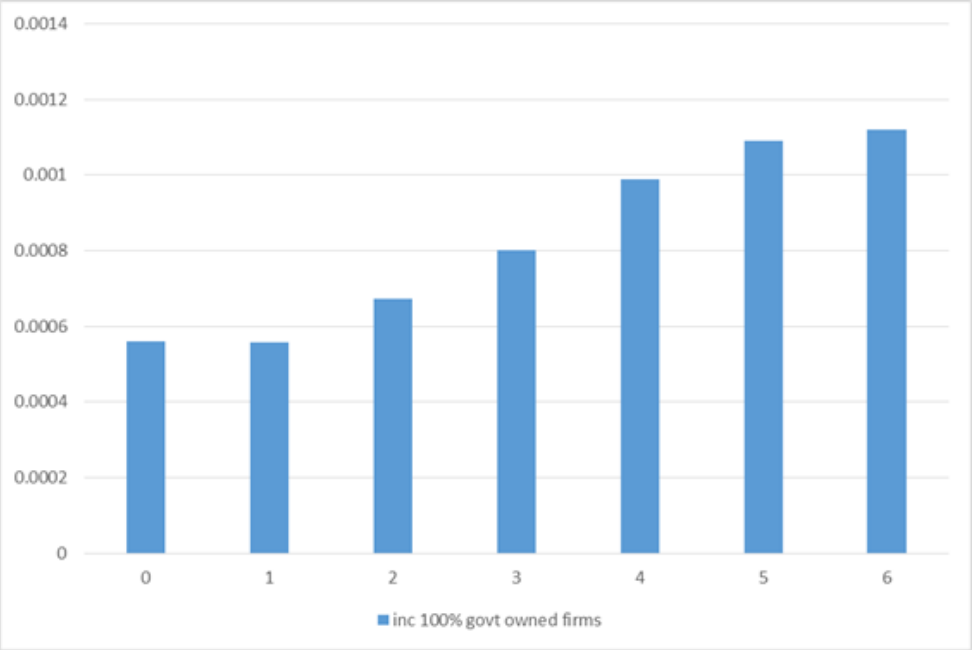
Source: CEG analysis using data from the Commerce Commission and Bloomberg

16. For a robustness check, we also retain observations with no BVAL scores to investigate the impact on the final result. When the sample includes observations with no BVAL scores and a minimum BVAL of 6, the spread premium slope becomes 0.000981. This is approximately the same as the result when observations with no BVAL scores are removed which is 0.001003.

17. The previous result assumes that the 5 year DRP is 1.69%. However, the NSS regression used by the Commerce Commission may also be impacted by observations with low BVAL scores. Therefore, we remove observations with low BVAL scores in the NSS regression stage to re-estimate the 5 year DRP and use the adjusted 5 year DRP to calculate the spread premium slope. The result of the analysis is illustrated in Figure 5.

18. The result is similar to the previous result in Figure 3. It shows that as observations with low BVAL scores are removed from the sample, the spread premium slope increases from less than 6bppa to above 10bppa.

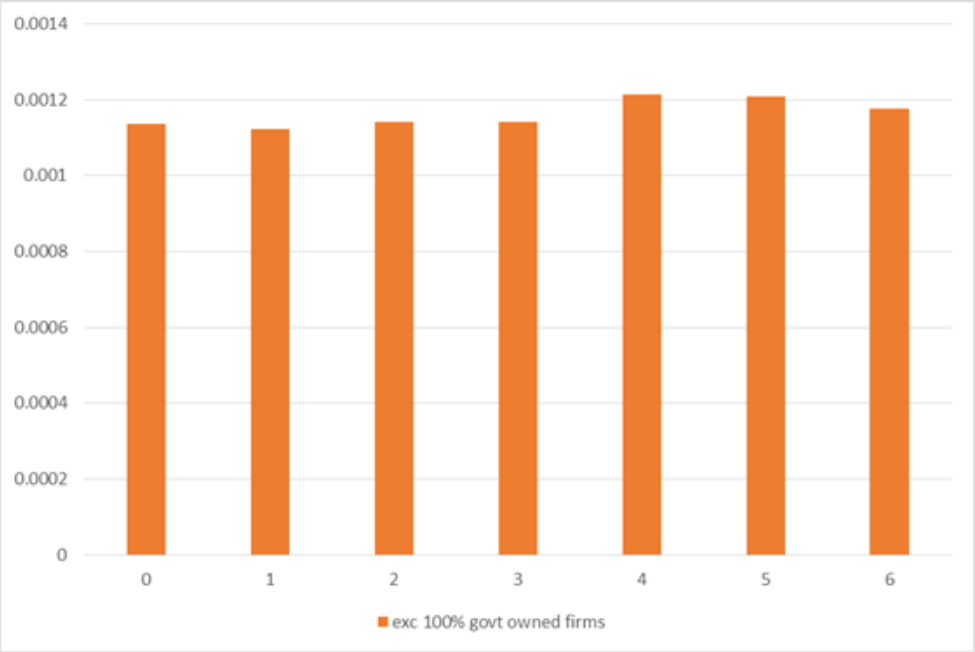
Figure 5: NSS regression with TCDS including 100% government owned firms



Source: CEG analysis using data from the Commerce Commission and Bloomberg

19. When the analysis is limited to the dataset where 100% government owned firms are excluded, removing low BVAL score observations has only a small impact on the final result as shown in Figure 6. The removal of low BVAL score observations results an increase in the spread premium slope from below 11.4bppa to around 11.8bppa. The difference in the spread premium slope is much smaller when the sample exclude 100% government owned firms' bonds compared to the sample that include these bonds. This indicates that observations with low BVAL scores are causing the downward bias to the spread premium slope in the 100% government owned firms' observations.

Figure 6: NSS regression with TCDS excluding 100% government owned firms[CEG1]



Source: CEG analysis using data from the Commerce Commission and Bloomberg

3.2 Applying a BVAL restriction to our amended version of the Commission method

3.2.1 Estimation of BBB+ bonds only

20. As noted in our previous report, pooled regression is only valid if the 5 year DRP is assumed to be constant across time. When the 5 year DRP is not constant, each time period should be estimated separately. This section takes into account the impact of BVAL scores into the monthly estimation of 5 year DRP and monthly spread premium slope introduced in the previous report.[13]

21. Section 3.2.1 of the previous report adopts the monthly estimation approach to estimate the 5 year DRP and spread premium slope. Then it reports the unweighted and weighted average of the monthly spread premium slope. This section updates the previous result to include the impact of BVAL scores. The estimation procedure is repeated for different BVAL score requirements.

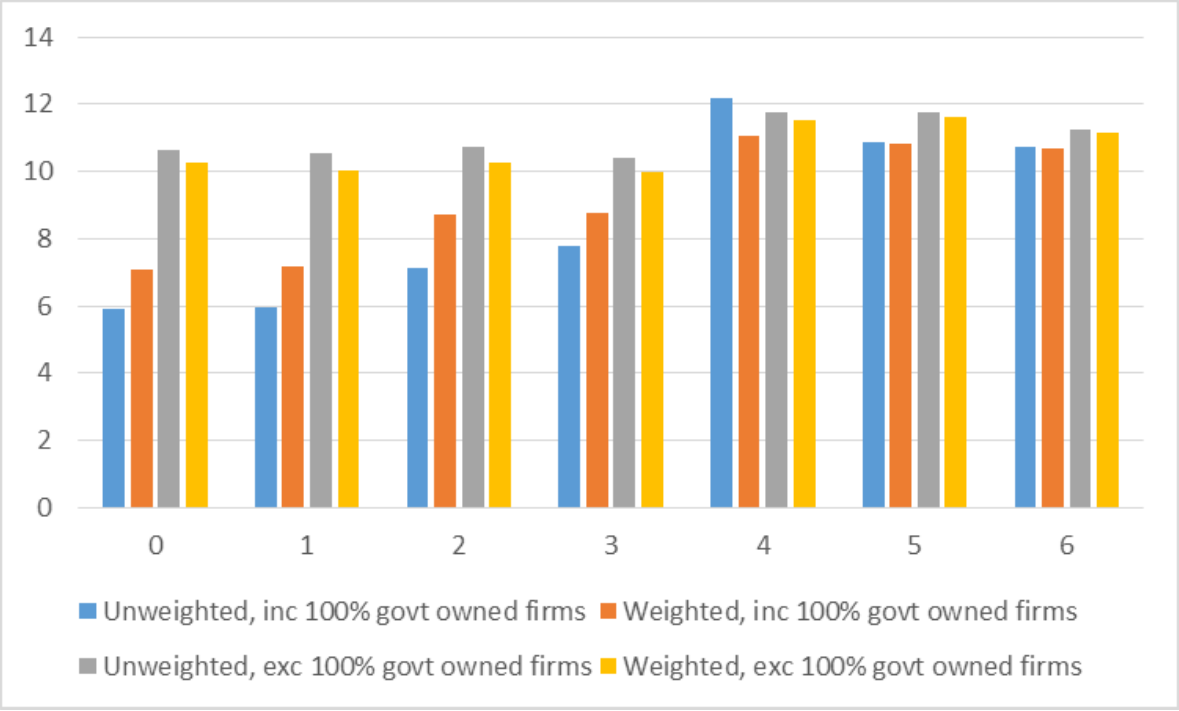
22. The result is shown in Figure 7. The first set of columns provides the results from the previous report which assumes no restrictions on the sample due to BVAL scores. The

[13] For details on the methodology see, CEG, "Review of the proposed TCSD calculations", 2016

next set excludes observations with no BVAL scores and the set after that has a minimum score of two and so forth. The first two columns of each set include 100% government owned firms' bonds and the next two columns of the set exclude 100% government owned firms' bonds. In addition, the first and third columns show the unweighted average slope and the second and fourth column report the average slope weighted by the number of bonds with tenor 5 years or higher beyond the minimum.

23. Figure 7 shows that when the calculation excludes 100% government owned firms' bonds, the removal of low quality data points have a small effect on spread premium slope. The spread premium slope increases from just above 10bppa per year of tenor to almost 12bppa per year of tenor. However, when the dataset include 100% government owned firms' bonds, removing observations with low BVAL scores can have a significant impact on the spread premium slope. When observation with low BVAL scores are removed, the slope increases from less than 6bppa per year of tenor to almost 11bppa per year of tenor for the unweighted case. Under the weighted average, the spread premium slope increases from around 7bppa per year of tenor to almost 11bppa per year or tenor.

Figure 7: Regression with only BBB+ bonds



Source: CEG analysis using data from Bloomberg

24. Furthermore the removal of observations with no BVAL scores does not affect the increasing trend of slopes as low quality observations are removed. Table 2 reports the spread premium slope when the minimum BVAL score is 6 and 100% government

owned firms' bonds are included. The inclusion and exclusion of observations with no BVAL scores does not impact the result materially.

Table 2: Spread Premium Slope with minimum BVAL score of 6 and BBB+ only

Observations with no BVAL scores	Unweighted	Weighted
Excluded	10.7	10.7
Included	11.9	11.1

Source: CEG analysis using data from Bloomberg

25. Removal of observations with low BVAL scores has only had a small impact on estimates of more recent DRP slope as seen in Table 3. The maximum spread in the estimates is only 1.2bppa, 0.5bppa and 1.8bppa for 2014, 2015 and 2016 till July 19th respectively.

Table 3: Impact of BVAL scores on estimates of DRP slope since 2014

Minimum BVAL Score	0	1	2	3	4	5	6
Calendar 2014	9.82	9.55	9.74	9.47	10.75	11.14	10.47
Calendar 2015	10.18	10.13	10.21	10.54	10.63	10.55	10.53
January to 19 July 2016	14.90	14.23	14.79	14.79	15.42	13.57	14.48

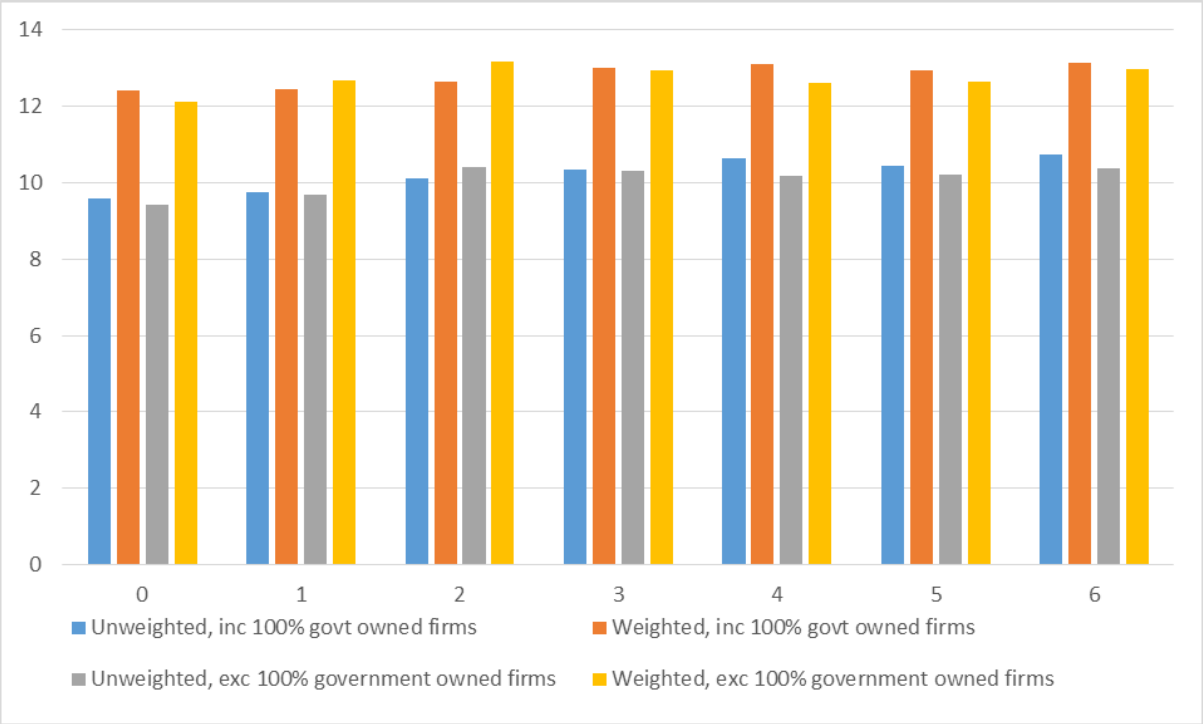
Source: CEG analysis using data from Bloomberg

3.2.2 Joint estimation of A- and BBB+ bonds

26. Section 3.2.2 of the previous report publishes the spread premium slope when A-, BBB+ and BBB bonds are estimated together using dummy variables to capture the difference between the credit ratings. This section updates the previous result taking into account BVAL scores. Figure 8 and Figure 9 reports the impact of BVAL scores for A- and BBB+ bonds respectively. As in the previous report, the slope of BBB bonds cannot be reported due to the small number of observations to calculate the slope for each month.

27. In the case of A- bonds in Figure 8, excluding observations with low BVAL scores has little effect on the result. The blue and grey columns report the simple average slope for including and excluding 100% government owned firms and they are very similar across different BVAL score requirements. The weighted average is approximately 2bppa per year of tenor higher than the simple average and the result holds whether the dataset includes or excludes 100% government owned bonds and any BVAL score requirement.

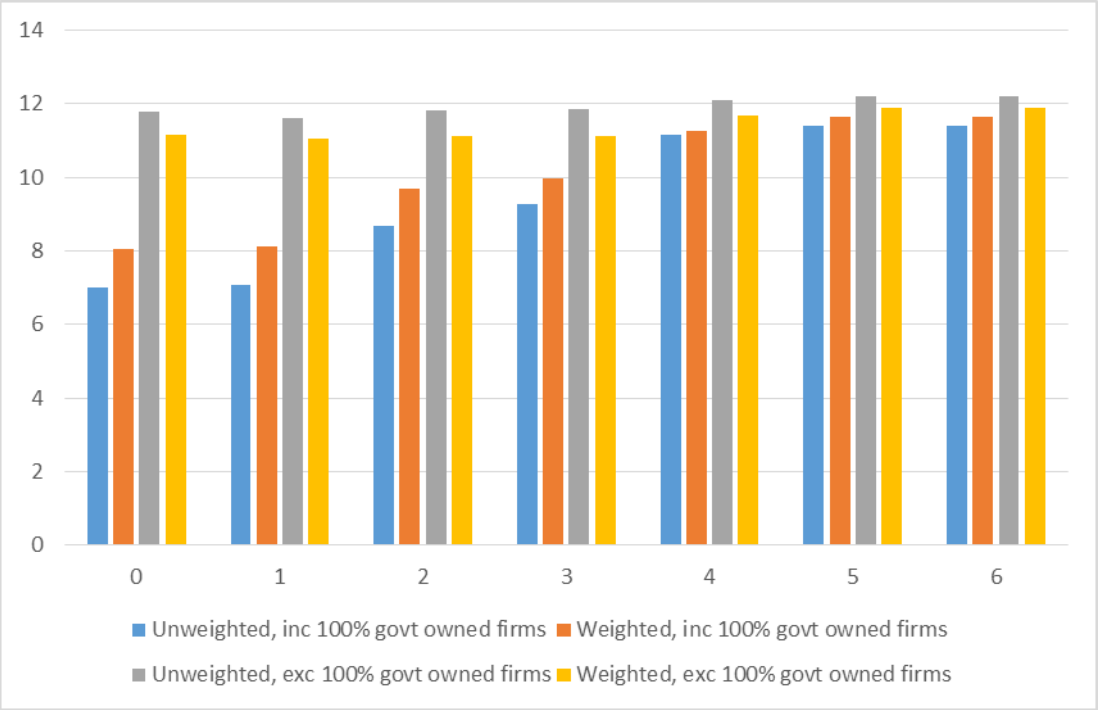
Figure 8: Effect of BVAL scores on the spread premium slope of A- bonds



Source: CEG analysis using data from Bloomberg

28. On the other hand, Figure 9 shows that low BVAL score observations have an impact for BBB+ bonds. When the dataset exclude 100% government owned firms' bonds, as indicated by the grey and yellow columns, applying BVAL scores and weighting does not affect the result. However, when the dataset include 100% government owned firms' bonds, removing observations with low BVAL scores can have a significant impact on the spread premium slope. When BBB+ observations with low BVAL scores are removed, the slope increases from less than 8bppa per year of tenor to almost 12bppa per year of tenor.

Figure 9: Effect of BVAL scores on the spread premium slope of BBB+ bonds



Source: CEG analysis using data from Bloomberg

29. Furthermore the removal of observations with no BVAL scores does not affect the increasing trend of slopes as low quality observations are removed. Table 4 reports the spread premium slope when the minimum BVAL score is 6 and 100% government owned firms' bonds are included. The inclusion and exclusion of observations with no BVAL scores does not impact the result.

Table 4: Spread Premium Slope with minimum BVAL score of 6

	A-	A-	BBB+	BBB+
Observations with no BVAL scores	Unweighted	Weighted	Unweighted	Weighted
Excluded	10.7	13.1	11.4	11.6
Included	10.5	13.2	11.4	11.5

Source: CEG analysis using data from Bloomberg

4 DRP slopes per issuer

30. In our original report, Table 16 and Table 18 reported an average slope for BBB+ issuers from a monthly regression of 11.29 (excluding pre-privatisation data) and 9.19 (including pre-privatisation data). These results are reflected in Table 5 below, where the Minimum BVAL score is 1. It can be seen that as the minimum BVAL score increases, the average slope increases. In fact, applying a minimum BVAL score of 8 increases the average slope by 3 basis points for the dataset including pre-privatisation data, and by less than 1 basis point for the dataset excluding pre-privatisation data. The difference in impact of the BVAL score restriction between the two datasets can be attributed to the fact that the data excluding pre-privatisation already excludes 53 monthly data points that would have had a BVAL score of less than 8.

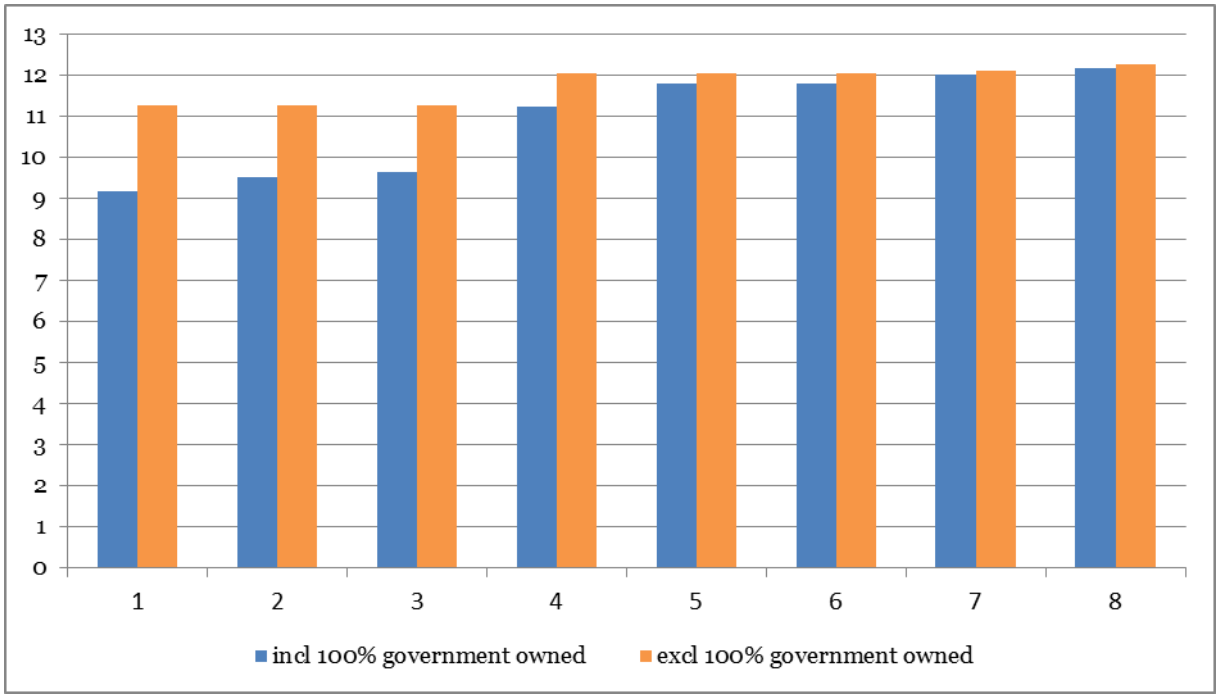
Table 5: BVAL score restrictions - BBB+

	Including pre-privatisation data			**Excluding pre-privatisation data**		
Minimum BVAL score	Average	Correlation	No. of Regressions	Average	Correlation	No. of Regressions
1	9.19	-0.6464	108	11.29	-0.5765	56
2	9.52	-0.7275	98	11.29	-0.5765	56
3	9.64	-0.7199	96	11.29	-0.5765	56
4	11.25	-0.7039	53	12.06	-0.4869	47
5	11.80	-0.6548	51	12.06	-0.4869	47
6	11.80	-0.6548	51	12.06	-0.4869	47
7	12.04	-0.5398	48	12.12	-0.4905	45
8	12.19	-0.6300	43	12.27	-0.5816	40

Source: Bloomberg data, CEG analysis. Note this analysis, similar to the original report, only includes fixed bonds that have an "at maturity" maturity type. These results also include the original restriction of a minimum of 3 bonds in a regression.

31. The increasing trend is demonstrated in Figure 10 which shows the average slopes when pre-privatisation data is both included and excluded.

Figure 10: Average slopes for BBB+ based on minimum BVAL score restriction



Source: Bloomberg, CEG analysis.

32. For issuers with a credit rating of A- (Table 16 and Table 18 in the original report) we previously estimated an average slope of 11.74. With a minimum BVAL score restriction of 8, the average slope is 13.02 as shown in Table 6 below.

Table 6: BVAL score restrictions - A-

Minimum BVAL score	Average	Correlation	No. of Regressions
1	11.74	-0.4095	64
2	12.08	-0.5207	58
3	12.08	-0.5207	58
4	11.74	-0.6202	44
5	11.76	-0.6199	42
6	11.80	-0.6187	41
7	12.43	-0.5966	35
8	13.02	-0.6550	27

Source: Bloomberg, CEG analysis.

33. Overall, for all credit ratings, implementing a BVAL score restriction results in higher average slopes, except for issuers with a credit rating of A (where the estimate stays constant across the BVAL scores).

Table 7: BVAL score restrictions - average slopes for all credit ratings

Minimum BVAL score	A	A-	BBB+	BBB	All issuers
1	10.81	11.74	9.19	2.03	9.90
2	10.81	12.08	9.52	2.03	10.05
3	10.81	12.08	9.64	2.03	10.05
4	10.81	11.74	11.25	5.28	10.70
5	10.81	11.76	11.80	5.28	10.71
6	10.81	11.80	11.80	5.28	10.73
7	10.81	12.43	12.04	5.28	11.02
8	10.81	13.02	12.19	5.91	11.43

Source: Bloomberg, CEG analysis. Note that the average slopes for BBB+ are derived from excluding pre-privatisation data.

34. For all issuers (Table 16 and Table 18 in the original report) we estimated an average slope of 9.90bppa (excluding pre-privatisation data) and 9.01bppa (including pre-privatisation). In Table 8 below, the average slopes increase by 2 basis points when pre-privatisation data is included and approximately 1.5 basis points, for data excluding pre-privatisation data.

Table 8: BVAL Score restrictions - all issuers

	Including pre-privatisation data			Excluding pre-privatisation data		
Minimum BVAL score	Average	Correlation	No. of Regressions	Average	Correlation	No. of Regressions
1	9.01	-0.3528	197	9.90	-0.3229	145
2	9.29	-0.4352	181	10.05	-0.3705	139
3	9.34	-0.4320	179	10.05	-0.3705	139
4	10.35	-0.4072	108	10.70	-0.3143	102
5	10.60	-0.3861	104	10.71	-0.3141	100
6	10.61	-0.3856	103	10.73	-0.3136	99
7	10.98	-0.3268	94	11.02	-0.3057	91
8	11.40	-0.3883	79	11.43	-0.3675	76

Source: Bloomberg, CEG analysis.

5 DRP term premium inversely related to DRP level

35. Adding an additional criterion for regression of a minimum BVAL score does not affect the relationship between the DRP term premium and the DRP level. From Table 9, it is clear that the inverse relationship persists despite the additional data restriction. There is no identifiable trend however, with regards to the impact of increasing the minimum BVAL score on the correlation between the DRP term premium and DRP level.

Table 9: Correlation for credit ratings (A-, BBB+ and all issuers)

Minimum BVAL score	A-	BBB+	All issuers
1	-0.4095	-0.5765	-0.3229
2	-0.5207	-0.5765	-0.3705
3	-0.5207	-0.5765	-0.3705
4	-0.6202	-0.4869	-0.3143
5	-0.6199	-0.4869	-0.3141
6	-0.6187	-0.4869	-0.3136
7	-0.5966	-0.4905	-0.3057
8	-0.6550	-0.5816	-0.3675