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19th September 2014

Our Reference: FG.05.06.01

Dr Guy Debelle
Assistant Governor (Financial Markets)
Reserve Bank of Australia
GPO Box 3947
SYDNEY NSW 2001

BY EMAIL TO: Radevskiv@rba.gov.au

Dear Mr Debelle,

BIASES IN TABLE F3, AGGREGATE MEASURES OF AUSTRALIAN CORPORATE BOND SPREADS AND YIELDS (NON-FINANCIAL CORPORATE BONDS)

I refer to the indicator series of corporate bond spreads that was developed by the Reserve Bank of Australia (RBA)[1], and which is published on a monthly basis as Table F3. I understand that the RBA aims to produce a data series of corporate credit spreads which is unbiased and properly representative of conditions in secondary bond markets.

The Australian Energy Regulator (AER) is considering whether to make use of the RBA indicator series for A rated or BBB rated corporate debt. If the AER were to draw upon the figures published by the RBA, then it would incorporate them into calculations for the regulatory return on debt. The AER commenced a round of consultations, on the use of third party proxy variables to determine the cost of debt, in April this year.

The AER is currently reviewing regulatory proposals from electricity and gas distribution businesses in NSW, and the ACT, and is due to hand down draft decisions later this year. Electricity distributors in Queensland and South Australia will be lodging regulatory proposals at the end of October. The draft decisions will incorporate allowances for the rate of return on capital which will apply for the forthcoming five-year regulatory control periods. Electricity distributors in Victoria are scheduled to submit proposals to the AER in April 2015.

United Energy and Multinet Gas have a direct and immediate interest in understanding the methods and

[1] Arsov I, M Brooks and M Kosev (2013), 'New Measures of Australian Corporate Credit Spreads', Reserve Bank of Australia Bulletin, December, pp 15–26..

data sources used by the RBA, and in ensuring that the measures of corporate bond spreads provide a fair and accurate reflection of the debt risk premium at target tenors of up to ten years.

A number of consultancy projects have been undertaken as businesses seek to replicate and then evaluate the methods that have been employed by the RBA.

The Competition Economists Group, (CEG), attempted to re-create the source data that the RBA had used to calculate its summary measures of corporate bond spreads. CEG also sought to repeat the exercise undertaken by the RBA, and to compile aggregate corporate bond indices, stratified by broad credit rating class. CEG followed the methods which had been documented by the RBA in the Bulletin article[2]. Thereafter, CEG provided the results of its empirical work to United Energy and Multinet Gas, and also supplied data.

ESQUANT Statistical Consulting made use of the data that had been compiled by CEG and then applied kernel smoothing techniques. ESQUANT compared the Gaussian kernel method, which was the technique used by the RBA, with the approach and the results from another non-parametric method, local linear smoothing. ESQUANT also estimated Nelson-Siegel yield curves, drawing upon the same daily data which covered the period from November 2013 to February 2014.

ESQUANT found that the RBA had implemented the Gaussian kernel method, (local constant smoothing), correctly. There was close agreement between the results for the spread-to-swap obtained by ESQUANT, using data supplied by CEG, and the figures published by the RBA. By way of example, Table 1 below presents the results for the spread-to-swap for A-rated securities in February 2014.

Table 1: A comparison of spreads over swap, A rated securities, February 2014

	3 years	5 years	7 years	10 years
RBA estimates, February 2014	66.36	88.07	107.37	118.84
CEG replication, February 2014	64.55	88.05	106.09	118.87
ESQUANT replication, February 2014	64.4	88.04	105.99	118.81

Source: A Review of Measures of Australian Corporate Credit Spreads published by the Reserve Bank of Australia, ESQUANT Statistical Consulting, May 19, 2014; section 3.

The RBA selected a value for the smoothing parameter, sigma, of 1.5, after apparently trialling a range of values[3]. In contrast, ESQUANT applied the technique of leave-one-out cross-validation to derive an

[2] Arsov I, M Brooks and M Kosev (2013), 'New Measures of Australian Corporate Credit Spreads', Reserve Bank of Australia Bulletin, December, pages 15–26..

[3] Arsov I, M Brooks and M Kosev (2013), 'New Measures of Australian Corporate Credit Spreads', Reserve Bank of Australia Bulletin, December, page 22.

appropriate value of sigma and determined, using data from 28th February 2014, that an optimal value for A-rated securities would be σ = 2, whilst an optimal value for BBB-rated securities would be σ = 1.1. ESQUANT concluded that these empirically-determined values were close to the value of σ = 1.5, chosen by the RBA[4].

Shortcomings of the Gaussian kernel method (local constant smoothing)

The report from ESQUANT explains that the method of local constant smoothing gives rise to biased estimates of the cost of debt at different target tenors. This is because the Gaussian kernel estimator assumes that the relationship between the spread to swap and the remaining term to maturity of a bond is constant at each of the target tenors, and in the vicinity of the target tenors (3, 5, 7, and 10 years)[5]. In practice, the relationship is not constant, but could be measured approximately using a straight line.

ESQUANT has explained that when the Gaussian kernel method is applied, there is bias at the boundary regions because of the inherent asymmetry of the kernel in those regions[6]. Over much of the domain, the smooth fitted curve captures the main trend of the data, as is required. However, when the Gaussian kernel estimate is applied at the right hand side boundary, at a target tenor of ten years, most of the observations used to construct the weighted average have a remaining term to maturity of less than ten years, and, correspondingly, the slope of the true relation induces boundary bias into the estimate of the spread to swap. The estimate of the cost of debt at ten years will therefore be less, under local constant smoothing, than what it would be if other more flexible methods were applied.

In a well-regarded text book, statisticians Hastie, Tibshirani and Friedman note that a bias may also be present in the interior of the domain, if the values along the horizontal axis (representing term to maturity, in the current context) are not equally spaced[7]. The bias also occurs because of the asymmetry of the kernel, but is generally less severe. The authors state further that by fitting straight lines rather than constants locally, the bias can be remedied to first order. Locally weighted linear regression is the technique used to make a first order correction.

ESQUANT has shown that the bias to first order is given by:

(Effective tenor – Target tenor) × (Slope at target tenor).

An inspection of the data in the RBA's Statistical Table F3 shows that at a ten-year term to maturity, the

[4] ESQUANT (2014), 'A Review of Measures of Australian Corporate Credit Spreads published by the Reserve Bank of Australia; SUBMISSION TO THE ISSUES PAPER (RETURN ON DEBT: CHOICE OF THIRD PARTY DATA SERVICE PROVIDER) RELEASED BY THE AUSTRALIAN ENERGY REGULATOR (APRIL 2014); a report prepared for United Energy and Multinet Gas'; ESQUANT Statistical Consulting; May 19 2014; page 14.

[5] Ibid; page 14.

[6] Ibid; page 15.

[7] Hastie, T., Tibshirani, R., and Friedman, J. (2009). The Elements of Statistical Learning: Data Mining, Inference, and Prediction, 2nd Edition. Springer: New York.; pages 194-195.

effective tenor is invariably below target[8]. This result is observed for A-rated and BBB-rated bonds.

ESQUANT applied a number of empirical methods to data on bonds which covered the period from November 2013 to February 2014. The models were fitted to samples of BBB rated bonds, with the samples chosen to "mimic" those that would be compiled by the RBA. ESQUANT demonstrated that the results from the Gaussian kernel method lay below those obtained by fitting Nelson-Siegel yield curves. The spreads to swap produced using the Gaussian kernel were also significantly below the spreads derived using local linear smoothing[9].

Possible ways forward

United Energy and Multinet Gas suggest that the RBA should consider alternative methods for generating its indices of corporate bond spreads. UEMG would like to propose that a meeting be convened with technical staff at the RBA so that the topics outlined in this letter can be discussed. We request that such a meeting be called before 31st October 2014. The parties that UEMG would bring along to the meeting would be representatives from ESQUANT Statistical Consulting, and, potentially, an economist from the Competition Economists Group.

I would be grateful if you could please let me know how you intend to take this matter forward.

Yours sincerely,

Jeremy Rothfield
Network Regulation and Compliance Manager

[8] RBA Table F3, AGGREGATE MEASURES OF AUSTRALIAN CORPORATE BOND SPREADS AND YIELDS: NON-FINANCIAL CORPORATE (NFC) BONDS; as at end-September 2014.

[9] ESQUANT (2014), 'A Review of Measures of Australian Corporate Credit Spreads published by the Reserve Bank of Australia; SUBMISSION TO THE ISSUES PAPER (RETURN ON DEBT: CHOICE OF THIRD PARTY DATA SERVICE PROVIDER) RELEASED BY THE AUSTRALIAN ENERGY REGULATOR (APRIL 2014); a report prepared for United Energy and Multinet Gas'; ESQUANT Statistical Consulting; May 19 2014; page 28.