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 2020 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.

This report was prepared solely to provide assistance to the Group of 100 and the relevant Actuaries Institute of Australia subcommittee. Milliman does not intend to benefit and assumes no duty or liability to other parties who receive this report. Milliman recommends that any recipient of this report be aided by its own actuary or other qualified professional when reviewing the report. Milliman does not certify the information in this report, nor does it guarantee the accuracy, completeness, efficacy, or timeliness of such information. Use of such information is voluntary and should not be relied upon unless an independent review of its accuracy, completeness, efficacy, and timeliness has been performed. Materials may not be reproduced without the express consent of Milliman.

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, putable, 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	13	6,475	8.7%
AA	82	23,645	31.8%
A	99	28,080	37.8%
BBB	50	15,460	20.8%
BB	3	675	0.9%
Other	0	0	0.0%
Total	**247**	**74,335**	**100.0%**

Source: Milliman analysis based upon Bloomberg data as at 31 December 2020.

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	12	6,200	95.8%
1 AAA rating	1	275	4.2%
Total Combined AAA	**13**	**6,475**	100.0%
Combined Credit Rating of AA			
3 AA ratings	5	1,375	5.8%
2 AA ratings	69	20,620	87.2%
1 AA rating	8	1,650	7.0%
Total Combined AA	**82**	**23,645**	100.0%

Source: Milliman analysis based upon Bloomberg data as at 31 December 2020.

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 31 December 2020, 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 31 DECEMBER 2020

MLES Parameters		
Long-Run	**b0**	5.7%
Param1	**λ1**	165.0%
Param2	**λ2**	31.6%
Param3	**λ3**	-146.4%
Param4	**λ4**	39.6%
Param5	**λ5**	33.2%
Param6	**λ6**	9.8%
Param7	**λ7**	-73.3%
Param8	**λ8**	18.4%
Param9	**λ9**	22.2%

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 31 DECEMBER 2020

Regression Statistic	
Adjusted R-Squared	**98.3%**

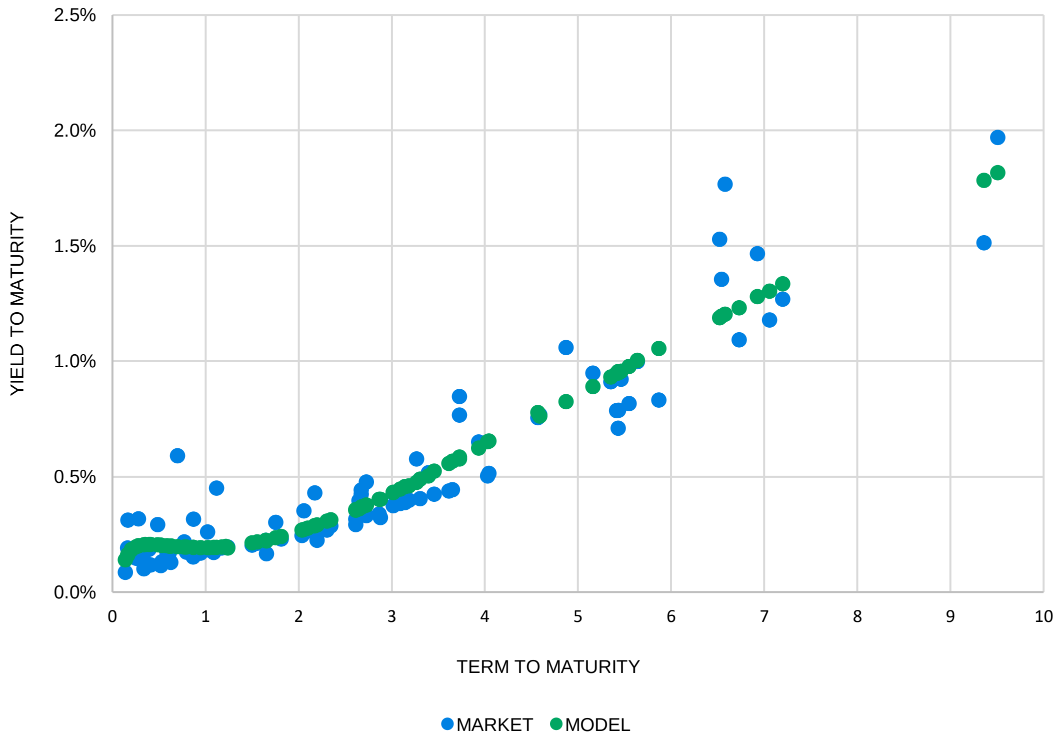
EXTRAPOLATION METHODOLOGY

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

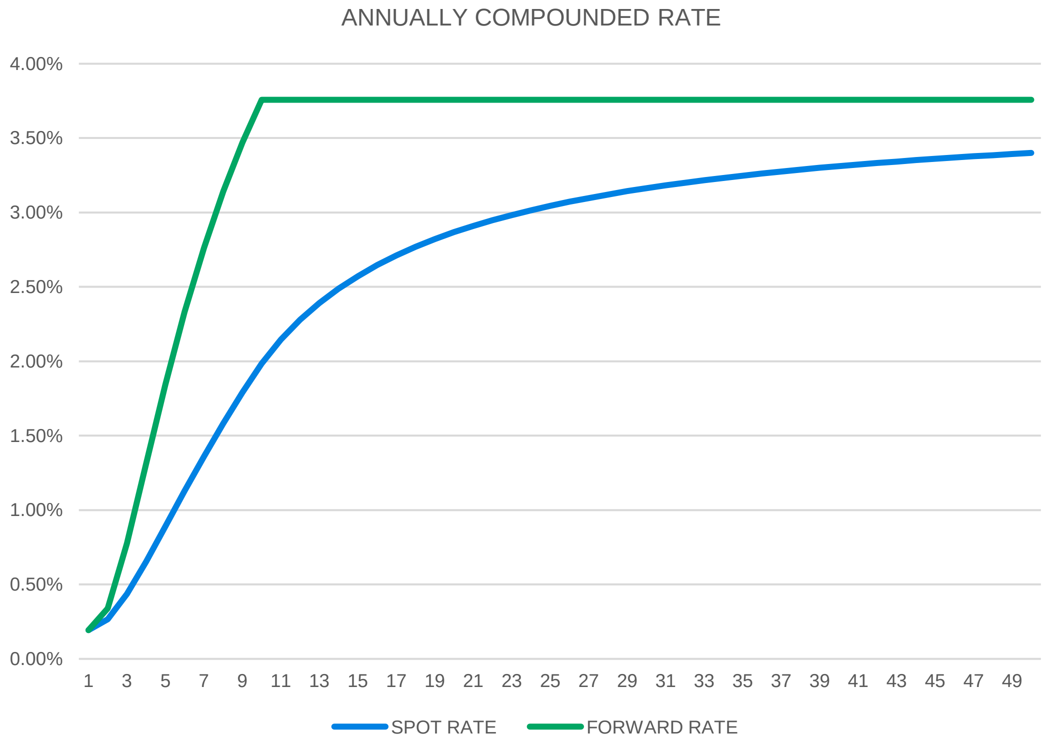
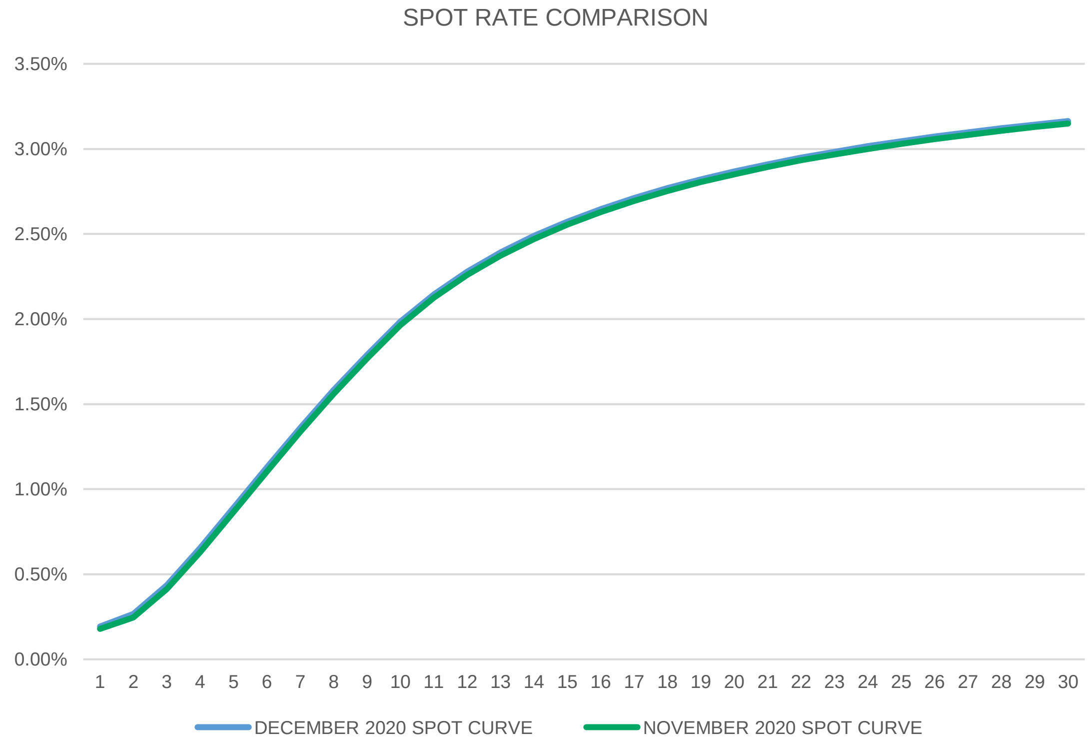


FIGURE 8: SPOT AND FORWARD RATE CURVES FOR ASSET CALIBRATION SET USING AN MLES INTERPOLATION AND CONSTANT FORWARD RATE EXTRAPOLATION METHOD

Term (Years)	Spot Rate	Discount Factor	Term (Years)	Spot Rate	Discount Factor
1	0.19%	0.998074	26	3.07%	0.455309
2	0.27%	0.994702	27	3.10%	0.438819
3	0.44%	0.987039	28	3.12%	0.422927
4	0.65%	0.974272	29	3.14%	0.407610
5	0.89%	0.956651	30	3.16%	0.392848
6	1.13%	0.934865	31	3.18%	0.378621
7	1.36%	0.909723	32	3.20%	0.364909
8	1.58%	0.882006	33	3.22%	0.351693
9	1.79%	0.852414	34	3.23%	0.338956
10	1.99%	0.821543	35	3.25%	0.326681
11	2.15%	0.791790	36	3.26%	0.314850
12	2.28%	0.763115	37	3.28%	0.303447
13	2.39%	0.735478	38	3.29%	0.292457
14	2.49%	0.708842	39	3.30%	0.281866
15	2.57%	0.683170	40	3.31%	0.271658
16	2.65%	0.658429	41	3.32%	0.261819
17	2.71%	0.634583	42	3.33%	0.252337
18	2.77%	0.611601	43	3.34%	0.243199
19	2.82%	0.589451	44	3.35%	0.234391
20	2.87%	0.568104	45	3.36%	0.225902
21	2.91%	0.547529	46	3.37%	0.217721
22	2.95%	0.527700	47	3.38%	0.209836
23	2.98%	0.508589	48	3.39%	0.202237
24	3.02%	0.490170	49	3.39%	0.194912
25	3.05%	0.472418	50	3.40%	0.187854

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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