



GROUP OF 100 DISCOUNT RATE

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1 BACKGROUND

Objectives and scope

The Group of 100 has commissioned Milliman to generate a standardised set of discount rates to be made publicly available for the purpose of discounting employee benefit liabilities under Australian Accounting Standard 119 (AASB 119). The scope of the work is limited to Australian employee benefit schemes, and excludes any schemes of foreign subsidiaries of domestic entities which are denominated in foreign currency.

This report provides the Australian corporate bond discount rate curve as at the end of April 2017 produced under the methodology and assumptions described in the 'Discount Rates for Australian Employee Benefit Liability Valuation' report.

Reliance and limitations

In producing this report, we have relied upon the following information:

- Capital market data as sourced from Bloomberg. Should this data be incorrect, it could materially affect the analysis and conclusions drawn from it.

Users of this report should also be aware that it is subject to the following limitations:

- Current debt market conditions. Issuance of corporate bonds is subject to change over time, which may impact upon whether the accounting standard requirements of a deep market are met.
- Current capital market conditions, in particular the liquidity and credit ratings of corporate bond markets, which can change rapidly. The asset calibration set could change very rapidly under stressed market conditions.
- Reassessments of the suitability of the asset calibration set would be needed if the AAA and/or AA corporate bond market thins, which would require a prospective change to the assets selected for AASB 119 calibration purposes.

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2 METHODOLOGY AND ASSUMPTIONS

Summary of the asset calibration set

The set of assets to be used to calibrate the discount rate curve is defined by those securities that meet the following conditions:

1. Individual bonds must have the following characteristics:
 - a. Physical bonds, with no embedded derivatives (e.g., callable, puttable, convertible, extendible, variable/floating coupon, index-linked)
 - b. High-quality corporate bonds issued by both domestic and foreign entities
 - c. Payments denominated in Australian dollars (AUD)
 - d. Pay fixed (or zero) coupons, non-inflation-linked
 - e. Maturity terms of greater than one month and less than 10 years
 - f. Minimum amount outstanding on an individual security of \$100 million
 - g. Securitised bonds are included

2. A deep market for these bonds must exist, as characterised by the ready availability of observable prices and current trades.

What is meant by high quality?

Figure 1 defines the credit ratings by each agency that map to each of these broad categories. This forms the basis for the asset calibration set used in this report.

Figure 1: Definition of AAA and AA Credit Ratings by Agency

Category	AAA	AA
S&P	AAA	AA+, AA, AA-
Fitch	AAA	AA+, AA, AA-
Moody's	Aaa	Aa1, Aa2, Aa3

Where there is disagreement between credit rating agencies on particular securities, we use the following conditions:

- If a security has at least two AAA ratings, then it is classified as a AAA security
- If a security has at least two AA ratings, then it is classified as a AA security
- If a security has only been rated by two agencies with different ratings, then the lower rating is used
- If a security has only been rated by one agency, then that rating becomes the sole reference

Hereafter, all references to credit ratings refer to those that meet the above conditions. For the purposes of this paper, we refer to this as the combined credit rating.

Corporate bond universe

The table in Figure 2 shows the decomposition of the market by the combined credit rating satisfying all but the 'high quality' characteristic.

Figure 2: Australian Corporate Bond Market Outstanding Debt by Combined Credit Rating (\$ millions)

Combined Rating	Number of Securities	Outstanding (\$ Millions)	% of Total
AAA	11	5,475	5.8%
AA	132	34,654	36.9%
A	141	39,004	41.5%
BBB	56	13,410	14.3%
BB	4	1,148	1.2%
Other	2	235	0.3%
Total	346	93,926	100.0%

Source: Milliman analysis based upon Bloomberg data as at 28 April 2017.

The table in Figure 3 shows the universe of AAA and AA bonds used in the asset calibration set broken down into the composition of their respective S&P, Moody's and Fitch ratings.

Figure 3: Australian AAA/AA Corporate Bond Market Outstanding Debt (\$ millions)

Credit Rating Composition	Number of Securities	Outstanding (\$ Millions)	% of Total
Combined Credit Rating of AAA			
3 AAA ratings	0	0	0.0%
2 AAA ratings	9	4,900	89.5%
1 AAA rating	2	575	10.5%
Total Combined AAA	11	5,475	100.0%
Combined Credit Rating of AA			
3 AA ratings	40	11,075	32.0%
2 AA ratings	81	21,124	61.0%
1 AA rating	11	2,455	7.1%
Total Combined AA	132	34,654	100.0%

Source: Milliman analysis based upon Bloomberg data as at 28 April 2017.

Interpolation methodology

For fitting the discount curve to the asset calibration set, the Merrill Lynch Exponential Spline (MLES) method with nine exponential basis functions was used calibrated to yield data as at 28 April 2017, weighting each issue by the inverse duration of the issue. The results of the calibrated MLES parameters are shown in Figure 4.

Figure 4: MLES-Calibrated Parameters as at 28 April 2017

MLES Parameters		
Long-Run	b0	5.7%
Param1	λ1	128.0%
Param2	λ2	10.5%
Param3	λ3	-70.2%
Param4	λ4	36.3%
Param5	λ5	40.2%
Param6	λ6	-3.9%
Param7	λ7	-64.2%
Param8	λ8	-16.2%
Param9	λ9	39.7%

For the calibration of the MLES basis functions, an adjusted R-squared statistical goodness-of-fit measure was applied to the difference between modelled and actual bond prices.

An adjusted R-squared statistic value close to 100% indicates a very good fit, whilst lower values (closer to 0%) indicate poor fits. Figure 5 shows the results of the interpolation analysis used.

Figure 5: Adjusted R-Squared Statistic as at 28 April 2017

Regression Statistic	
Adjusted R-Squared	96.9%

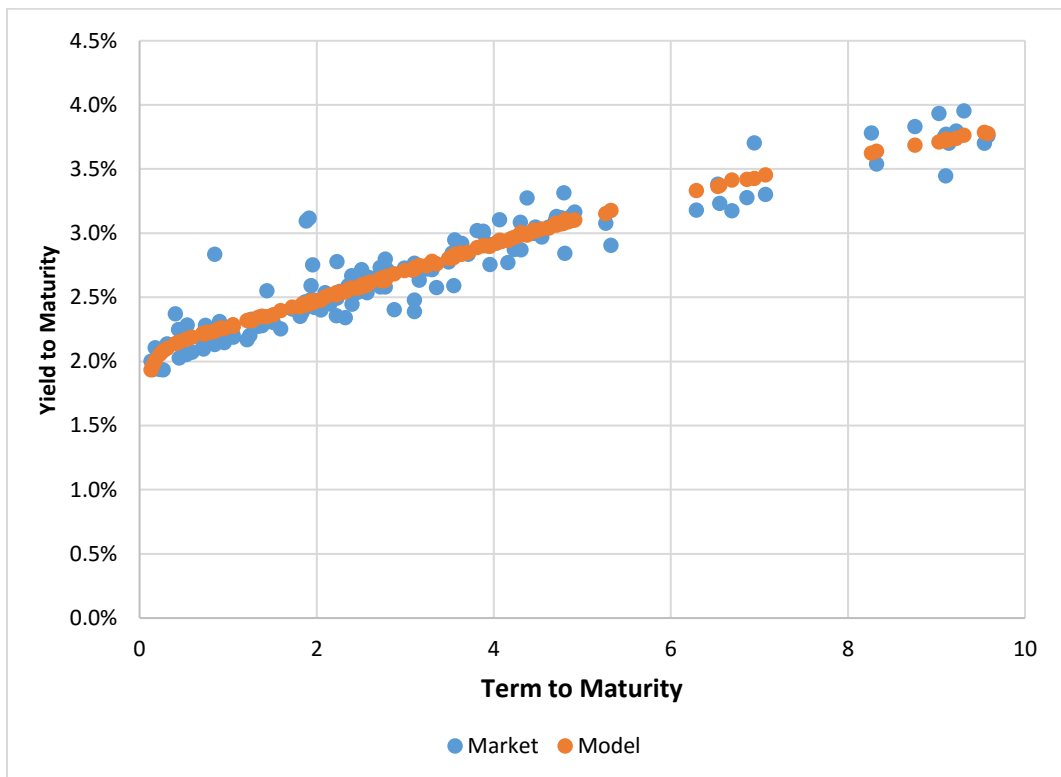
Extrapolation methodology

For rates beyond 10-year maturities, the fitted yield curve has been extrapolated by assuming that 1-year forward rates remain constant for all subsequent maturities. This is based on the 1-year forward rate between 9- and 10-year maturities, based on the fitted MLES model.

3 FITTED YIELD CURVE

Figure 6 shows the modelled yield-to-maturity for each bond in the asset calibration set, compared with the actual yield-to-maturity, using the MLES method with inverse duration weightings. Note that these are the same bonds as those discussed and analysed in Section 2 above.

Figure 6: Modelled vs. Market Yields to Maturity for Asset Calibration Set Using the MLES Method with Inverse Duration Weightings



Figures 7 and 8 show the resulting spot and forward yield curves of one to 50 years for the calibration set using the MLES method and extrapolated with the constant forward rate extrapolation method. Spot rates shown are quoted as annually compounded rates on zero coupon bonds with maturities of the specified term, forward rates shown are 1-year forward rates ending at the specified term.

Figure 7: Spot and Forward Rate Curves for Asset Calibration Set Using an MLES Interpolation and Constant Forward Rate Extrapolation Method

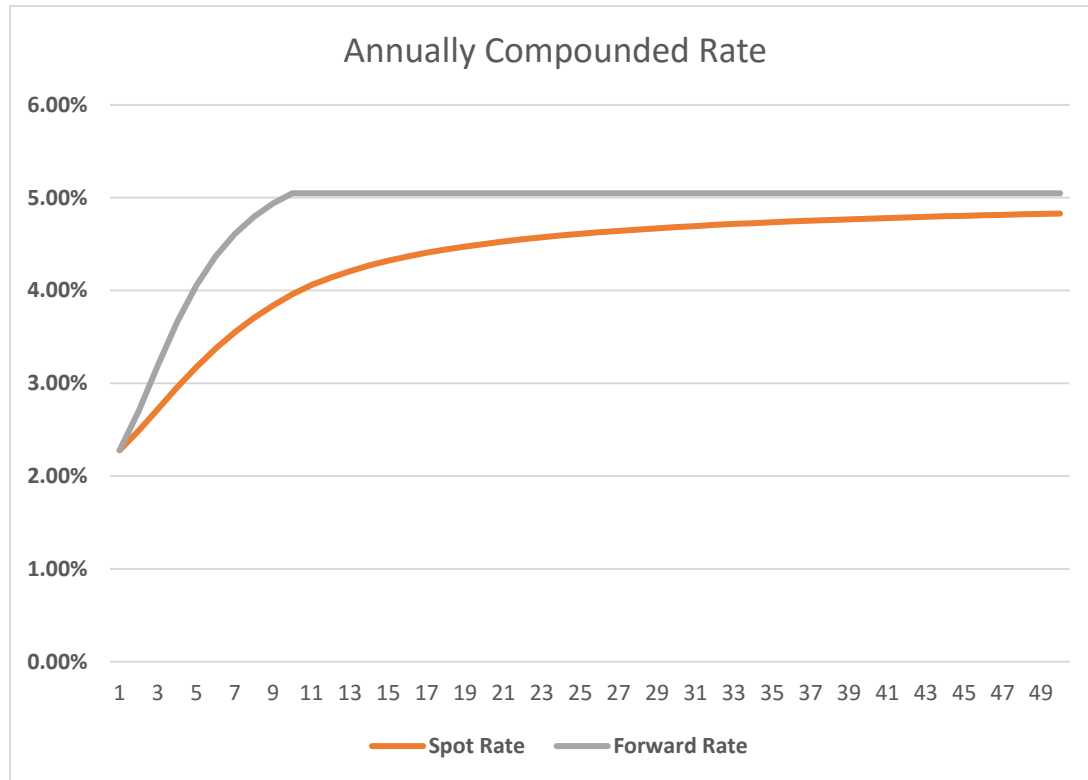


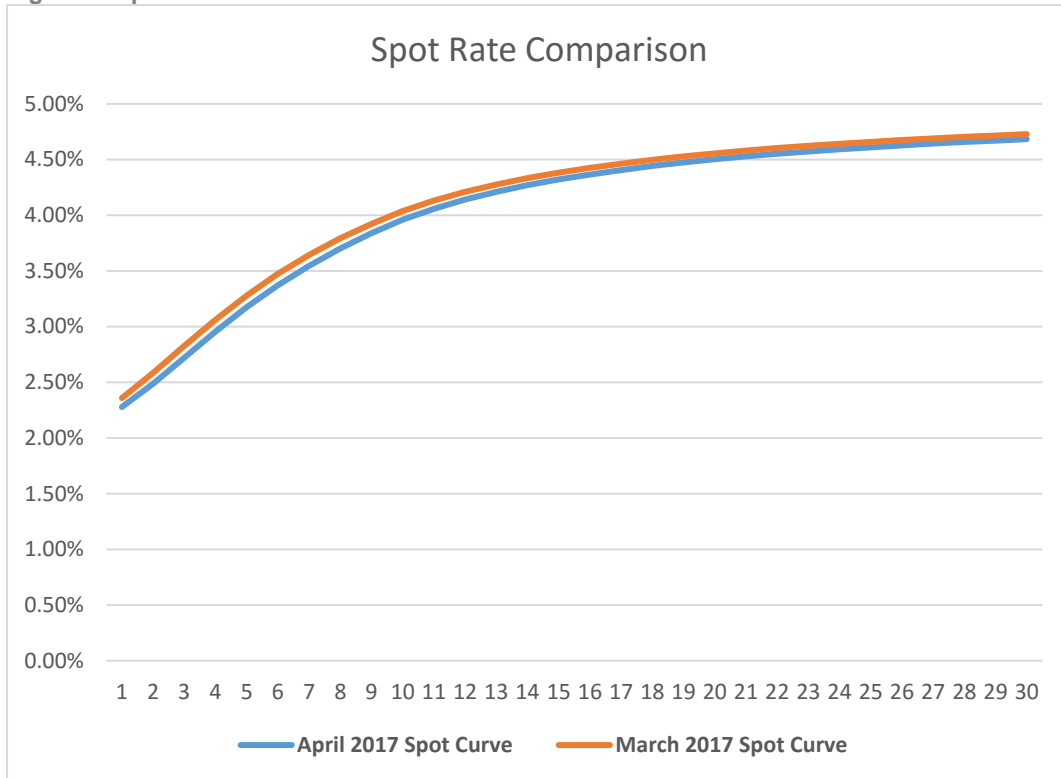
Figure 8: Spot and Forward Rate Curves for Asset Calibration Set Using an MLES Interpolation and Constant Forward Rate Extrapolation Method

Term (Years)	Spot Rate	Discount Factor
1	2.28%	0.977727
2	2.49%	0.952028
3	2.72%	0.922578
4	2.96%	0.890018
5	3.17%	0.855360
6	3.37%	0.819578
7	3.55%	0.783467
8	3.70%	0.747618
9	3.84%	0.712441
10	3.96%	0.678206
11	4.06%	0.645617
12	4.14%	0.614593
13	4.21%	0.585060
14	4.27%	0.556946
15	4.32%	0.530184
16	4.37%	0.504707
17	4.41%	0.480454
18	4.44%	0.457367
19	4.47%	0.435389
20	4.50%	0.414468
21	4.53%	0.394551
22	4.55%	0.375592
23	4.57%	0.357544
24	4.59%	0.340363
25	4.61%	0.324008

Term (Years)	Spot Rate	Discount Factor
26	4.63%	0.308438
27	4.64%	0.293617
28	4.66%	0.279508
29	4.67%	0.266077
30	4.68%	0.253291
31	4.70%	0.241120
32	4.71%	0.229533
33	4.72%	0.218503
34	4.73%	0.208004
35	4.74%	0.198009
36	4.74%	0.188494
37	4.75%	0.179436
38	4.76%	0.170814
39	4.77%	0.162606
40	4.77%	0.154792
41	4.78%	0.147354
42	4.79%	0.140273
43	4.79%	0.133533
44	4.80%	0.127116
45	4.80%	0.121008
46	4.81%	0.115193
47	4.82%	0.109658
48	4.82%	0.104388
49	4.82%	0.099372
50	4.83%	0.094597

Figure 9 shows the resulting spot rate curve of one to 30 years relative to the prior period fitted curve.

Figure 9: Spot Rate Curves Relative to Prior Period Fitted Curve





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