



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 December 2016 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	7,050	7.5%
AA	134	34,839	37.2%
A	132	37,121	39.6%
BBB	58	14,145	15.1%
BB	1	373	0.4%
Other	1	180	0.2%
Total	337	93,707	100.0%

Source: Milliman analysis based upon Bloomberg data as at 30 December 2016.

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	6,475	91.8%
1 AAA rating	2	575	8.2%
Total Combined AAA	11	7,050	100.0%
Combined Credit Rating of AA			
3 AA ratings	40	12,350	35.4%
2 AA ratings	82	19,754	56.7%
1 AA rating	12	2,735	7.9%
Total Combined AA	134	34,839	100.0%

Source: Milliman analysis based upon Bloomberg data as at 30 December 2016.

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 30 December 2016, 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 30 December 2016

MLES Parameters		
Long-Run	b0	5.7%
Param1	λ1	124.1%
Param2	λ2	9.3%
Param3	λ3	-69.5%
Param4	λ4	39.6%
Param5	λ5	43.7%
Param6	λ6	-2.7%
Param7	λ7	-63.3%
Param8	λ8	-17.9%
Param9	λ9	36.7%

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 30 December 2016

Regression Statistic	
Adjusted R-Squared	96.2%

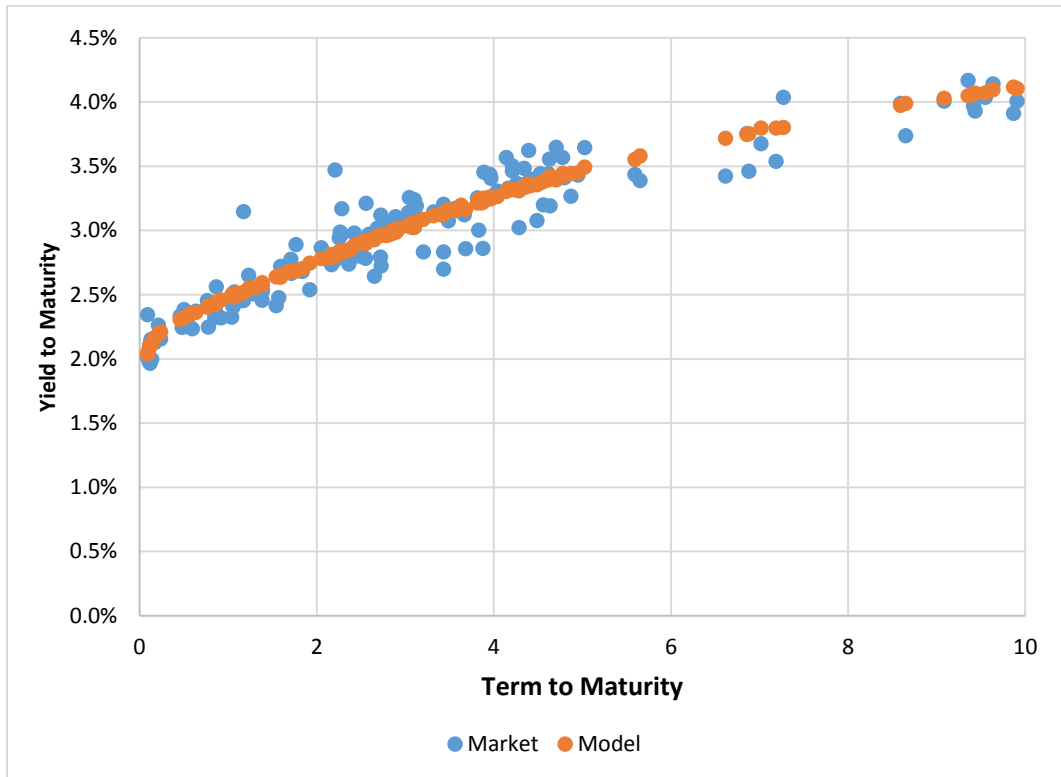
Extrapolation methodology

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

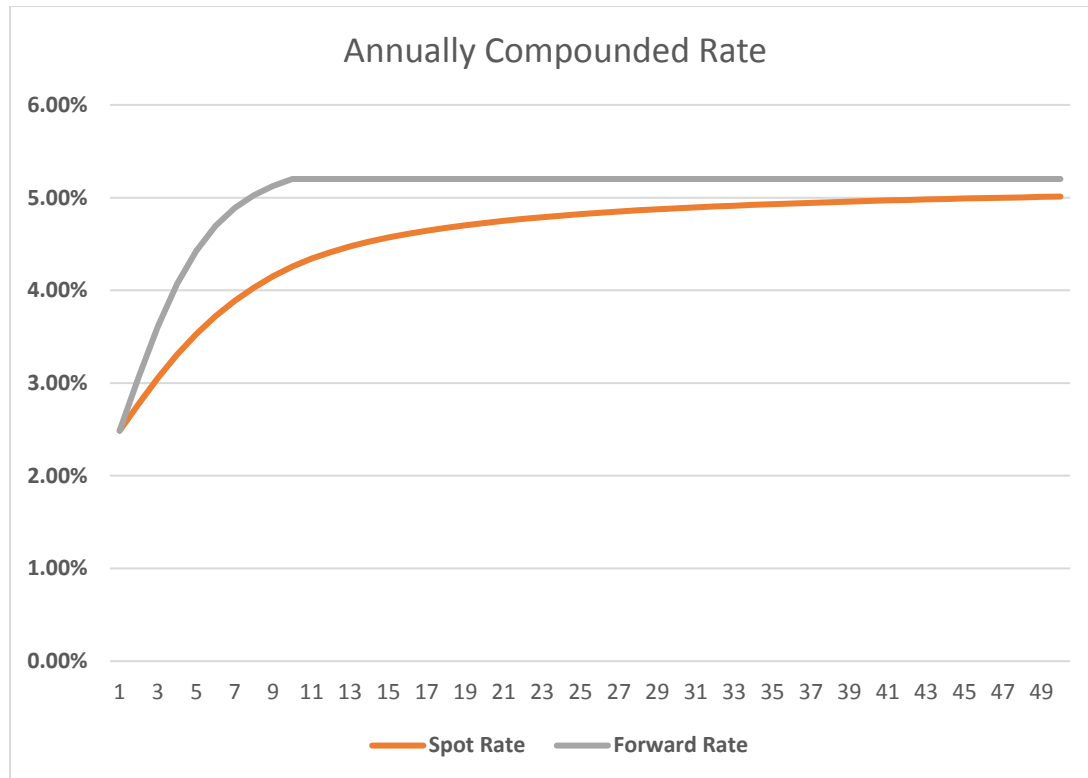


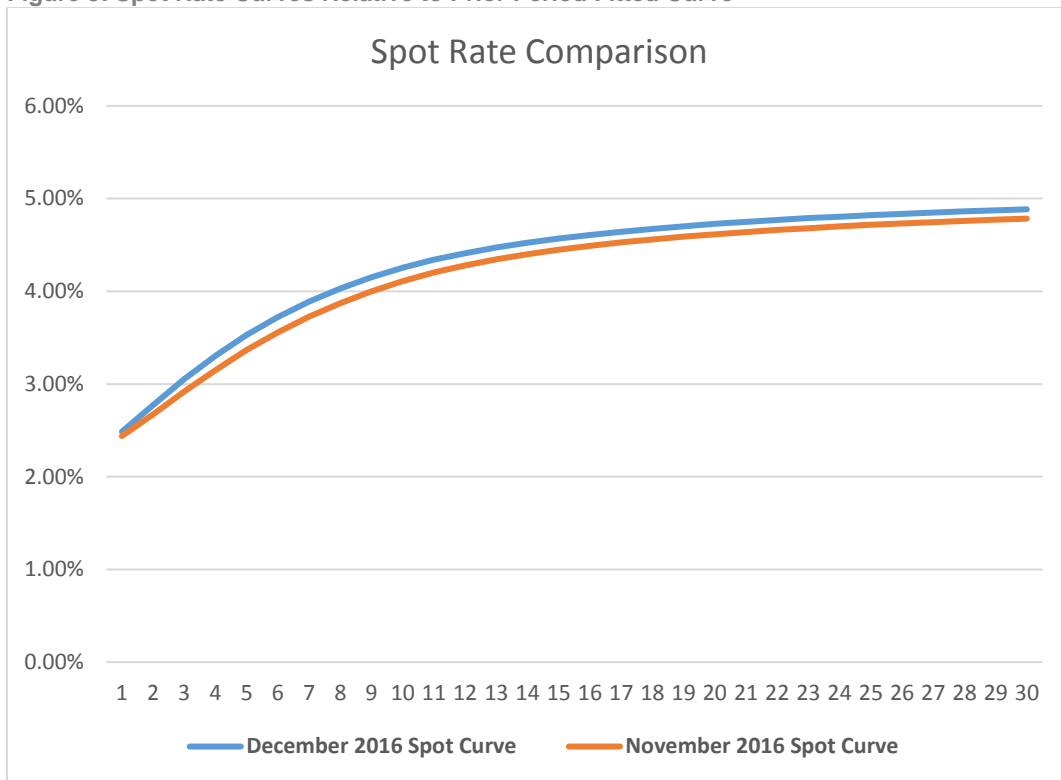
Figure 8: Spot and Forward Rate Curves for Asset Calibration Set Using an MLES Interpolation and Constant Forward Rate Extrapolation Method

Term (Years)	Spot Rate	Discount Factor
1	2.49%	0.975743
2	2.78%	0.946721
3	3.05%	0.913728
4	3.31%	0.878003
5	3.53%	0.840788
6	3.72%	0.803098
7	3.89%	0.765677
8	4.03%	0.729031
9	4.15%	0.693474
10	4.26%	0.659189
11	4.34%	0.626599
12	4.41%	0.595619
13	4.47%	0.566172
14	4.52%	0.538181
15	4.57%	0.511573
16	4.61%	0.486281
17	4.64%	0.462239
18	4.67%	0.439386
19	4.70%	0.417663
20	4.73%	0.397013
21	4.75%	0.377385
22	4.77%	0.358727
23	4.79%	0.340992
24	4.81%	0.324133
25	4.82%	0.308108

Term (Years)	Spot Rate	Discount Factor
26	4.84%	0.292875
27	4.85%	0.278395
28	4.86%	0.264631
29	4.87%	0.251548
30	4.88%	0.239111
31	4.90%	0.227290
32	4.90%	0.216053
33	4.91%	0.205371
34	4.92%	0.195217
35	4.93%	0.185566
36	4.94%	0.176391
37	4.94%	0.167671
38	4.95%	0.159381
39	4.96%	0.151501
40	4.96%	0.144011
41	4.97%	0.136891
42	4.98%	0.130123
43	4.98%	0.123690
44	4.99%	0.117575
45	4.99%	0.111762
46	4.99%	0.106236
47	5.00%	0.100984
48	5.00%	0.095991
49	5.01%	0.091245
50	5.01%	0.086734

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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