Exposure Draft

Actuarial Guidance Note 1

Conversion of Spot Rates to Forward Rates and

Recommended Method to Derive Unobserved A2 PDS Rates

Developed by the

Actuarial Standards Committee of

Actuarial Society of Malaysia

12 August 2007

Actuarial Standards Committee

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Section 1   Background

Bank Negara Malaysia (BNM) issued the final Risk-Based Capital (RBC) Framework for Insurers on 19 April 1997. The RBC framework is scheduled for full implementation from 1 January 2009, with parallel calculation beginning April 2007.

At the time of writing, 2 parallel runs have been submitted to BNM by insurers. There have been wide interpretations of RBC framework by Appointed Actuaries (AA) resulting in non-comparable output among insurance companies.

Hence BNM senior actuary has requested Actuarial Society of Malaysia (ASM) to form an Actuarial Standard Committee (ASC) to develop recommended actuarial standards as guidance to AA.

Section 2   Exposure Draft

The current Exposure Draft on Actuarial Guidance Note 1 was issued on 12 August 2007 and sent out to all AA in Malaysia for comment deadline 28 September 2007.

Section 3   Purposes

This Actuarial Guidance Note provides guidance to actuaries with respect to the conversion of spot rates to forward rates and the recommended method to derive unobserved A2 PDS rates for the RBC purposes.

Section 4   Analysis of Issues and Recommended Practices

4.1   Current RBC framework specified the discount risks to be used in the valuation assumptions as the after investment tax, currently at 8%, market yield of Malaysian Government Securities (MGS) for guaranteed benefits, and correspondingly A2-rated Private Debt Security (PDS) for total guaranteed and non-guaranteed benefits.

4.2   These rates are obtained from website https://fast.bnm.gov.my/.

4.3   To implement RBC calculation, most actuarial software programs use a recursive algorithm to discount the liability cash-flows from the last policy term to the current date of valuation. Thus, with a non-level set of discount rates, it is customarily and computationally efficient to convert the spot rates of both MGS and A2 PDS yield curves to their corresponding forward rates.

4.4 To ensure that the value of the discounted liability is the same whether spot rates or forward rates are used, the Bootstrap method is used to convert spot rates to forward rates. The issue on deriving forward rates beyond the end of term of the spot curve. For both MGS and A2 PDS yield curve, the current RBC framework set the maximum end of term at 10 years term to maturity.

4.5 To demonstrate the conversion issue, take the MGS yields as at 30 March 2007 for example. The self-explanatory table below shows how the forward rates are derived using the bootstrap method.

Bootstrap Method

Year K	MGS (1)	After Tax Spot Rate (2)	(3)	(4)	Forward Rate (5)	Checking (6)
		$(1) * (1-0.08)$	$[1 + (2)]^k$	$(3)_t/(3)_{t-1}$	$(4) - 1$	$(4)_{t-1} * (4)_t$
1	3.4230%	3.149160%	1.0314916	1.0314916	0.0314916	1.0314916
2	3.4350%	3.160200%	1.0642027	1.0317124	0.0317124	1.0642027
3	3.4410%	3.165720%	1.0980099	1.0317676	0.0317676	1.0980099
4	3.4540%	3.177680%	1.1332952	1.0321357	0.0321357	1.1332952
5	3.4630%	3.185960%	1.1697769	1.0321909	0.0321909	1.1697769
6	3.4750%	3.197000%	1.2078206	1.0325222	0.0325222	1.2078206
7	3.4820%	3.203440%	1.2469792	1.0324209	0.0324209	1.2469792
8	3.4900%	3.210800%	1.2876599	1.0326233	0.0326233	1.2876599
9	3.4970%	3.217240%	1.3297505	1.0326877	0.0326877	1.3297505
10	3.5070%	3.226440%	1.3737557	1.0330928	0.0330928	1.3737557
11	3.5070%	3.226440%	1.4180791	1.0322644	0.0322644	1.4180791
12	3.5070%	3.226440%	1.4638325	1.0322644	0.0322644	1.4638325
13	3.5070%	3.226440%	1.5110622	1.0322644	0.0322644	1.5110622

Note that column (6) checked that the cumulative function using forward rates are same as those using after tax spot rates in column (3)

4.6   Some companies used an alternative method to derive the forward rates as given below

Alternative Method – Not Recommended

Year K	MGS (1)	After Tax Spot Rate (2)	(3)	(4)	Forward Rate (5)	Checking (6)
		$(1) * (1-0.08)$	$[1 + (2)]^k$	$(3)_t/(3)_{t-1}$	$(4) - 1$	$(4)_{t-1} * (4)_t$
1	3.4230%	3.149160%	1.0314916	1.0314916	0.0314916	1.0314916
2	3.4350%	3.160200%	1.0642027	1.0317124	0.0317124	1.0642027
3	3.4410%	3.165720%	1.0980099	1.0317676	0.0317676	1.0980099
4	3.4540%	3.177680%	1.1332952	1.0321357	0.0321357	1.1332952
5	3.4630%	3.185960%	1.1697769	1.0321909	0.0321909	1.1697769
6	3.4750%	3.197000%	1.2078206	1.0325222	0.0325222	1.2078206
7	3.4820%	3.203440%	1.2469792	1.0324209	0.0324209	1.2469792
8	3.4900%	3.210800%	1.2876599	1.0326233	0.0326233	1.2876599
9	3.4970%	3.217240%	1.3297505	1.0326877	0.0326877	1.3297505
10	3.5070%	3.226440%	1.3737557	1.0330928	0.0330928	1.3737557
11	3.5070%	3.226440%	1.4180791	1.0330928	0.0330928	1.4192171
12	3.5070%	3.226440%	1.4638325	1.0330928	0.0330928	1.4661829
13	3.5070%	3.226440%	1.5110622	1.0330928	0.0330928	1.5147029

This method is **not** recommended by the Actuarial Standards Committee.

This method derived the forward rates up to year 10 using after tax spot rates up to year 10, then set all future forward rates year 11 and onwards to the year 10 forward rate. As shown in column (6), such method produces different cumulative function by using the forward rates versus using the spot rates.

4.7   An alternative recommended method is to convert the coupon MGS spot rates to equivalent zero coupon MGS spot rates before deriving the forward rates. However, this method will be reviewed in future.

4.8   The second issue addresses in this Actuarial Guidance Note relates to the derivation of unobserved A2 PDS rates. To demonstrate the issue, take the A2 PDS yields as at 30 March 2007 for example. The observed market A2 PDS for year 3, 5, 7 and 10 years are given below. Thus there requires a method to derive the unobserved rates for year 1, 2, 4, 6, 8 and 9. Rates for year 11 and onwards are set equal to the rate at year 10 under current RBC framework.

Year	A2 PDS
1	
2	
3	5.670%
4	
5	6.152%
6	
7	6.739%
8	

9	
10	7.595%

4.9   Available numerical methods for interpolation (and extrapolation) include but not limited to linear interpolation, Lagrange polynomial, Newton's divided difference formula, cubic spline[1] and regression method in Microsoft Excel. The differences in the interpolated rates are negligible in practice as shown in the table below. Hence all methods are acceptable by this committee.

Year	Linear	Cubic Spline	Regression
1	5.188%	5.188%	5.307%
2	5.429%	5.440%	5.467%
3	5.670%	5.670%	5.670%
4	5.911%	5.900%	5.902%
5	6.152%	6.152%	6.152%
6	6.446%	6.438%	6.441%
7	6.739%	6.739%	6.739%
8	7.024%	7.032%	7.028%
9	7.310%	7.316%	7.321%
10	7.595%	7.595%	7.595%

Section 5   Communications and Disclosures

5.1   Actuarial Report and Documentation - The degree of documentation of the methods used will vary with the purpose of the actuarial report. The documentation should be most comprehensive for internal company manual, detailing all formulae with working examples. For fiscal year end RBC actuarial report, the documentation should be more complete than for the quarterly RBC abbreviated report. The former should include an appendix stating all formulae used or demonstrating how the method works. The latter could just name the methods used and refer the detailed documentation to the annual report.

5.2   Deviation from Recommended Practice - The actuary must be prepared to justify any methods that depart materially from the methods recommended in this Guidance Note and must include, in any actuarial communication disclosing the results of the deviated method, an appropriate statement with the nature, rationale, and effect of such departure. Compliance with applicable law that conflicts with this standard shall not be deemed a deviation from this Guidance Note, provided the actuary discloses that the professional services were performed in accordance with the requirements of such applicable law.

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[1] Refer to Chapter 15, "Loss Model – From Data to Decisions", 2nd Edition, Stuart A. Kugman, Harry H. Panjer and Gordon E. Wilmot.