Review of CEG Report: Estimating the debt risk premium

A report for United Energy

Neil Diamond, B.Sc.(Hons), Ph.D., A.Stat.
ESQUANT Statistical Consulting

Prof. Robert Brooks, B.Ec.(Hons), Ph.D.
Department of Econometrics and Business Statistics

Daniel Young, B.Sc., M.Com.(Hons)
Competition Economists’ Group

August 30, 2013
Contents

1 Introduction 4

2 Terms of Reference - Review of Yield Curves 4
   2.1 Background .................................................. 4
   2.2 Scope of work .............................................. 5
   2.3 Timeframe .................................................. 6
   2.4 Fees ......................................................... 6
   2.5 Contacts .................................................... 7

3 Review of CEG methods 7
   3.1 Confirmation of CEG Parameter Estimates ............... 8
      3.1.1 Method of Estimation ................................ 8
   3.2 Fitting the Nelson-Siegel model to the Four Data Sets . 11
   3.3 Value of Curve Fitting .................................. 11
   3.4 Opinion .................................................... 12

4 References 12

5 Statement 14

A Neil Diamond 15

B Professor Robert Brooks 29

C Daniel Young 41
List of Tables

1. Comparison of Table 4 in the report, and the results calculated using the R \texttt{optim} package. 8
2. Parameter estimates and Residual Sum of Squares using R \texttt{optim} package for Rows 1 to 4. 9
3. Comparison of results in Report with fitting the model in R, using average data: Data sets Data1, Data2, Data3, and Data4. 11
List of Figures

1. Profile t plots for the original Nelson-Siegel model. ........................................ 10
2. Profile t plots for the revised Nelson-Siegel model ........................................ 10
3. Scatter plots of Yield to Maturity vs. Term, with fitted Nelson-Siegel curve for Data1, Data2, Data3, and Data4 with 95% pointwise confidence intervals, based on average values. ................................................................. 12
1 Introduction

In early 2013, the Energy Networks Association (ENA) commissioned the Competition Economists’ Group (CEG) to assess indicators of the Debt Risk Premium for benchmark 10 year corporate bonds rated BBB+ by Standard & Poors consistent with the current benchmark used by the Australian Energy Regulator (AER). CEG prepared a report (CEG, 2013a) which was lodged with the AER. The Victorian electricity distributors\textsuperscript{1} are relying on CEG (2013a), together with an associated addendum memorandum (CEG, 2013b). These documents are to be presented to the AER as part of the cost of capital submissions by the businesses for advanced metering infrastructure (AMI).

We have been asked to conduct a review of the empirical work presented in the CEG reports so as to determine whether the methods applied to estimate the yield curves were reasonable and defensible. In our review we have re-estimated the yield curves using a different software package and algorithms, and have given standard errors for the estimated Debt Risk Premiums.

We acknowledge that we have read, understood and complied with the Federal Court of Australia’s Practice Note CM 7, Expert Witnesses in Proceedings in the Federal Court of Australia.

2 Terms of Reference - Review of Yield Curves

2.1 Background

The Victorian electricity distribution businesses are required, pursuant to the AMI Cost Recovery Order (as amended) to make revised charges applications (charges revision applications) to set revised changes in respect of advanced metering infrastructure (AMI) for the year commencing 1 January 2014 by 31 August 2013.

The AMI Cost Recovery Order provides that the return on capital to be applied in determining charges for 2014 and 2015 is to be determined as a weighted average cost of capital (WACC), calculated in accordance with the formula set out in clause 6.5.2(b) of the National Electricity Rules (NER). Note that the references to the NER in the AMI Cost Recovery Order should be read as references to the version of the NER that applied before those rules were amended in November 2012 (in other words, the references should be to version 52 of the NER). As you would be aware, the rules relating to the rate of return were significantly amended in November 2012. These amendments included the replacement of the obligation on the Australian Energy Regulator (AER) to issue a statement of regulatory intent dealing with various cost of capital matters, with an obligation to issue cost of capital guidelines. The expectation is that the forthcoming cost of capital guidelines will be quite different in substance and presentation from the previous statement of regulatory intent. In these terms of reference, a description of the National Electricity Rules (NER) should be construed as being a reference to version 52 of the NER. In relation to the measurement of individual parameters within the WACC formula, the AMI Cost Recovery Order provides that:

- Measurement of “market observables (defined as the nominal risk free rate and the debt risk premium) is to occur in a period in 2013 proposed by the relevant business and agreed to by the AER; and
- Market observables and non-market observables are to be determined in accordance with the Statement of Regulatory Intent (SoRI) issued by the AER pursuant to clause 6.5.4 of the NER and as if clause 6.5.4(g) of the NER applied. Clause 6.5.2(b) of the NER provides that the return on capital must be calculated as a nominal post-tax weighted average cost of capital, in accordance with a prescribed formula, as follows:

\[
WACC = k_e(E/V) + k_d(D/V)
\]

\textsuperscript{1}The Victorian electricity distributors are: Citipower, Jemena, Powercor, SP AusNet, and United Energy.
where: $k_e$ is the return on equity (determined using the Capital Asset Pricing Model) and is calculated as

$$r_f + \beta_e \times \text{MRP}$$

where: $r_f$ is the nominal risk free rate for the regulatory control period. It is to be calculated on a moving average basis from the annualised yield on Commonwealth Government Securities (CGS); $\beta_e$ is the equity beta with a value in the SoRI of 0.8; and MRP is the market risk premium. $k_d$ is the return on debt and is calculated as:

$$r_f + \text{DRP}$$

where: DRP is the debt risk premium for the regulatory control period. The debt risk premium for a regulatory control period is the premium determined for that regulatory control period by the AER as the margin between the annualised nominal risk free rate and the observed annualised Australian benchmark corporate bond rate for corporate bonds which have a maturity equal to that used to derive the nominal risk free rate and a credit rating from a recognised credit rating agency. $E/V$ is the value of equity as a proportion of the total value of equity and debt, which is $1 - D/V$; and $D/V$ is the value of debt as a proportion of the total value of equity and debt.

Clause 6.5.4 of the NER details the basis upon which the AER must develop a SoRI in relation to the rate of return. On 1 May 2009, the AER issued its SoRI in accordance with clause 6.5.4 of the NER. The SoRI set out (among other things) a value for the MRP of 6.5%. Clause 6.5.4(g) of the Rules states that a distribution determination to which a SoRI is applicable must be consistent with the statement unless there is persuasive evidence justifying a departure, in the particular case, from a value, method or credit rating level that is written into the statement. As noted above, the relevant market observables are to be determined as if this clause applied, which implies that the determination of these parameters for the purposes of the charges revision applications of the Victorian electricity distributors must be consistent with the SoRI unless there is persuasive evidence justifying a departure. United Energy is 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 consultant will be supplied with:

- A spreadsheet 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 will contain empirical estimates of yield curves. A pro forma of the CEG report is currently available: Estimating the debt risk premium, a report prepared by Dr Tom Hird for the Energy Networks Association, Competition Economists Group, June 2013. The report will contain yield curves that have been estimated according to the methods of Nelson and Siegel (1987). The report will also contain an assessment of the performance of the Bloomberg fair value curve for BBB+ corporate debt.

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

### 2.2 Scope of work

The consultant is required to undertake a 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.
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. For the purposes of this exercise, concentrate on the main regression equations, those which have been estimated over the larger bond samples.

2. Examine and report on the accuracy and correctness of the results from the estimated equations. Review the regression diagnostics, calculate 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.

The consultant is expected to provide a report that should:

- Attach these terms of reference and the qualifications (in the form of curriculum vitae) of the person(s) preparing the report.
- Identify any current or potential future conflicts of interest.
- Comprehensively set out the bases for any conclusions made.
- Only rely on information or data that is fully referenced and that could be made reasonably available to the AER or others.
- Document the methods, data, adjustments, equations, statistical package specifications, printouts and assumptions that are used in preparing your opinion.
- Include specified wording at the beginning of the report stating that “[the person(s)] acknowledge(s) that [the person(s)] has read, understood and complied with the Federal Court of Australia’s Practice Note CM 7, Expert Witnesses in Proceedings in the Federal Court of Australia” as if your brief was in the context of litigation;
- Include specified wording at the end of the report to declare that [the person(s)] has made all the inquiries that [the person(s)] believes are desirable and appropriate and that no matters of significance that [the person(s)] regards as relevant have, to [the person(s)] knowledge, been withheld;
- Contain an acknowledgement that the opinions in the report are based wholly or substantially on the specialised knowledge which the person(s) preparing the report has; and
- State that the person(s) have been provided with a copy of the Federal Court of Australia’s “Guidelines for Expert Witnesses in Proceedings in the Federal Court of Australia” and that the Report has been prepared in accordance with those Guidelines, refer to Annexure A to these Terms of Reference or alternatively online at http://www.federalcourt.gov.au/law-and-practice/practice-documents/practice-notes/cm7.

2.3 Timeframe

The consultant is to provide a draft report by 15 August 2013 and a final report by 28 August 2013.

2.4 Fees

The consultant is requested to:

- Propose a fixed total cost of the project and hourly rates for the proposed project team should additional work be required;
• Provide details of the staff who will undertake the analysis and formulate opinions;
• Declare the absence of any relevant conflict of interest in undertaking the project; and
• Indicate preparedness to enter into a confidentiality agreement regarding research and findings.

Miscellaneous costs such as travel and accommodation will be reimbursed, by prior arrangement.

2.5 Contacts

Any questions regarding these terms of reference should be directed to:
Catherine Dermody
Email: CDermody@gtlaw.com.au
Phone: 03 8656 3320.

3 Review of CEG methods

In our review of the CEG report, outlined below, we have:

• Confirmed that the estimated parameters of the yield curves provided by CEG for the various bond samples generally match those which we calculate.

• Given standard errors of the parameters in order to measure the precision with which yield curves are estimated.

• Based on this empirical work, given an opinion on whether the estimates for the cost of debt provided by CEG are justifiable.
3.1 Confirmation of CEG Parameter Estimates

Table 4A of CEG (2013b) gives Debt Risk Premiums (DRPs) for 32 different groups of bonds. In the CEG report, for each group of bonds, defined by the rating class (BBB+ only; or A-, BBB+ and BBB), currency (AUD or All), type (i.e. options or no options), source (Bloomberg only or both Bloomberg and UBS), and country of origin (Australia or All), the Nelson-Siegel curve (Nelson and Siegel, 1987) was fitted, and the 7 year DRP and 10 year DRP were calculated with

\[ \text{DRP}_7 = \text{Yield}(7) - 3.244 \]
\[ \text{DRP}_{10} = \text{Yield}(10) - 3.515 \]

and

\[ \Delta \text{DRP} = \frac{100(\text{DRP}_{10} - \text{DRP}_7)}{3}. \]

The values 3.244 and 3.515 are the average yields on 7-year and 10-year Commonwealth Government Securities, measured over February, 2013. These yields were calculated by CEG using an interpolation method that was applied to daily data sourced from Table F16 from the RBA website. A monthly average was taken of the daily results for 7-year and 10-year CGS.

The Nelson-Siegel model can be written as

\[ \text{Yield}(t, \text{rank}) = \beta_1,\text{rank} + (\beta_2 + \beta_3) \frac{1 - \exp(-t/\beta_0)}{t/\beta_0} - \beta_3 \exp(-t/\beta_0) \]

where \( t \) is the remaining term to maturity of the bond, and A- and BBB are dummy variables for A- and BBB bonds respectively. Hence the asymptote of the Nelson-Siegel curve as \( t \to \infty \) is \( \beta_1 \) for BBB+ bonds, \( \beta_1 + \beta_4 \) for A- bonds, and \( \beta_1 + \beta_5 \) for BBB bonds.

Table 1 gives the comparison between the results obtained in the CEG report and those using the \texttt{optim} command in the R environment for statistical computing and graphics (R Core Team, 2013) for the four main groups of bonds considered by CEG. The results from the report, obtained using Excel Solver, are very similar to the results using R \texttt{optim}.

<table>
<thead>
<tr>
<th>Row</th>
<th>Ratings</th>
<th>Curr.</th>
<th>Type</th>
<th>Source</th>
<th>Country of domicile</th>
<th># Bonds</th>
<th>7 year DRP</th>
<th>10 year DRP</th>
<th>∆DRP</th>
<th>7 year DRP</th>
<th>10 year DRP</th>
<th>∆DRP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>All</td>
<td>All</td>
<td>All</td>
<td>BB</td>
<td>All</td>
<td>260</td>
<td>2.76</td>
<td>2.99</td>
<td>7.62</td>
<td>2.76</td>
<td>2.99</td>
<td>7.59</td>
</tr>
<tr>
<td>2</td>
<td>All</td>
<td>All</td>
<td>All</td>
<td>BB</td>
<td>AU</td>
<td>221</td>
<td>2.76</td>
<td>2.99</td>
<td>7.38</td>
<td>2.76</td>
<td>2.98</td>
<td>7.35</td>
</tr>
<tr>
<td>3</td>
<td>All</td>
<td>All</td>
<td>All</td>
<td>BB &amp; UBS</td>
<td>All</td>
<td>307</td>
<td>2.78</td>
<td>2.98</td>
<td>6.67</td>
<td>2.78</td>
<td>2.97</td>
<td>6.64</td>
</tr>
<tr>
<td>4</td>
<td>All</td>
<td>All</td>
<td>All</td>
<td>BB &amp; UBS</td>
<td>AU</td>
<td>258</td>
<td>2.76</td>
<td>2.96</td>
<td>6.71</td>
<td>2.76</td>
<td>2.96</td>
<td>6.68</td>
</tr>
</tbody>
</table>

Table 1: Comparison of Table 4 in the report, and the results calculated using the R \texttt{optim} package.

Tables 2 and 3 give the parameter estimates using Solver and those obtained by R \texttt{optim}, as well as the Residual Sum of Squares (RSS) and calculated DRP7, DRP10, and ∆DRP.

3.1.1 Method of Estimation

The four rows are called Data 1, Data 2, Data 3, and Data 4 in this report. In the CEG report, the individual yields for each day and each bond were used as input to the Excel Solver. The dataset was essentially therefore non-linear panel data. The use of daily data in this way would be unlikely to have much effect on the parameter estimates, but would almost certainly affect the calculation of

Note that the results given in the Report columns actually correspond to those given in the Addendum report issued by CEG.

\texttt{optim} is a general purpose optimisation method. The BFGS quasi-Newton method was used, (from the user guide: “specifically, that published in 1970 by Boyden, Fletcher, Goldfarb, and Sharmo. This uses function values and gradients to build up a picture of the surface to be optimised.”
Table 2: Parameter estimates and Residual Sum of Squares using R optim package for Rows 1 to 4.

the standard errors because there is usually very little change in the yield of an individual bond from day-to-day. To overcome the limitations of the use of daily data in this manner, the average yield and average term to maturity were calculated over the month of February 2013, with the resulting values then employed as inputs.

Standard errors from a non-linear regression rely on an assumption that the non-linear mean function can be approximated locally by a linear function. To examine whether the linear approximation is appropriate, the profile $t$ function (see, for example, Bates and Watts, 1988) defined by

$$\tau_j = \text{sign}(\beta_j - \hat{\beta}_j) \sqrt{\frac{\text{RSS}(\beta_j) - \text{RSS}(\hat{\beta})}{s}}$$

is plotted, where $\beta_j$ is a parameter of interest with estimate $\hat{\beta}_j$, $\text{RSS}(\beta_j)$ is the residual sum of squares at the solution, $\text{RSS}(\hat{\beta})$ is the residual sum of squares holding the $j$th parameter at $\beta_j$, and $s$ is the residual standard error. By default, the absolute value of $\tau_j$ is plotted.

Figure 1 shows the profile $t$ functions for all six parameters. The x-axis shows the value of $\beta_j$ while the y-axis shows the corresponding absolute value of $\tau_j$. The parameters $\beta_1$ to $\beta_5$ are well-behaved. However, $\beta_0$ shows some curvature, suggesting that confidence intervals based on standard errors for this parameter will not be accurate. In addition, confidence intervals for functions of the parameters, such as

$$\text{DRP}_{10} = \beta_1 + (\beta_2 + \beta_3) \frac{1 - \exp(-10/\beta_0)}{10/\beta_0} - \beta_3 \exp(-10/\beta_0)$$

$$\text{DRP}_7 = \beta_1 + (\beta_2 + \beta_3) \frac{1 - \exp(-7/\beta_0)}{7/\beta_0} - \beta_3 \exp(-7/\beta_0)$$

and

$$\Delta\text{DRP} = \frac{100(\text{DRP}_{10} - \text{DRP}_7)}{3},$$

will also not be appropriate, because of the non-linear behaviour of $\beta_0$.

To overcome this, $\beta_0$ was re-parameterised as

$$\beta_6 = \log(\beta_0).$$

This re-parameterisation does not change the model, but improves the estimation of it. The re-parameterised Nelson-Siegel model is

$$\text{Yield}(t, \text{rank}) = \beta_1 + (\beta_2 + \beta_3) \frac{1 - \exp(-t/\exp(\beta_6))}{t/\exp(\beta_6)} - \beta_3 \exp(-t/\exp(\beta_6)) + \beta_4 A + \beta_5 BBB.$$
Figure 1: Profile t plots for the original Nelson-Siegel model. The dotted lines correspond to 50%, 80%, 90%, 95%, and 99% confidence intervals.

Figure 2: Profile t plots for the revised Nelson-Siegel model

The correct confidence interval can be computed as

\[
\frac{(\text{Upper Limit} - \text{Estimate})}{(\text{Estimate} - \text{Lower Limit})} = \frac{(1.9022 - 1.4510)}{(1.4510 - 1.1408)} = 1.4545.
\]

so clearly, a symmetric confidence interval is not a good summary of the uncertainty attached to the \( \beta_0 \) parameter. On the other hand, the estimated \( \beta_6 \) parameter is 0.3722 with a standard error of 0.1460.
The correct confidence interval, based on the profile t function, is (0.1317,0.6430), with an asymmetry of 
\[
\frac{(0.6430 - 0.3722)}{(0.3722 - 0.1377)} = 1.1548.
\]
which is clearly closer to 1.

### 3.2 Fitting the Nelson-Siegel model to the Four Data Sets

The reparameterised Nelson-Siegel model was fitted to the Data1, Data2, Data3, and Data4 data sets. Estimates of the DRP\(_7\), DRP\(_{10}\) and \(\Delta(\text{DRP})\) were found by substituting the parameter estimates into the relevant formula. Standard errors were found using the delta method\(^5\). Estimates and standard errors are given in Table 3. Similar results are obtained using robust methods.

One point to notice is that the standard errors for \(\Delta\text{DRP}\) appear to be large. However, the units for \(\Delta\text{DRP}\) are bppa. If the units were quoted as percentages, then for Data1 the standard error would be 0.0163.

<table>
<thead>
<tr>
<th>Data Set</th>
<th>Source</th>
<th>Data</th>
<th>7 year DRP Estimate (%)</th>
<th>Std.err</th>
<th>10 year DRP Estimate (%)</th>
<th>Std.err</th>
<th>(\Delta\text{DRP}) (bppa)</th>
<th>Std.err</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data1</td>
<td>Report</td>
<td>Individual</td>
<td>2.76</td>
<td></td>
<td>2.99</td>
<td></td>
<td>7.62</td>
<td></td>
</tr>
<tr>
<td></td>
<td>optim</td>
<td>Individual</td>
<td>2.76</td>
<td></td>
<td>2.99</td>
<td></td>
<td>7.59</td>
<td></td>
</tr>
<tr>
<td></td>
<td>nls</td>
<td>Average</td>
<td>2.73</td>
<td>0.1</td>
<td>2.97</td>
<td>0.09</td>
<td>7.8</td>
<td>1.63</td>
</tr>
<tr>
<td>Data2</td>
<td>Report</td>
<td>Individual</td>
<td>2.76</td>
<td></td>
<td>2.99</td>
<td></td>
<td>7.38</td>
<td></td>
</tr>
<tr>
<td></td>
<td>optim</td>
<td>Individual</td>
<td>2.76</td>
<td></td>
<td>2.98</td>
<td></td>
<td>7.35</td>
<td></td>
</tr>
<tr>
<td></td>
<td>nls</td>
<td>Average</td>
<td>2.73</td>
<td>0.11</td>
<td>2.96</td>
<td>0.1</td>
<td>7.58</td>
<td>1.72</td>
</tr>
<tr>
<td>Data3</td>
<td>Report</td>
<td>Individual</td>
<td>2.78</td>
<td></td>
<td>2.98</td>
<td></td>
<td>6.67</td>
<td></td>
</tr>
<tr>
<td></td>
<td>optim</td>
<td>Individual</td>
<td>2.49</td>
<td></td>
<td>2.97</td>
<td></td>
<td>6.64</td>
<td></td>
</tr>
<tr>
<td></td>
<td>nls</td>
<td>Average</td>
<td>2.76</td>
<td>0.09</td>
<td>2.96</td>
<td>0.09</td>
<td>6.78</td>
<td>1.49</td>
</tr>
<tr>
<td>Data4</td>
<td>Report</td>
<td>Individual</td>
<td>2.76</td>
<td></td>
<td>2.96</td>
<td></td>
<td>6.71</td>
<td></td>
</tr>
<tr>
<td></td>
<td>optim</td>
<td>Individual</td>
<td>2.76</td>
<td></td>
<td>2.96</td>
<td></td>
<td>6.68</td>
<td></td>
</tr>
<tr>
<td></td>
<td>nls</td>
<td>Average</td>
<td>2.75</td>
<td>0.1</td>
<td>2.95</td>
<td>0.09</td>
<td>6.79</td>
<td>1.57</td>
</tr>
</tbody>
</table>

Table 3: Comparison of results in Report with fitting the model in R, using average data: Data sets Data1, Data2, Data3, and Data4.

Figure\(^6\) shows the data and the fitted curve with 95% confidence limits based on \(\pm 1.96\) standard errors. The confidence intervals are quite narrow.

### 3.3 Value of Curve Fitting

We agree with CEG about the value of curve fitting to estimate the Debt Risk Premium at 10 years. The usefulness of this technique is amplified when standard errors are calculated. As shown in the previous section, the estimates of the Debt Risk Premiums at 7 years and at 10 years are estimated relatively precisely. However the increase in the DRP (bppa) is estimated less precisely.

One issue that needs to be addressed is how to extrapolate the Bloomberg fair value curve from 7 to 10 years. Two methods have been suggested:

1. Using the bond pairs analysis, as suggested by the AER.
2. Using the increase implied by the fitted curve.

CEG identified five bond pairs that could be applied to the task of paired bond analysis. The increases in the DRP were 5.613, 4.221, 5.908, 6.802, and 3.304\(^6\) bppa with an average of 5.170 bppa and a standard error of 0.624. This is less than the standard errors for the increase in the DRP from

5In one dimension, \(\text{Var}(g(x)) \approx [g'(\mu)]^2\text{Var}(x)\); In higher dimensions \(\text{Var}(g(x)) \approx d'\Sigma d\) where \(\Sigma\) is the variance-covariance matrix of \(x\) and \(d\) is the vector of first derivatives of \(g\) evaluated at \(\mu\), implemented in the \text{delta.method} command in the package \text{alr3}.

6These numbers showing the increments to the debt risk premium implied by different pairs of bonds are reported to two decimal places in Table 5 of CEG (2013a).
the curve fitting. It should be borne in mind that the standard error of 0.624 is estimated with only 4 degrees of freedom and hence is subject to some variability. In addition, we have obtained reduced standard errors for the increase implied by the yield curves by fitting a non-linear mixed effects model (see, for example, Pinheiro and Bates, 2004) with random effects for each bond issuer. Based on our analysis, there is no clear statistical superiority of one method over the other. However, both methods of extrapolating the debt risk premium are reasonable and appropriate.

### 3.4 Opinion

The results show good agreement with those given by CEG. We agree with CEG in the value of using curve fitting to estimate the Debt Risk Premium at 10 years. The calculation of standard errors is a necessary and useful addition to the fitted curves. The standard errors for the Debt Risk Premiums at 7 and 10 years are relatively small and therefore the estimates can be used with confidence.

### 4 References


5 Statement

We have made all the inquiries that we believe are desirable and appropriate and that no matters of significance that we regard as relevant have, to our knowledge, been withheld.

We acknowledge that the opinions in the report are based wholly or substantially on the specialised knowledge that we have; and indicate that we have been provided with a copy of the Federal Court of Australia’s “Guidelines for Expert Witnesses in Proceedings in the Federal Court of Australia” and that the Report has been prepared in accordance with those Guidelines, available online at [http://www.federalcourt.gov.au/law-and-practice/practice-documents/practice-notes/cm7](http://www.federalcourt.gov.au/law-and-practice/practice-documents/practice-notes/cm7).
A  Neil Diamond
Neil Diamond CV

Curriculum Vitae
Neil Diamond March 2013

Full Name: Neil Thomas Diamond
Date of Birth: 2/2/1956
Academic Qualifications: B.Sc (Hons) (Monash), Ph.D. (Melbourne), A.Stat

Career History

1977-78 Statistician, ICI Explosives Factory, Deer Park
1979-86 Research Officer, Research Scientist, Senior Research Scientist And Statistics and Computing Team Leader, ICI Central Research Laboratories, Ascot Vale
1987-1989 Lecturer, Department of Mathematics, Computing and Operations Research, Footscray Institute of Technology
(1989) Visiting Scientist, Center for Quality and Productivity Improvement, University of Wisconsin-Madison, USA.
1990-2003 Senior Lecturer, Department of Computer and Mathematical Sciences, Victoria University of Technology
(1995) Visiting Fellow, Center for Quality and Productivity Improvement, University of Wisconsin-Madison, USA.
2003-2004 Senior Statistician, Insureware
2004-2006 Senior Lecturer and Deputy Director of Consulting, Department of Econometrics and Business Statistics, Monash University.
2007- 2012 Senior Lecturer and Director of Consulting, Department of Econometrics and Business Statistics, Monash University.
2011- 2012 Associate Professor and Co-ordinator of Statistical Support, Victoria University.
2012- Director, ESQUANT Statistical Consulting

Research and Consulting Experience

• A Ph.D. from the University of Melbourne entitled “Two-factor interactions in non-regular foldover designs.”

• Ten years with ICI Australia as an industrial statistician initially with the Explosives group and eventually with the research group.

• Two six month periods (Professional Experience Program and Outside Studies Program) at the Center for Quality and Productivity Improvement, at the University of Wisconsin-Madison. The Center, founded and directed by Professor George Box, conducts innovative practical
research in modern methods of quality improvement and is an internationally recognised forum for the exchange of ideas between experts in various disciplines, from industry and government as well as academia.

- Extensive consulting and training on behalf of the Centre for Applied Computing and Decision Analysis based at VUT for the following companies:

  Data Sciences                      Initiating Explosives Systems
  Analytical Science Consultants     Saftec
  Glaxo Australia                   Datacraft Australia
  Enterprise Australia              ICI Australia
  The LEK partnership               Kaolin Australia
  BP Australia                      AMCOR
  Melbourne Water                   Kinhill Group
  Australian Pulp and Paper Institute


- From 2003-2004 worked as a Senior Statistician with Insureware on the analysis of long-tailed liability data.

- From December 2004 to December 2006 Deputy Director of Consulting of Monash University Statistical Consulting Service based in the Department of Econometrics and Business Statistics.


- Extensive consulting and training on behalf of the Monash University Statistical Consulting Service for the following companies and organisations:

  Australian Tax Office          Department of Human Services
  J D McDonald                    IMI Research
  Port of Melbourne Corporation  Incitec Pivot
  Agricola, Wunderlich & Associates  Parks Victoria
  Australian College of Consultant Physicians  ANZ
  Department of Justice
  Australian Football League Players’ Association  CRF (Colac Otway)
  ETSA                               United Energy
  Australian Pulp and Paper Institute  ENA
Postgraduate Supervision

Principal Supervisor


**Ewa Sztendur** (1999-2005). Ph.D. completed. “Precision of the path of steepest ascent in response surface methodology.” [As a result of this thesis, Ewa was awarded the 2006 Victoria University Vice-Chancellor’s Peak Award for Research and Research Training-Research Degree Graduate.]

Co-supervisor


M.Sc. Minor Theses


Theses Examination

One M.Sc. major thesis (University of Melbourne) and one M.Sc minor thesis (Victoria University).
Workshops

Victoria University
- Experimental Design.
- Longitudinal Data Analysis.
- Statistics for Biological Sciences.
- Introductory Statistics for Research.
- Software Packages for Statistics.
- Design and Analysis of Questionnaires and Sample Surveys.
- Introductory SPSS.
- Statistics for Biological Sciences using R.
- Statistics for Biological Sciences using SPSS.
- Research Design and Statistics.

Monash University
- Expert Stats Seminars for higher degree research students on Software Packages for Statistics, Questionnaire Design, Analysis of Survey Data, and Multivariate Statistics.
- Introduction to Statistics for Pharmacy (5 hours).

Other
- Design of Experiments for ICI Australia (One day course).
- Design of Experiments for Quality Assurance-including Taguchi Methods. A 2-day professional development short course on behalf of the Centre for Manufacturing Advanced Engineering Centre.
- Design of Experiments for the Australian Pulp and Paper Institute.
- Statistical Methods for ANZ Analytics.
Teaching Experience

Monash University

• Business Statistics (First Year), Marketing Research Analysis (Second Year), Survey Data Analysis (Third Year-Clayton and Caulfield).

Victoria University of Technology

• Applied Statistics (First Year), Linear Statistical Models, Sampling and Data Analysis (Second Year), Experimental Design (Third Year).
• Forecasting (Graduate Diploma in Business Science)

Sessional Teaching

• Various other: The University of Melbourne, Enterprise Australia, Swinburne Institute of Technology.

Industry Projects

Over 30 projects for the following companies and organisations:
- Gas and Fuel Corporation, Ford Australia
- Mobil Australia, Fibremakers
- ICI Australia, Western General Hospital
- Data Sciences, Keilor City Council
- AMCOR, Composite Buyers
- Davids, Email Westinghouse
- Craft Coverings, Australian Wheat Board
- CSL, Holding Rubber
- Viplas Olympic, Melbourne Water
- Federal Airports Corporation
Publications

Chapters in Books

Journal Articles


Refereed Conference Papers


**Reports**

A number of confidential reports for ICI Australia from 1977-1987.

**Victoria University**


**Monash University**


ESQUANT Statistical Consulting


R Packages (Extensions to R Programming Environment)


Professional Service

  – Terms as Council Member, Vice-President, and Past President.

• Referee: Australian and New Zealand Journal of Statistics, Biometrika, Journal of Statistical Software
B Professor Robert Brooks
Robert Brooks is a professor in the Department of Econometrics and Business Statistics and Deputy Dean, Education in the Faculty of Business and Economics.

Robert obtained his honours and PhD degrees from Monash University and has previously worked at RMIT University.

His primary area of research interest is in financial econometrics, with a particular focus on beta risk estimation, volatility modelling and the analysis of the impacts of sovereign credit rating changes on financial markets. His research in the financial econometrics area has produced a number of publications in top-tier journals, along with research funding from ARC Discovery and ARC Linkage and industry sources.

Given his education management role, Robert also works in areas of educational research relating to pedagogy of teaching business statistics and in particular applications of problem based learning in that setting.

Publications

Books


Book Chapters


Boucher, C., Brooks, R.D., 2005, Changing times, changing research, changing degrees: supervising and managing the first PhD by project undertaken in a business faculty, in Supervising postgraduate research: contexts and processes, theories and practices, eds Pam Green, RMIT University Press, Melbourne Vic Australia, pp. 73-88.


Journal Articles


Dimovski, W., Brooks, R.D., 2005, Dividend forecasts and dividend payments of initial public offerings - when zero means zero and no comment most likely also means zero, *Applied Financial Economics Letters*, vol 1, issue 3, Routledge, UK, pp. 139-141.

Dimovski, W., Brooks, R.D., 2005, Putting their money where their mouth is: the importance of shareholder directors post listing, *Accounting Research Journal*, vol 18, issue 1, Queensland University of Technology, Australia, pp. 34-39.


Maldonado-Rey, D., Brooks, R.D., 2004, ARC linkage projects and research-intensive organizations: Are research-intensive organizations likely to participate?, *Economic Papers*, vol 23, issue 2, Economic Society of Australia, St Ives NSW Australia, pp. 175-188.


38
Accountability and Performance, vol 7, issue 1, Griffith University, Gold Coast Qld Australia, pp. 23-30.


Thomas, S., Brooks, R.D., 2001, GARCH-based hedge ratios for Australian share price index futures: Does asymmetry matter?, Accounting, Accountability & Performance, vol 7, issue 2, Griffith University, Department of Accounting, Finance & Economics, Gold Coast Qld Australia, pp. 61-76.


Conference Proceedings


**Other**


Curriculum Vitae

Daniel Young / Senior Economist

Contact Details
T / +61 (2) 9881 5752
M / +61 405 170 290
E / daniel.young@ceg-ap.com

Key Practice Areas
Daniel is a Senior Economist working in CEG’s Sydney office with extensive experience in the economic analysis of firms and markets. He has advised regulators, law firms and businesses on a range of issues across industry sectors including electricity, gas, telecommunications, transport, mining and finance.

Daniel has particular expertise in the application of mathematical and computational modelling techniques in economic analysis. His experience spans the design and construction of telecommunications cost models, building regulatory cost models, merger modelling, estimation of the cost of capital, calculating economic damages and econometric modelling. These techniques have formed the basis of expert reports provided to courts and regulators in Australia, New Zealand, the United Kingdom, the Netherlands, Hong Kong, Macau and Samoa.

Daniel was previously an analyst at NERA Economic Consulting. Daniel has a Masters of Commerce (in Economics) with first class honours and Bachelor degrees in Commerce and Science, majoring in Economics and Operations Research respectively.

Selected Projects
- Advised Chorus New Zealand on the Commerce Commission’s proposed method of determining the UCLL price in New Zealand by benchmarking against prices in other jurisdictions
- Advice to the Australian Energy Market Commission on barriers to entry in electricity generation
- Assisting the ACCC in developing its analysis about the competitive effects of two recent proposed acquisitions in the media sector
- Advised Everything Everywhere UK on its submissions and appeal in respect of Ofcom’s decision on mobile termination rates
- Advising Optus on appropriate principles for fixed line pricing and the formation of a roll-forward regulatory regime. Responding to and identifying a critical error in the proposed pricing principles
- Developing mobile cost models for Digicel in Samoa, Papua New Guinea and Tahiti for submission in regulatory proceedings.
- Estimating benchmarks for mobile termination prices using econometric analysis for Digicel in Vanuatu and Tonga
- Making adjustments to the ACCC's fixed line cost model to estimate the cost of a fibre to the premise roll out in Australia for Optus
• Estimating the potential cost improvements that could be achieved within the ACCC's fixed line cost model by the use of Steiner trees rather than minimum spanning trees on behalf of the Competition Carriers' Coalition
• Constructing spreadsheet models of the price effects of a major proposed merger in the European pharmaceutical industry
• Estimating a reserve price in Commercial Radio Australia's auction of unallocated multiplexer capacity
• Assisted in the preparation of expert statements on the likely impact of the joint venture of the Pilbara iron ore assets of BHP Billiton and Rio Tinto and before that the proposed merger between these parties
• Assisted in the preparation of an expert report on the competitive implications of a merger in the industrial packaging sector
• Analysis of the appropriate cost of capital to be used proposed damages claim being brought by Deutsche Telecom against Vivendi in relation to alleged unlawful activity in a Polish mobile telephony joint venture
• Assisted a European firm examining the implications for competition in the United Kingdom electricity generation market of a number of proposed transactions
• Developed a mobile cost model for an Australian telecommunications company.
• Estimating the likely response in the demand for electricity to the increased proliferation of time of day and critical peak tariffs as part of the MCE’s cost/benefit analysis of the introduction of smart meters
• Assisted in the preparation of expert reports for Telecom New Zealand on the correct methodology for calculating the cost of providing the TSO (universal service obligation) using new entrant costs
• Prepared estimates of the potential damages faced by Telstra under a class action lawsuit from shareholders
• Provided drafting and analytical assistance for an expert report examining the effect of Foxtel’s proposed special access undertaking on competition in the market for subscription television services
• Contributed to an analysis of the extent of competition in the auto-fuel retail sector in Hong Kong by estimating the margins of local firms and developing international comparisons as benchmarks
• Development of a modelling framework for the ACCC analysing the effect on competition of a merger between electricity generator and advised on potential divestitures