Statutory Margins within a Principle-Based Valuation System – *Part 2*
From the American Academy of Actuaries' Life Reserves Work Group

Presented to the National Association of Insurance Commissioners'
Life and Health Actuarial Task Force

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Background

Recently the NAIC's Life and Health Actuarial Task Force (LHATF) issued a request to the Life Reserves Work Group (LRWG) for additional guidance surrounding the topic of margins and specifically regarding the ranges of margins to be placed on risk factors within a principle-based valuation framework. This paper is intended to provide LHATF with information on the impact of various margin levels. It is not intended to provide LHATF with any specific proposal on prescribed margin ranges. While it would be ideal to have various product models available (and volunteers to perform the modeling) to demonstrate these concepts, it is not practical given the current time frame. As a result, we have used the LRWG's Modeling Subgroup reports on Universal Life with Secondary Guarantee, Term Insurance, Participating Whole Life and Accumulation Universal Life as references for content. The product being tested in this report is intended to represent a profitable universal life with secondary guarantee (ULSG) product but is not an actual product in the marketplace. Intended as an illustrative proxy, this product is not meant to provide an example for all products that could be called ULSG.

Universal Life with Secondary Guarantee

In April 2006, the LRWG sent a report to LHATF outlining the impact of principle-based valuation concepts on the Universal Life with Secondary Guarantee (ULSG) product (LRWG report). This report can be found on the Academy website at http://www.actuary.org/pdf/life/ulsg_apr06.pdf. Research performed for the ULSG product in the LRWG report included calculation of deterministic reserves at various margin levels. Some of these margins, mortality in particular, were derived from the Canadian Educational Note "Margins for Adverse Deviations." In looking back at the LRWG report, we find that not only were varying margin levels tested, the margin ratio was also calculated. The table and discussion below summarize this material, and attempt to re-evaluate this information in light of the current LHATF question on margin ranges.

The tables below provide deterministic reserves under certain margin levels. A brief discussion follows each table.

AGE 45		Deterministic Reserve					
	Formulaic Reserves	Anticipated Experience (fn1)	(1)	(2)	(3)	(4)	(5)
0	0	(13,865)	13,755	7,487	5,145	92	(522)
1	43	(20,585)	9,185	2,536	148	(5,275)	(5,929)
2	6,140	(14,778)	17,128	10,092	7,659	1,935	1,239
3	11,947	(8,480)	25,534	18,107	15,633	9,679	8,941
4	21,916	(1,642)	34,440	26,621	24,107	18,000	17,219
5	32,140	5,778	43,875	35,663	33,112	26,932	26,106
10	113,966	50,560	98,731	88,473	85,753	79,941	78,858
20	323,901	175,365	238,692	225,090	222,321	217,099	215,495
30	536,476	353,302	416,693	401,430	398,941	394,106	392,056
40	708,521	564,420	611,711	596,991	595,020	590,817	588,614
50	844,459	756,287	784,922	772,730	771,341	772,261	770,446
60	936,727	868,320	883,833	877,228	876,133	876,798	875,451
70	970,246	917,734	923,951	923,018	922,036	922,458	921,422
PV Req Cap (t=0)		119,631	119,631	119,631	119,631	119,631	119,631
PV Req Cap (t=10)		221,294	221,294	221,294	221,294	221,294	221,294
Interest Rate Margin	N/A	None	Dterm Scenario	Dterm Scenario	Dterm Scenario	Dterm Scenario	Dterm Scenario
Qx Improvement	N/A	Yes	No	No	No	No	No
Qx Margin	N/A	None	2001CSO /ex	9.375/ex	3.50/ex	1.20%	None
Lapse Margin	N/A	None	30%	30%	30%	None	None
Expense Margin	N/A	None	5%	5%	5%	5%	None
Z at issue	11.59%	0%	23.09%	17.85%	15.89%	11.67%	11.59%
Z at t=10	28.65%	0%	21.77%	17.13%	15.90%	13.28%	12.79%

Note: This table is excerpted from Exhibit 4, page 14 of the April 2006 LRWG report.

(fn1) With no cash value floor.

Discussion – Age 45

In reviewing the aggregate margin *range* from the least conservative (set 5) to the most conservative (set 1) for the product tested:

Set (5) uses only those types of margins that are specified by VM-20:

- Deterministic Interest Scenario, as required by VM-20
- No mortality margin
- No mortality improvement, as required by VM-20
- No lapse margin
- No expense margin

Set (1) uses specified margins *and* margins on significant risk factors:

- Deterministic Interest Scenario, as required by VM-20
- 2001 CSO level of mortality margin divided by expectation of life
- No mortality improvement, as required by VM-20
- 30% lapse margin
- 5% expense margin

These margin sets are measured against the Anticipated Experience set which uses:

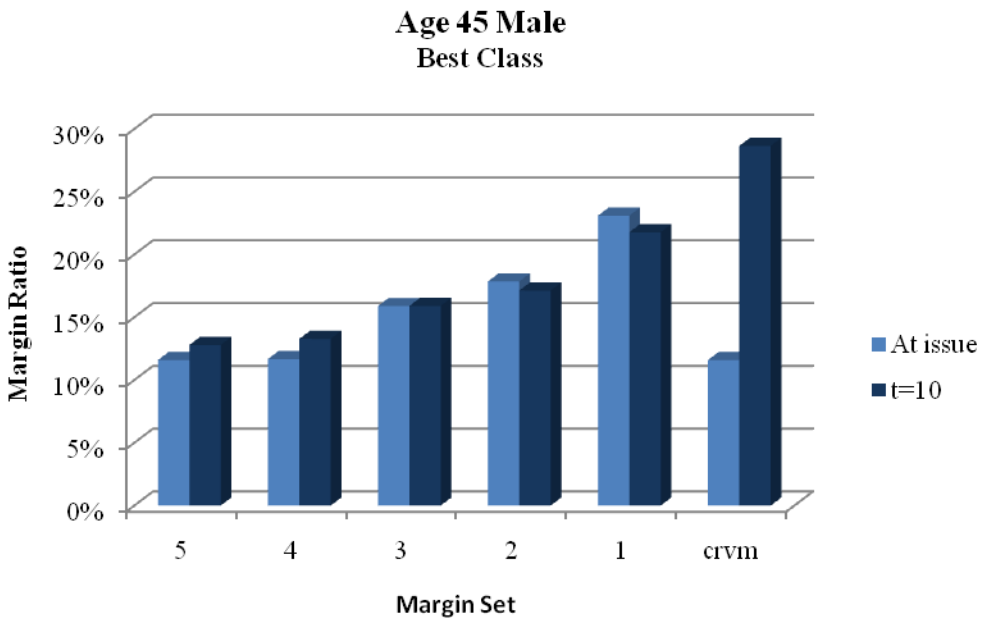
- Anticipated interest experience
- No mortality margin
- Mortality improvement
- No lapse margin
- No expense margin

The April 2006 LRWG report uses the margin ratio to quantify the amount of aggregate margin for the product tested. This method is also referred to as the Cost of Capital Method. To calculate the margin ratio at issue for Margin Set (1), for example, the margin at (t=0) is quantified as $13,755 - $(13,865) = $27,620, where the second value comes from the Anticipated Experience column. This amount becomes the numerator. The denominator is the present value at issue of future capital requirements which is $119,631. This amount was determined using a simple (two- to three-factor) methodology to derive an approximate company-level capital amount:

$$\text{Margin Ratio at issue}^{\text{Margin Set (1)}} = \$27{,}620/\$119{,}631 = 23.09\%$$

Margin level (1) is the level with the highest margin ratio and therefore the most conservative aggregate margin for this product block. Margin level (5) is the level with the lowest margin ratio, 11.59%, and therefore the least conservative aggregate margin for this product block. For purposes of this paper, the margin ratio is used to contrast varying levels of aggregate margin. The margins tested in the LRWG report range from a low of 11.59% to a high of 23.09%. Note the margin ratio for current formulaic reserve for the product tested is 11.59% at issue and 28.65% at duration 10.

Next we can review each interim level of aggregate margin using the range of 11.59% to 23.09% as a guide to the boundary points.



Observations from this analysis:

i. All levels of margin produce a margin ratio at issue that equals or exceeds the CRVM margin ratio at issue.
ii. None of the margin levels tested produces a margin ratio at duration 10 that exceeds the CRVM margin ratio at duration 10. In fact, the margin ratios are more consistent between the "at issue" margin and the duration 10 margin than are the CRVM margin measurements.

iii. For this product, the aggregate margin increases with increasing conservatism of the individual margins. This is confirmed by the increasing margin ratio from margin level (5) to margin level (1).

iv. In moving from a lower margin (Canadian 3.5 extra deaths per 1,000) to a higher margin (Canadian 9.375 extra deaths per 1,000) the margin ratio increases 12% at issue (i.e. 15.89% to 17.85%) and 7.7% at duration 10 (i.e. 15.90% to 17.13%).

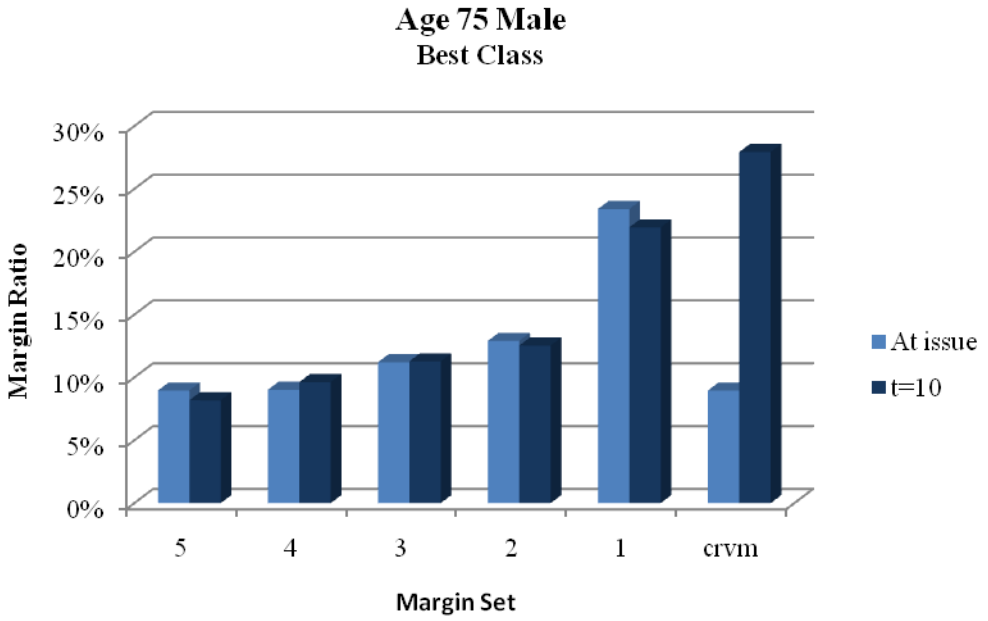
v. On the surface, these margin ratios seem high to members of the LRWG, but this condition is explained in the April 2006 LRWG report on page 4.

vi. Had a NAIC RBC required minimum capital amount been the target for the margin ratio denominator, then higher margin ratios would have resulted for the product tested.

A similar table and chart are presented for issue age 75.

AGE 75		Deterministic Reserve					
	Formulaic Reserves	Anticipated Experience (fn1)	(1)	(2)	(3)	(4)	(5)
0	0	(21,986)	35,426	9,679	5,504	132	(3,059)
1	3,332	(51,626)	7,343	(18,463)	(22,565)	(28,334)	(31,644)
2	46,828	(14,325)	45,686	19,899	15,880	9,910	6,494
3	85,756	23,469	84,040	58,343	54,416	48,401	44,895
4	127,782	61,142	121,845	96,301	92,472	86,518	82,946
5	175,074	98,388	158,842	133,511	129,786	123,955	120,340
10	352,869	283,340	337,929	314,538	311,409	307,293	303,694
20	661,259	624,932	657,256	641,655	639,892	641,051	638,602
30	936,727	868,346	883,863	877,254	876,158	876,821	875,475
40	970,246	923,443	929,482	928,486	927,401	927,678	926,721
PV Req Cap (t=0)		245,316	245,316	245,316	245,316	245,316	245,316
PV Req Cap (t=10)		248,837	248,837	248,837	248,837	248,837	248,837
Interest Rate Margin	N/A	None	Dterm Scenario	Dterm Scenario	Dterm Scenario	Dterm Scenario	Dterm Scenario
Qx Improvement	N/A	Yes	No	No	No	No	No
Qx Margin	N/A	None	2001CSO /ex	9.375/ex	3.50/ex	1.20%	None
Lapse Margin	N/A	None	30%	30%	30%	None	None
Expense Margin	N/A	None	5%	5%	5%	5%	None
Z at issue	8.96%	0%	23.40%	12.91%	11.21%	9.02%	8.96%
Z at t=10	27.94%	0%	21.94%	12.54%	11.28%	9.63%	8.18%

(fn1) With no cash value floor


Age 75 Male
Best Class
30%
25%
20%
15%
10%
5%
0%
Margin Ratio
5
4
3
2
1
crvm
Margin Set
At issue
t=10