AMERICAN ACADEMY of ACTUARIES

Follow-up to Proposed New Risk-Based Capital Method for Separate Accounts that Guarantee an Index

Presented by the American Academy of Actuaries' Life Capital Adequacy Subcommittee to the National Association of Insurance Commissioners' Life Risk-Based Capital Working Group

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The following revision (from December 2001 report/proposal) to the Academy's Guaranteed Index Separate Account recommendation maintains the approach recommended in the original, but reflects two refinements:

a) We have refined the factors used in the calculation based on input from external reviewers, this improves the accuracy of the approximation.

b) We have moved from a 95th percentile, 12 month capital goal to a 95th percentile 24 month goal.

Both of these changes tend to increase the factor from the previous version. For example, the previous factors when applied to a weekly mean of -.13 percent and weekly standard deviation of .18 percent produced a pre-tax capital requirement of 3.42 percent. The revised factors produce 7.09 percent.

The current "Overview and Instructions" says that, "Indexed separate accounts are invested to mirror an established securities index that is the basis of the guarantee. Consequently, indexed separate accounts are relatively low risk; the risk-based capital factor is the same as class 1 bonds." Class 1 bonds have a (C-1) factor of .4 percent. Since the formula was developed, it has become clear that, in many instances, companies that guarantee an index do not follow an investment strategy that tracks as closely as this factor implies. Since the number of possible investment strategies is very large, tabular factors or a standardized modeling approach do not appear to be practical. In the absence of these methods, the American Academy of Actuaries' Life Capital Adequacy Subcommittee recommends an approach that reflects actual loss volatility and adjusts the result for exposure to lower rated debt. This approach will produce factors similar to the current factor for relatively passive strategies (e.g., buy T-Bills and S&P futures), but much higher factors if credit, duration, or basis risk is significant.

The proposed new method is as follows:

a) Calculate the "tracking error" as periodic (monthly or weekly) fund performance (net of fees) minus the guaranteed performance (after fees) for the 100 most recent months (if the product has 100 months of history, otherwise the 100 most recent weeks or the lifetime of the fund, if shorter). If the product has less than 100 months of history and weekly data is unavailable, see Appendix 1.

b) For periods in which the difference is positive, record a value of zero; if negative, retain the calculated value.

c) Calculate the mean and standard deviation of these results.

d) Calculate the initial RBC percentage as follows, where m is the calculated mean and s is the calculated standard deviation: Calculate "a" as 1.34 + m/s, but not greater than 1.00.

-- For monthly data, the initial capital requirement is $-24 * (m + a*s) + 13.5 * s$
-- For weekly data, the requirement is $-104* (m + a*s) + 28.5 * s$

Apply the above percentage to the accumulated guaranteed value.

e) Adjust for below investment grade securities. If the portfolio has included securities in Class 3 or higher during the measurement period, an adjustment must be made following one of the following two alternatives:

i) In calculating tracking error, replace the Class 3 and higher securities actual results, with those of Treasury bonds of similar duration. Then, add the C-1 factor amounts for these securities to the total, as calculated above.

OR

ii) Calculate the tracking error for the actual portfolio (without adjustment), then add the excess C-1 factor above the Class 2 amount for those securities in Class 3 or higher.

f) If the result of the above calculations is less than .4 percent times the accumulated guaranteed amount, increase it to that level.

This calculation is to be done for each distinct guarantee/portfolio combination separately.

Since the tracking error reflects the impact of any duration mismatches, guaranteed index separate account products do not get a C3a charge.

All the above is pre-tax, and should be fully tax adjusted by multiplying by 1 minus the corporate tax rate..

APPENDIX 1: How to proceed if the product does not have 100 months of data and weekly data is unavailable.

If weekly data can be produced for future periods, use monthly data for prior periods to develop a capital formula percentage. Use weekly data going forward to develop a capital formula. Combine these into a combined annualized mean and standard deviation by time weighting the results.

If weekly data cannot be produced, then use monthly data throughout.

APPENDIX 2: Support for how to annualize the monthly mean of the truncated tracking error.

The attached spreadsheet helps demonstrate the need for a special method of annualization. It shows the distribution of annual values of a variable with an annual mean of zero and annual standard deviation of 1. The outcomes are in Column A, the density in Column B, their product in Column C, and A*A*B in Column F.

Untruncated, sum(x)=C163=0, sum(x*x)=F163=19.98, n=B163=20. With truncation at zero, sum(x)=E82=-7.975, sum(x*x)=F163/2=9.99, n=20.

Since standard deviation = {(n*sum((x*x)-(sum(x))^2)/(n*n)}^.5, the untruncated data gives us {(20*19.98-0)/400}^.5 = 1.00 s.d, mean of 0/20=0.

Truncated we get {(20*9.99-7.975^2)/400}^.5 = .584 s.d and mean = -7.975/20 = -.399.

If, instead, we wanted the statistics for this same distribution, but tabulating monthly results, we can get that simply by dividing all the values in Column A by 12^.5. This produces a measured monthly mean of truncated values of -.399/12^.5 and monthly standard deviation of .584/12^.5

If we attempt to annualize this mean by multiplication by 12, it produces -1.38 for the annual mean, but the correct value is -.399. This shows the need for a significant correction. The formula provided reflects that correction.

Appendix 2

value	density	cola*colb	cdf	a^2*b
-4	0.000134	-0.000535321	6.71E-06	0.002141
-3.95	0.000163	-0.000644863	8.18E-06	0.002547
-3.9	0.000199	-0.000774756	9.96E-06	0.003022
-3.85	0.000241	-0.000928337	1.21E-05	0.003574
-3.8	0.000292	-0.001109398	1.46E-05	0.004216
-3.75	0.000353	-0.001322234	1.77E-05	0.004958
-3.7	0.000425	-0.001571687	2.13E-05	0.005815
-3.65	0.00051	-0.001863197	2.56E-05	0.006801
-3.6	0.000612	-0.002202847	3.07E-05	0.00793
-3.55	0.000732	-0.002597409	3.67E-05	0.009221
-3.5	0.000873	-0.003054389	4.37E-05	0.01069
-3.45	0.001038	-0.00358207	5.2E-05	0.012358
-3.4	0.001232	-0.004189545	6.18E-05	0.014244
-3.35	0.001459	-0.004886748	7.31E-05	0.016371
-3.3	0.001723	-0.005684477	8.63E-05	0.018759
-3.25	0.002029	-0.006594406	0.000102	0.021432
-3.2	0.002384	-0.007629082	0.00012	0.024413
-3.15	0.002794	-0.008801914	0.00014	0.027726
-3.1	0.003267	-0.010127139	0.000164	0.031394
-3.05	0.00381	-0.011619774	0.000191	0.03544
-3	0.004432	-0.013295545	0.000222	0.039887
-2.95	0.005143	-0.015170791	0.00048	0.044754
-2.9	0.005953	-0.017262344	0.000778	0.050061
-2.85	0.006873	-0.019587385	0.001123	0.055824
-2.8	0.007915	-0.022163264	0.00152	0.062057
-2.75	0.009094	-0.025007297	0.001975	0.06877
-2.7	0.010421	-0.028136524	0.002498	0.075969
-2.65	0.011912	-0.031567446	0.003095	0.083654
-2.6	0.013583	-0.03531572	0.003776	0.091821
-2.55	0.015449	-0.039395835	0.00455	0.100459
-2.5	0.017528	-0.043820751	0.005429	0.109552
-2.45	0.019837	-0.048601518	0.006423	0.119074
-2.4	0.022395	-0.053746873	0.007546	0.128992
-2.35	0.025218	-0.059262817	0.00881	0.139268
-2.3	0.028327	-0.065152187	0.01023	0.14985
-2.25	0.03174	-0.071414217	0.011821	0.160682
-2.2	0.035475	-0.078044104	0.013599	0.171697
-2.15	0.03955	-0.085032589	0.015581	0.18282
-2.1	0.043984	-0.092365552	0.017786	0.193968
-2.05	0.048792	-0.100023638	0.020232	0.205048
-2	0.053991	-0.107981933	0.022938	0.215964
-1.95	0.059595	-0.116209677	0.025925	0.226609
-1.9	0.065616	-0.124670048	0.029214	0.236873
-1.85	0.072065	-0.133320018	0.032826	0.246642
-1.8	0.07895	-0.142110285	0.036784	0.255799
-1.75	0.086277	-0.150985308	0.041108	0.264224
-1.7	0.094049	-0.159883432	0.045823	0.271802
-1.65	0.102265	-0.168737126	0.050949	0.278416
-1.6	0.110921	-0.177473335	0.056509	0.283957
-1.55	0.120009	-0.186013951	0.062524	0.288322
-1.5	0.129518	-0.194276393	0.069016	0.291415

Appendix 2

-1.45	0.139431	-0.202174321	0.076005		0.293153
-1.4	0.149727	-0.209618452	0.08351		0.293466
-1.35	0.160383	-0.216517492	0.09155		0.292299
-1.3	0.171369	-0.22277917	0.10014		0.289613
-1.25	0.182649	-0.228311357	0.109295		0.285389
-1.2	0.194186	-0.233023266	0.119029		0.279628
-1.15	0.205936	-0.236826709	0.129351		0.272351
-1.1	0.217852	-0.239637395	0.140271		0.263601
-1.05	0.229882	-0.241376248	0.151794		0.253445
-1	0.241971	-0.241970725	0.163923		0.241971
-0.95	0.254059	-0.241356104	0.176658		0.229288
-0.9	0.266085	-0.239476725	0.189995		0.215529
-0.85	0.277985	-0.236287153	0.203929		0.200844
-0.8	0.289692	-0.231753242	0.21845		0.185403
-0.75	0.301137	-0.225853074	0.233545		0.16939
-0.7	0.312254	-0.218577753	0.249197		0.153004
-0.65	0.322972	-0.209932034	0.265386		0.136456
-0.6	0.333225	-0.199934762	0.282089		0.119961
-0.55	0.342944	-0.18861912	0.299279		0.103741
-0.5	0.352065	-0.176032663	0.316926		0.088016
-0.45	0.360527	-0.162237133	0.334998		0.073007
-0.4	0.36827	-0.147308056	0.353457		0.058923
-0.35	0.37524	-0.131334121	0.372267		0.045967
-0.3	0.381388	-0.114416345	0.391384		0.034325
-0.25	0.386668	-0.096667029	0.410766		0.024167
-0.2	0.391043	-0.078208539	0.430367		0.015642
-0.15	0.394479	-0.0591719	0.45014		0.008876
-0.1	0.396953	-0.039695255	0.470037		0.00397
-0.05	0.398444	-0.019922196			0.000996
-2.29E-15	0.398942	-9.13512E-16	9.975163	-7.974766	2.09E-30
0.05	0.398444	0.019922196			0.000996
0.1	0.396953	0.039695255			0.00397
0.15	0.394479	0.0591719			0.008876
0.2	0.391043	0.078208539			0.015642
0.25	0.386668	0.096667029			0.024167
0.3	0.381388	0.114416345			0.034325
0.35	0.37524	0.131334121			0.045967
0.4	0.36827	0.147308056			0.058923
0.45	0.360527	0.162237133			0.073007
0.5	0.352065	0.176032663			0.088016
0.55	0.342944	0.18861912			0.103741
0.6	0.333225	0.199934762			0.119961
0.65	0.322972	0.209932034			0.136456
0.7	0.312254	0.218577753			0.153004
0.75	0.301137	0.225853074			0.16939
0.8	0.289692	0.231753242			0.185403
0.85	0.277985	0.236287153			0.200844
0.9	0.266085	0.239476725			0.215529
0.95	0.254059	0.241356104			0.229288
1	0.241971	0.241970725			0.241971
1.05	0.229882	0.241376248			0.253445
1.1	0.217852	0.239637395			0.263601

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1.15	0.205936	0.236826709	0.272351
1.2	0.194186	0.233023266	0.279628
1.25	0.182649	0.228311357	0.285389
1.3	0.171369	0.22277917	0.289613
1.35	0.160383	0.216517492	0.292299
1.4	0.149727	0.209618452	0.293466
1.45	0.139431	0.202174321	0.293153
1.5	0.129518	0.194276393	0.291415
1.55	0.120009	0.186013951	0.288322
1.6	0.110921	0.177473335	0.283957
1.65	0.102265	0.168737126	0.278416
1.7	0.094049	0.159883432	0.271802
1.75	0.086277	0.150985308	0.264224
1.8	0.07895	0.142110285	0.255799
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1.9	0.065616	0.124670048	0.236873
1.95	0.059595	0.116209677	0.226609
2	0.053991	0.107981933	0.215964
2.05	0.048792	0.100023638	0.205048
2.1	0.043984	0.092365552	0.193968
2.15	0.03955	0.085032589	0.18282
2.2	0.035475	0.078044104	0.171697
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3.85	0.000241	0.000928337	0.003574
3.9	0.000199	0.000774756	0.003022
3.95	0.000163	0.000644863	0.002547
4	0.000134	0.000535321	0.002141
	19.99886	1.94365E-15	19.9794

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