Comments on RBA Measures of Australian Corporate Credit Spread

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1 Summary

The Reserve Bank of Australia (RBA) intends to publish monthly kernal smoothing based estimates of bond spreads, beginning December 2013. This note gives some comments on the advantages and disadvantages of this non-parametric method relative to traditional parametric methods such as fitting Nelson-Siegel yield curves. The kernal based method is a locally weighted average and it is suggested that if a smoothing method is to be used, then there are advantages in using local linear smoothing, particularly at the boundaries.

2 Non-Parametric vs. Parametric Methods

Non-parametric methods, such as the kernal smoothing method proposed by the RBA (Arsov et al., 2013) do not assume a functional form for the relationship between the dependent variable and the independent variable, in this case the average bond spread and term to maturity, respectively. Generally, non-parametric methods are not as precise as parametric methods but they do avoid the possible bias that can occur if the assumed parametric model is incorrect (See, for example, James et al., 2013, p 23).

3 Nelson-Siegel Models

The most commonly used parametric technique is that due to Nelson and Siegel (1987). Diebold and Rudenbusch (2013) list the desirable properties of the method: The curve enforces some basic constraints from financial economic theory; it provides a parsimonious approximation; and also provides a flexible approximation, which is desirable because the yield curve can assume different shapes at different times.

The Nelson-Siegel model is non-linear so can be difficult to fit. Arsov et al. (2013) report difficulties with fitting the Nelson-Siegel model. These difficulties can occur, but usually with smaller sample sizes than those used here and where the data is over a smaller range of maturities. Anneart et al. (2013) give methods to help overcome these computational problems.

4 Smoothing Methods

4.1 Kernal Smoothing

The RBA proposal is a Kernal estimator. Performance is usually quite similar irrespective of the Kernal chosen. The pragmatic choice of σ seems quite sensible. However, it should be pointed out that the model underlying the Kernal estimator is that the local relationship is that of a constant. As the RBA itself points out, there are problems at the boundaries.

Hastie et al. (2009, pp 194–195) discuss the properties of Kernal estimators:

> "The smooth kernal fit still has problems .... Locally weighted averages can be badly biased on the boundaries of the domain because of the asymmetry of the kernal in that region. By fitting straight lines rather than constants locally, we can remove this bias exactly to first order." ...

4.2 Local Linear Smoothing

As indicated above, to overcome the bias Hastie et al (2009, p 198) show that local linear or quadratic smooths are superior to local constant smooths:

> "To summarise some collected wisdom on the issue:
>
> - Local linear fits can help reduce bias dramatically at the boundaries at a modest cost in variance. Local quadratic fits do little at the boundaries for bias, but increase the variance a lot.
> - Local quadratic fits tend to be most helpful in reducing the bias due to curvature in the domain."

5 Time Series

The RBA intends to publish the new series on a monthly basis. It would be straightforward and useful to smooth in both directions, maturity and time. The RBA appears to be proposing a separate analysis each month, not taking into account results of previous months.

It would also be possible to do the same with the Nelson-Siegel methods, although this would involve more demanding computations. Diebiold and Rudenbusch (2013) detail the dymnamic Nelson-Siegel model, which accounts for the yield curve at a particular point in time, but also how the yield curve evolves over time. The methods used are based on state-space modelling of the level, slope, and curvature factors in the Nelson-Siegel model and estimation via the Kalman Filter.

Both these methods would extract more information that the method proposed by the RBA.

References

Anneart, J., Claes, A.G.P., De Cuester, M.J.K., and Zhang, H. (2013). 'Estimating the Spot Rate Curve Using the Nelson-Siegel Model: A Ridge Regression Approach', *International Review of Economics and Finance*, **27** pp 482–496.

Arsov, I., Brooks, M., and Kosev, M. (2013). 'New Measures of Australian Credit Spreads', *Bulletin, Reserve Bank of Australia*, December Quarter 2013.

Diebold, F.X. and Rudenbusch, G.D. (2013). *Yield Curve Modelling and Forecasting: The Dynamic Nelson-Siegel Approach (The Econometric and Tinbergen Institutes Lectures)*, Princeton University Press: New Jersey.

Hastie, T., Tibshirani, R., and Friedman, J. (2009). *The Elements of Statistical Learning: Data Mining, Inference, and Prediction*, 2nd Edition. Springer: New York.

James, G., Witten, D., Hastie, T., and Tibshirani, R. (2013). *An Introduction to Statistical Learning: with Applications in R*, Springer: New York.

Nelson C.R. and Siegel, A.F. (1987). 'Parsimonious Modeling of Yield Curves', *The Journal of Business*, **60**(4), pp 473–489.

FEDERAL COURT OF AUSTRALIA
Practice Note CM 7
EXPERT WITNESSES IN PROCEEDINGS IN THE FEDERAL COURT OF AUSTRALIA

Practice Note CM 7 issued on 1 August 2011 is revoked with effect from midnight on 3 June 2013 and the following Practice Note is substituted.

Commencement

1. This Practice Note commences on 4 June 2013.

Introduction

2. Rule 23.12 of the Federal Court Rules 2011 requires a party to give a copy of the following guidelines to any witness they propose to retain for the purpose of preparing a report or giving evidence in a proceeding as to an opinion held by the witness that is wholly or substantially based on the specialised knowledge of the witness (see **Part 3.3 - Opinion** of the *Evidence Act 1995* (Cth)).

3. The guidelines are not intended to address all aspects of an expert witness's duties, but are intended to facilitate the admission of opinion evidence[1], and to assist experts to understand in general terms what the Court expects of them. Additionally, it is hoped that the guidelines will assist individual expert witnesses to avoid the criticism that is sometimes made (whether rightly or wrongly) that expert witnesses lack objectivity, or have coloured their evidence in favour of the party calling them.

Guidelines

1. General Duty to the Court[2]

1.1 An expert witness has an overriding duty to assist the Court on matters relevant to the expert's area of expertise.

1.2 An expert witness is not an advocate for a party even when giving testimony that is necessarily evaluative rather than inferential.

1.3 An expert witness's paramount duty is to the Court and not to the person retaining the expert.

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[1] As to the distinction between expert opinion evidence and expert assistance see *Evans Deakin Pty Ltd v Sebel Furniture Ltd* [2003] FCA 171 per Allsop J at [676].

[2] The "*Ikarian Reefer*" (1993) 20 FSR 563 at 565-566.

2. The Form of the Expert's Report[3]

2.1 An expert's written report must comply with Rule 23.13 and therefore must

(a) be signed by the expert who prepared the report; and

(b) contain an acknowledgement at the beginning of the report that the expert has read, understood and complied with the Practice Note; and

(c) contain particulars of the training, study or experience by which the expert has acquired specialised knowledge; and

(d) identify the questions that the expert was asked to address; and

(e) set out separately each of the factual findings or assumptions on which the expert's opinion is based; and

(f) set out separately from the factual findings or assumptions each of the expert's opinions; and

(g) set out the reasons for each of the expert's opinions; and

(ga) contain an acknowledgment that the expert's opinions are based wholly or substantially on the specialised knowledge mentioned in paragraph (c) above[4]; and

(h) comply with the Practice Note.

2.2 At the end of the report the expert should declare that "[the expert] has *made all the inquiries that* [the expert] *believes are desirable and appropriate and that no matters of significance that* [the expert] *regards as relevant have, to* [the expert's] *knowledge, been withheld from the Court*."

2.3 There should be included in or attached to the report the documents and other materials that the expert has been instructed to consider.

2.4 If, after exchange of reports or at any other stage, an expert witness changes the expert's opinion, having read another expert's report or for any other reason, the change should be communicated as soon as practicable (through the party's lawyers) to each party to whom the expert witness's report has been provided and, when appropriate, to the Court[5].

2.5 If an expert's opinion is not fully researched because the expert considers that insufficient data are available, or for any other reason, this must be stated with an indication that the opinion is no more than a provisional one. Where an expert witness who has prepared a report believes that it may be incomplete or inaccurate without some qualification, that qualification must be stated in the report.

2.6 The expert should make it clear if a particular question or issue falls outside the relevant field of expertise.

2.7 Where an expert's report refers to photographs, plans, calculations, analyses, measurements, survey reports or other extrinsic matter, these must be provided to the opposite party at the same time as the exchange of reports[6].

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[3] Rule 23.13.

[4] See also *Dasreef Pty Limited v Nawaf Hawchar* [2011] HCA 21.

[5] The *"Ikarian Reefer"* [1993] 20 FSR 563 at 565

[6] The *"Ikarian Reefer"* [1993] 20 FSR 563 at 565-566. See also Ormrod *"Scientific Evidence in Court"* [1968] Crim LR 240

3. Experts' Conference

3.1 If experts retained by the parties meet at the direction of the Court, it would be improper for an expert to be given, or to accept, instructions not to reach agreement. If, at a meeting directed by the Court, the experts cannot reach agreement about matters of expert opinion, they should specify their reasons for being unable to do so.

J L B ALLSOP
Chief Justice
4 June 2013

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TERMS OF REFERENCE – REVIEW OF FAIR VALUE CURVES AND AN ASSESSMENT OF METHODS USED TO DETERMINE THE SPOT COST OF DEBT

Background

On 30th August 2013, the Australian Energy Regulator (AER) published its draft rate of return guideline that will form the basis of the regulated rate of return to be applied in energy network decisions made from 2014 onwards. Previously the AER published an Issues Paper on 18th December 2012 and a Consultation Paper on 10th May 2013.

Under the new Rules, promulgated by the Australian Energy Market Commission, (AEMC), in December 2012, fundamental changes have been made to the way in which the allowance for the return of debt can be determined. Clause 6.5.2(j) of the National Electricity Rules (NER) provides that, at each determination, the allowance for the return of debt can be computed in one of three different ways:

(1) The return that would be required by debt investors in a benchmark efficient entity if it raised debt at the time or shortly before the making of the distribution determination for the regulatory control period.

(2) The average return that would have been required by debt investors in a benchmark efficient entity if it raised debt over an historical period prior to the commencement of a regulatory year in the regulatory control period; or

(3) Some combination of the returns referred to in subparagraphs (1) and (2). Implicit in these considerations is that the regulatory framework should encourage efficient financing practices that the former approach did not explicitly consider.

Implicit in these considerations is that the regulatory framework should encourage efficient financing practices that the previous approach did not explicitly consider.

The calculation of the spot cost of debt, or the market cost of debt at a particular point in time remains an essential component of all three of the aforementioned approaches. Option one, which is known as the rate-on-the day approach, uses an estimate of the cost of debt that is determined over a limited number of days in advance of the commencement of a new regulatory period. Option two calculates a form of historical average cost of debt, using historic information on spot rates. Under option three, the base cost of debt may be estimated separately from the debt risk premium.

United Energy and Multinet Gas are seeking a suitably qualified consultant to undertake specific analysis in relation to the current cost of debt, as measured over a recent 20 to 30 day averaging period. The purpose of the current exercise is to investigate whether yield curves can be used to derive robust estimates of the cost of debt for a benchmark corporate bond with a ten-year tenor.

The consultant will be supplied with:

- A spread sheet database containing information about the characteristics of bonds used in the empirical analysis. The attributes covered will include credit ratings, maturity dates, and yields. Data covering plain vanilla bonds will, in the main, be provided, although there may also be results for callable bonds and other types of bonds. Both domestic and foreign currency bonds will be supplied, although the yields on the latter will have been swapped into Australian dollar yields.

- A report from CEG which contains empirical estimates of yield curves. Please refer to: *Estimating the debt risk premium* (Incorporating CEG notice of errata, 22nd August 2013), prepared for the Energy Networks Association by the Competition Economists Group, August 2013. The report discusses yield curves that have been estimated according to the methods of Nelson and Siegel (1987)[1]. The report also contains an assessment of the performance of the Bloomberg fair value curve for BBB+ corporate debt.

- Regression results will have been reported in a spread sheet workbook. Program code may be supplied if it is available.

Scope of work

The consultant is required to undertake a detailed review of the yield curves that have been estimated by CEG, with a view to assessing the merits of the overall approach. The yield curves are a tool for working out the benchmark cost of debt corresponding to a particular term to maturity. The Nelson-Siegel model is non-linear in the parameters and is therefore more complicated to fit than a normal regression model.

The consultant should assess the case for using yield curves by comparison with the method of direct averaging of observed bond yields. The direct averaging technique takes a simple arithmetic average of bond yields, and has been applied by the AER and the Economic Regulation Authority (Western Australia).

The consultant should also develop yield curves for zero coupon bonds, and par yield curves. A zero coupon bond is a fixed income investment that provides only one payment at maturity. Bonds which trade at par are those for which the calculated yield is equal to the coupon rate. Par yield curves provide a theoretically correct specification for the term structure of the cost of debt.

Preliminary review of CEG methods

(1) Investigate the equations which have been estimated by CEG and seek to reproduce the reported results using a suitable software package. Categorise the results from yield-to-maturity curves separately from the results for par value yield curves. Assess how the estimated equations vary according to the bond samples used.

[1] Nelson, C.R. and Siegel, A.F. (1987). "Parsimonious Modeling of Yield Curves," The Journal of Business, 60, pages 473-489.

(2) Examine and report on the accuracy and correctness of the results from the estimated equations. Check whether outliers are present, and review the regression diagnostics. Note the standard errors and report on the precision of the parameter estimates.

(3) Assess whether the estimates of the cost of debt that have been presented by CEG are justifiable in the context of the estimated yield curves.

Refinements to the analysis – for both types of yield curve

(4) Investigate the case for the use of alternative estimation methods, such as robust regression techniques, for the daily regressions. Compare the results from different estimation methods.

(5) Examine the day-to-day drift of the parameter estimates over the nominated days of the averaging period. Suggest an alternative method for combining the daily results for the estimated benchmark 10-year corporate bond yield.

(6) Examine the validity of restrictions that may be imposed upon the Nelson-Siegel curves. The types of restriction are likely to include different intercept terms for bonds in different credit rating bands.

(7) The empirical methods that are applied to derive par value yield curves are more advanced. Firstly, a zero coupon yield curve is estimated. Secondly, a further non-linear equation has to be solved in order to determine par value yields. Diagnostic tests are needed for the overall model, and these should be developed by the consultant. The consultant should also investigate the impact of the weighting scheme based on Macaulay duration[2].

(8) Evaluate the results for the cost of debt that have been determined as par value yields. Comment on the methods that have been applied.

Comparison of results from yield curves with those obtained using the methods applied separately by the AER and the Economic Regulation Authority (WA).

(9) Critically assess the statistical properties of the cost of debt estimators developed separately by the AER and the ERA (WA). Consider the use of an overall measure of usefulness such as mean squared error (which is equal to the sum of the variance and the bias squared).

(10) Undertake a simulation analysis and apply other methods as appropriate.

Timeframe

The consultant is to provide a draft report which discusses the results of the analysis by Monday 23rd September 2013. A final report should be provided by no later than Monday 7th October.

[2] CEG (2012), Estimating the regulatory debt risk premium for Victorian gas businesses, a report prepared by Dr Tom Hird for APA Group, Envestra, Multinet Gas, and SP AusNet, Competition Economists Group, March 2012; page 31. A standard measure of risk is the Macaulay duration which computes the average maturity of a bond using the present values of its cash flows as weights.

Reporting

Jeremy Rothfield will serve as the primary contact for the period of the engagement. The consultant will prepare reports showing the work-in-progress on a regular basis. The consultant will make periodic presentations on analysis and advice as appropriate.

The consultant is likely to be called upon to present analysis and advice to the cost of capital sub-group of the Energy Networks Association (ENA).

Conflicts

The consultant is to identify any current or potential future conflicts.

Compliance with the Code of Conduct for Expert Witnesses

Attached is a copy of the Federal Court's Practice Note CM 7, entitled "Expert Witnesses in Proceedings in the Federal Court of Australia", which comprises the guidelines for expert witnesses in the Federal Court of Australia (Expert Witness Guidelines).

Please read and familiarise yourself with the Expert Witness Guidelines, and comply with them at all times in the course of your engagement with United Energy and Multinet Gas.

In particular, your report prepared for United Energy and Multinet Gas should contain a statement at the beginning of the report to the effect that the author of the report has read, understood and complied with the Expert Witness Guidelines.

Your report must also:

1. Contain particulars of the training, study or experience by which the expert has acquired specialised knowledge.

2. Identify the questions that the expert has been asked to address.

3. Set out separately each of the factual findings or assumptions on which the expert's opinion is based.

4. Set out each of the expert's opinions separately from the factual findings or assumptions.

5. Set out the reasons for each of the expert's opinions; and

6. Otherwise comply with the Expert Witness Guidelines.

The expert is also required to state that each of the expert's opinions is wholly or substantially based on the expert's specialised knowledge.

The declaration contained within the report should be that "[the expert] has made all the inquiries that [the expert] believes are desirable and appropriate and that no matters of significance that [the expert] regards as relevant have, to [the expert's] knowledge, been withheld from the report".

Please also attach a copy of these terms of reference to the report.