AMERICAN ACADEMY *of* ACTUARIES

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 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 1.65 times the annualized standard deviation minus the annualized mean*. Apply this 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.

*Due to the truncation of the tabulated values, annualizing the mean cannot be done by taking the monthly mean (m) times 12 or weekly mean times 52. Instead, the mean is annualized in two parts: (m+.68s) is multiplied by 12 or 52 then .68s times 12^.5 or 52^.5 is subtracted, where s is the modal standard deviation. The annualized standard deviation is s times 12^.5 or 52^.5

For example, if weekly results produced a weekly mean of -.13 percent and weekly standard deviation of .18 percent, the annualized mean is –1.28 percent and annualized s.d. is 1.30 percent so the RBC = 1.30*1.65+1.28=3.42 percent

All the above is pre-tax, and should be fully tax adjusted.

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 an annualized mean and standard deviation. Use weekly data from this date forward to produce annualized mean and standard deviation. 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.

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 correction and it also provides the basis for that correction. The error results due to our tabulation of adverse deviations, but not good deviations in the truncated means, which lowers the measured mean by .399/.584 times the standard deviation. This part of the measured monthly mean needs to be annualized by multiplication by 12^.5. The balance of the measured mean is annualized by multiplication by 12.

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
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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
1.85	0.072065	0.133320018	0.246642
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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