Group of 100 Discount Rate

May 2020

Prepared by:

Craig McCulloch, FIAA FFA
Victor Huang, FIAA

TABLE OF CONTENTS

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 May 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	14	6,625	9.0%
AA	84	23,090	31.2%
A	96	26,605	36.0%
BBB	52	16,705	22.6%
BB	3	900	1.2%
Other	0	0	0.0%
Total	249	73,925	100.0%

Source: Milliman analysis based upon Bloomberg data as at 29 May 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	13	6,350	95.8%
1 AAA rating	1	275	4.2%
Total Combined AAA	14	6,625	100.0%
Combined Credit Rating of AA			
3 AA ratings	4	930	4.0%
2 AA ratings	71	20,260	87.7%
1 AA rating	9	1,900	8.2%
Total Combined AA	84	23,090	100.0%

Source: Milliman analysis based upon Bloomberg data as at 29 May 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 29 May 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 29 MAY 2020

MLES Parameters		
Long-Run	**b0**	5.7%
Param1	**λ1**	136.6%
Param2	**λ2**	90.8%
Param3	**λ3**	-187.6%
Param4	**λ4**	40.7%
Param5	**λ5**	41.8%
Param6	**λ6**	24.0%
Param7	**λ7**	-91.3%
Param8	**λ8**	23.2%
Param9	**λ9**	21.9%

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 29 MAY 2020

| Regression Statistic	
Adjusted R-Squared	**95.8%**

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
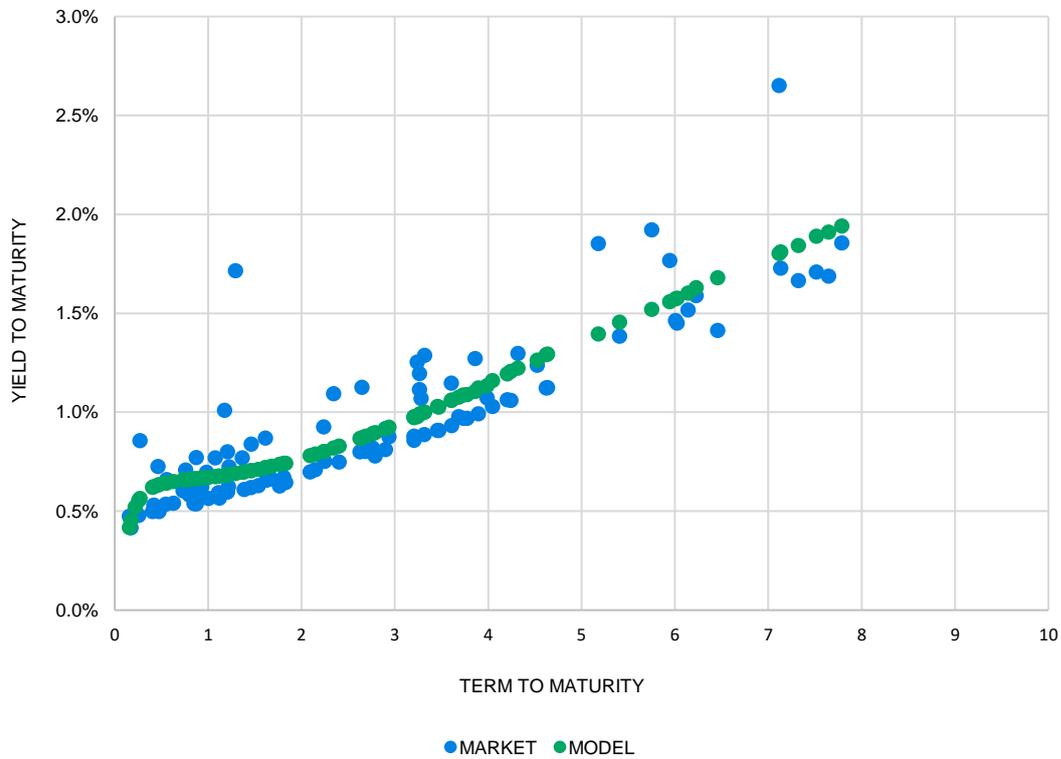
Figures 7 and 8 show the resulting spot and forward yield curves of one to 50 years for the calibration set using the MLES method and extrapolated with the constant forward rate extrapolation method. Spot rates shown are quoted as annually compounded rates on zero coupon bonds with maturities of the 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
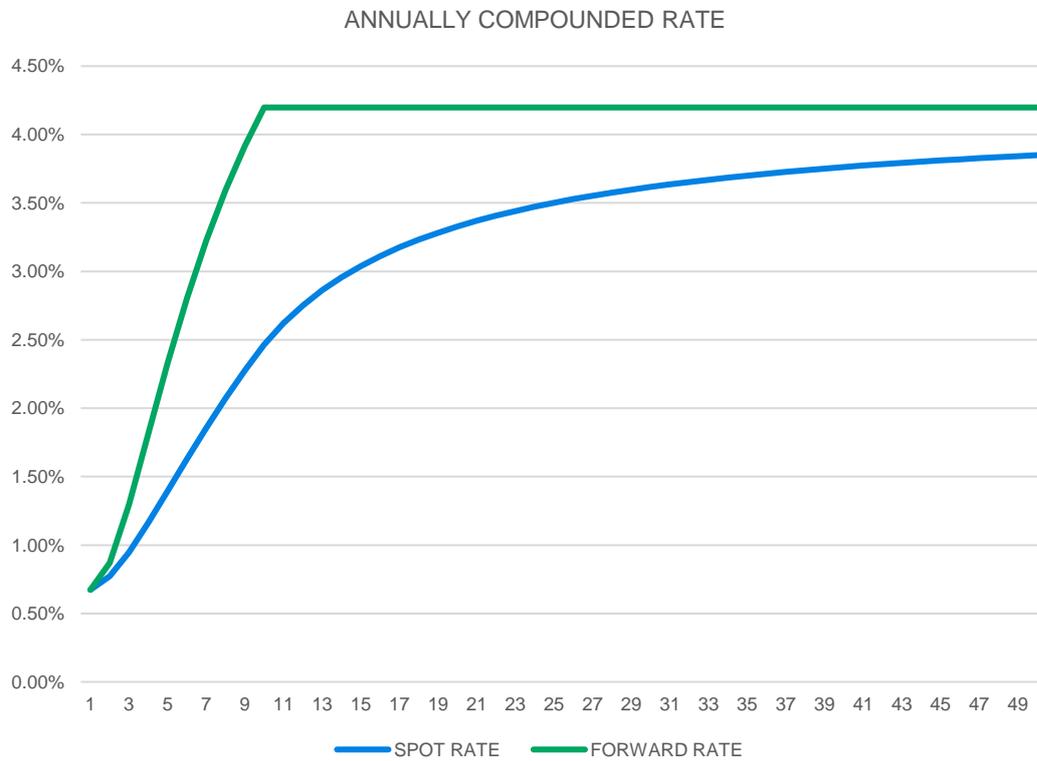
ANNUALLY COMPOUNDED RATE

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	0.67%	0.993316	26	3.53%	0.405924
2	0.77%	0.984745	27	3.55%	0.389569
3	0.95%	0.972119	28	3.58%	0.373873
4	1.16%	0.954776	29	3.60%	0.358810
5	1.40%	0.933030	30	3.62%	0.344353
6	1.63%	0.907579	31	3.64%	0.330479
7	1.86%	0.879219	32	3.65%	0.317163
8	2.07%	0.848708	33	3.67%	0.304385
9	2.28%	0.816716	34	3.69%	0.292121
10	2.47%	0.783809	35	3.70%	0.280351
11	2.62%	0.752229	36	3.71%	0.269055
12	2.75%	0.721921	37	3.73%	0.258215
13	2.86%	0.692834	38	3.74%	0.247811
14	2.96%	0.664920	39	3.75%	0.237827
15	3.04%	0.638129	40	3.76%	0.228245
16	3.11%	0.612419	41	3.77%	0.219048
17	3.18%	0.587744	42	3.78%	0.210223
18	3.23%	0.564063	43	3.79%	0.201753
19	3.28%	0.541337	44	3.80%	0.193624
20	3.33%	0.519526	45	3.81%	0.185823
21	3.37%	0.498594	46	3.82%	0.178336
22	3.41%	0.478505	47	3.83%	0.171150
23	3.44%	0.459226	48	3.83%	0.164255
24	3.47%	0.440723	49	3.84%	0.157637
25	3.50%	0.422966	50	3.85%	0.151285

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

SPOT RATE COMPARISON

MAY 2020 SPOT CURVE   APRIL 2020 SPOT CURVE
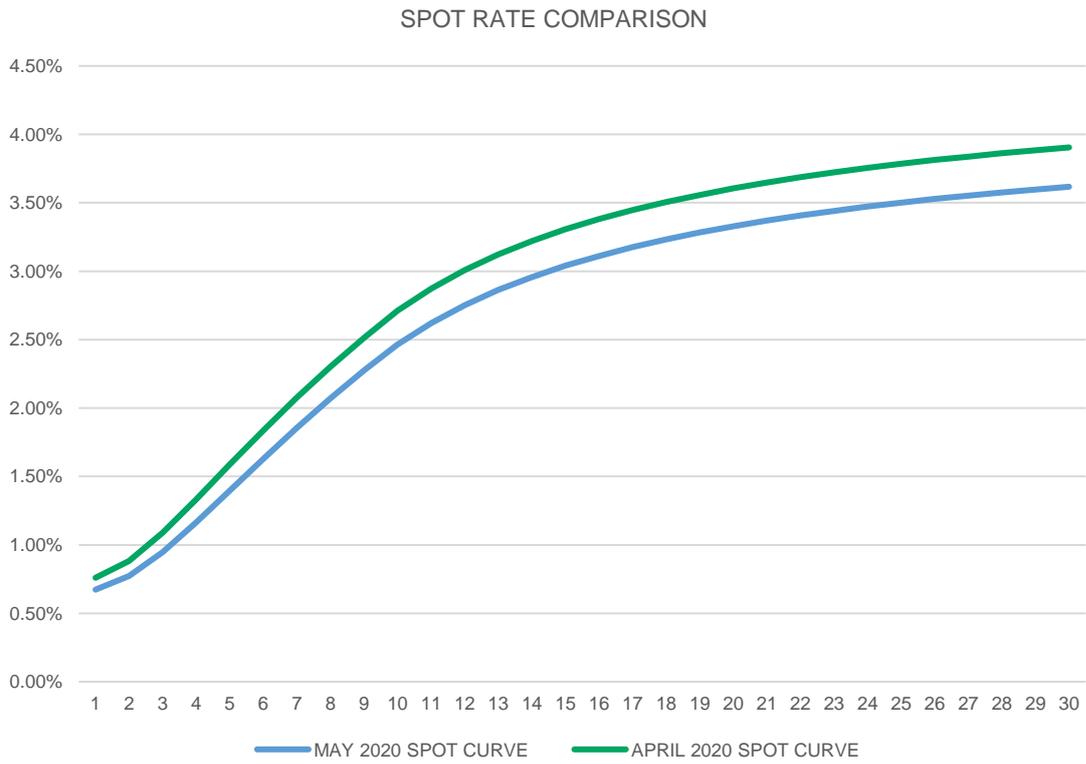
Milliman

Milliman is among the world's largest providers of actuarial and related products and services. The firm has consulting practices in life insurance and financial services, property & casualty insurance, healthcare, and employee benefits. Founded in 1947, Milliman is an independent firm with offices in major cities around the globe.

milliman.com

CONTACT

Craig McCulloch
craig.mcculloch@milliman.com

Victor Huang
victor.huang@milliman.com