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Standard Valuation Law
Interest Rate Modernization
Work Group
American Academy of Actuaries
February 2016

Executive Summary

At the request of the VM-22 Subgroup of the Life Actuarial Task Force (LATF) of the National Association of Insurance Commissioners (NAIC), the Standard Valuation Law Interest Rate Modernization Work Group of the American Academy of Actuaries[1] has reviewed the statutory regulations regarding the determination of statutory valuation interest rates.

We propose changes to the current methodology for determining the statutory valuation interest rate for single premium immediate annuities (SPIAs) and other similar contracts. The following are the key differences between the current method and the proposed method:

	Current	Proposed
Reference Index	Moody's Long Term Corporate Index	Treasuries plus VM-20 spreads
Credit Quality	Moody's Index, i.e., average of industrial and public utilities	Average Life Insurer Bond Portfolio
Provisions for Adverse Deviation	20% of reference rate in excess of 3%	VM-20 defaults and investment expenses
Floor	None, but bias toward 3%	None
Duration Buckets	1	4
Frequency of Updates	Annual	Quarterly/Daily
Multiple Premiums	N/A	Separate rate for each premium
Rounding	Nearest 25 basis points	Quarterly: nearest 25 basis points Daily: nearest basis point

[1] The American Academy of Actuaries is an 18,500+ member professional association whose mission is to serve the public and the U.S. actuarial profession. For more than 50 years, the Academy has assisted public policymakers on all levels by providing leadership, objective expertise, and actuarial advice on risk and financial security issues. The Academy also sets qualification, practice, and professionalism standards for actuaries in the United States.

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In general, the proposed valuation rates are similar to the current rates for longer-duration contracts, i.e., those 15 years and longer (>15Y). The proposed valuation rates for shorter contracts are almost always lower than current valuation rates.

Background and Scope

In May 2015, the VM-22 Subgroup of the Life Actuarial Task Force (LATF) of the National Association of Insurance Commissioners (NAIC) requested that the Standard Valuation Law Interest Rate Modernization Work Group of the American Academy of Actuaries be created to investigate and recommend modifications to the existing statutory regulations regarding the determination of statutory valuation interest rates. Specifically, the VM-22 subgroup gave the Academy work group the following charge:

> *Review the current methodology, and if appropriate, recommend changes to the current methodology for establishing "dynamic" valuation interest rates in the Standard Valuation Law (SVL).*

Subsequently, the VM-22 Subgroup narrowed the focus of the Academy work group efforts by prioritizing the following areas of the current single premium immediate annuity (SPIA) valuation rate methodology for review:

1. Interest rate basis (source, credit quality, and provisions for adverse deviation);
2. Appropriate valuation rate for liabilities issued on a non-uniform basis; i.e., "jumbo" single premium group annuities; and
3. Minimum valuation interest rate, if any.

In light of these priorities, the Academy work group focused on researching valuation interest rates for the following products:

- Single premium group annuities;
- Single premium immediate annuities;
- Structured settlements; and
- Deferred income annuities.

Note: The valuation interest rate methodology for other products, including fixed deferred annuities and fixed indexed annuities, may be examined at a later date.

Principles

The principles listed below were developed based upon input from stakeholders along with the experience and expertise of the work group members. In turn, these principles guided the work group's efforts in developing a new SPIA valuation rate framework:

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1. Valuation rates based on asset portfolios: The valuation rates should reflect the characteristics of the actual assets backing the liabilities with respect to credit quality, duration, and timing of asset purchases.
2. Prudent and transparent provisions for adverse deviation (PADs): Explicit PADs make it easier for regulators and others to quantify conservatism.
3. Equal treatment across companies: All companies should hold the same reserves for identical liabilities. In this way, no company will have an advantage over another company.
4. Avoidance of perverse incentives: The methodology should not incent companies to invest in a riskier fashion than they would otherwise in order to secure a more favorable valuation rate.
5. Consistency with other recent statutory frameworks: The methodology should be consistent with other frameworks, where appropriate. Inconsistent treatment could unfairly disadvantage a given product relative to another. In addition, employing an existing framework reduces duplication of efforts and eases implementation.
6. Daily valuation rate is ideal: Ignoring implementation costs, a valuation rate updated daily is the ideal, as this best reflects actual assets purchased to back the liability.
7. Optimal tradeoff of accuracy and effort: The methodology should balance precision and ease of implementation.

Recommendations

A. **Reference Index**—The work group considered many indices, including Moody's, Barclays, and Treasuries plus VM-20 spreads. Ultimately, Treasuries plus VM-20 spreads were chosen as the reference index as they are updated frequently and are the most granular with regards to duration and credit quality (Principle 1: Valuation rates based on asset portfolios) and are consistent with VM-20 (Principle 5: Consistency with other recent statutory frameworks). The VM-20 spreads are published quarterly by the NAIC.

Note: The work group recommends that valuation rates continue to be set and locked in at issue.

B. **Credit Quality**—The work group decided that the most appropriate approach is to base the valuation rate on the average credit quality of U.S. life insurers' public corporate bond holdings. This hypothetical portfolio should serve as a proxy for actual assets held by companies to back SPIA liabilities (Principle 1: Valuation rates based on asset portfolios). This approach also meets Principle 3 (equal treatment across companies) because all insurers will hold the same reserve for identical liabilities. Furthermore, because only bonds were considered, this methodology will provide an element of conservatism given that life insurer non-bond assets on average have a higher yield than bonds. Finally, use of the industry average rather than an individual company's credit quality distribution avoids the incentive for companies to invest in a riskier manner than they would otherwise in order to increase valuation rates (Principle 4: Avoidance of perverse incentives).

The work group recommends use of the average bond credit quality distribution data below as supplied by the NAIC to the Academy C1 Work Group:

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Rating Class		Industry Weight		Average
		12/31/2011	12/31/2013	
1	Aaa	4.04%	2.71%	3.38%
2	Aa1	2.23%	2.62%	2.42%
3	Aa2	4.21%	4.17%	4.19%
4	Aa3	6.12%	6.03%	6.07%
5	A1	8.23%	8.07%	8.15%
6	A2	13.66%	14.71%	14.19%
7	A3	15.29%	14.86%	15.08%
8	Baa1	15.39%	15.42%	15.40%
9	Baa2	17.06%	15.95%	16.51%
10	Baa3	7.63%	8.59%	8.11%
11	Ba1	1.88%	2.36%	2.12%
12	Ba2	1.35%	1.67%	1.51%
13	Ba3	1.12%	1.02%	1.07%
14	B1	0.61%	0.81%	0.71%
15	B2	0.46%	0.50%	0.48%
16	B3	0.40%	0.31%	0.36%
17	Caa1	0.18%	0.12%	0.15%
18	Caa2	0.11%	0.05%	0.08%
19	Caa3	0.01%	0.02%	0.02%

The work group recommends that the credit quality distribution assumption be revisited periodically to determine whether the composition of life insurance company bond portfolios has changed significantly.

C. **Provisions for Adverse Deviation**—In accordance with Principle 5 (consistency with other frameworks), the work group recommends use of the VM-20 baseline defaults. The work group is not recommending use of the "spread related factor," as it greatly complicates the methodology without significantly affecting the valuation rate (Principle 7: Optimal tradeoff of accuracy and effort). The work group is also not recommending inclusion of the "maximum net spread adjustment factor" in the VM-20 default cost factors methodology. This adjustment reduces asset spreads in excess of those of a benchmark portfolio in order to reduce the incentive for companies to invest in riskier assets than they would otherwise. Given that the work group recommends basing spreads on the average credit quality of life insurer bond portfolios, there is no such incentive because the assumed credit quality distribution is based on the industry average (Principle 4: Avoidance of perverse incentives).

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The VM-20 default factors represent a cumulative default probability consistent with a conditional tail expectation (CTE) 70 level and thus contain an element of conservatism (Principle 2: Prudent and transparent PADs).

The work group recommends assuming investment expenses of 10 basis points, the same "maximum net spread adjustment factor" as is prescribed in VM-20 Section 9.F.1.c.iii.4.

See Appendix A for sample calculations of provisions for adverse deviations.

D. **Valuation Rate Floor**—The work group is not recommending a floor because insurers would likely realize an economic cost in a negative-interest-rate environment. Companies would probably not be able to hold large amounts of physical cash, but rather would remain nearly fully invested. This approach is consistent with Principle 1: Valuation rates based on asset portfolios.

E. **Duration Buckets**—In order to match the duration of the assets backing the liabilities (Principle 1: Valuation rates based on asset portfolios), four groupings, A through D, are proposed. The groupings are based on contract and annuitant characteristics and are meant to be a proxy for duration. The advantages of this method over calculating the duration for each contract individually are that it is easier to both implement and audit while still being an improvement over the single rate used today.

For contracts without life contingencies, groupings are based upon the length of the period during which guaranteed benefit payments will be made:

A	<= 5 years
B	More than 5 years, up to 10 years
C	More than 10 years, up to 15 years
D	More than 15 years

Contracts with life contingencies would be mapped based on the length of any guaranteed certain period and issue age. For joint and survivor contracts, the recommendation is to use the issue age of the younger annuitant.

For single premium group annuities, the work group recommends using the average age and the average guaranteed certain period of the group for mapping purposes.

Duration Bucket Mapping				
	Guaranteed Certain Period (GCP)			
Issue Age	GCP ≤ 5 Y	5Y < GCP ≤ 10Y	10Y < GCP ≤ 15Y	GCP > 15 Y
91+	A	B	C	D
80 - 90	B	B	C	D
72 - 79	C	C	C	D
<72	D	D	D	D

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The age cutoff points were based on the IRS single lifetime table:

(Single Life Expectancy) (For Use by Beneficiaries)			
Age	Life Expectancy	Age	Life Expectancy
56	28.7	84	8.1
57	27.9	85	7.6
58	27	86	7.1
59	26.1	87	6.7
60	25.2	88	6.3
61	24.4	89	5.9
62	23.5	90	5.5
63	22.7	91	5.2
64	21.8	92	4.9
65	21	93	4.6
66	20.2	94	4.3
67	19.4	95	4.1
68	18.6	96	3.8
69	17.8	97	3.6
70	17	98	3.4
71	16.3	99	3.1
72	15.5	100	2.9
73	14.8	101	2.7
74	14.1	102	2.5
75	13.4	103	2.3
76	12.7	104	2.1
77	12.1	105	1.9
78	11.4	106	1.7
79	10.8	107	1.5
80	10.2	108	1.4
81	9.7	109	1.2
82	9.1	110	1.1
83	8.6	111 and over	1

Source: https://www.irs.gov/publications/p590b/

Although alternative sources of life expectancy were discussed, this source was chosen as it is gender-neutral, published, and currently in use.

The valuation interest rate calculated for each grouping would be based upon Treasury

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yields and VM-20 spreads with the following maturities:

A*	2.5 years
B**	7.5 years
C ***	12.5 years
D	20 years

*Average of 2-year and 3-year Treasuries and VM-20 Spreads
**Average of 7-year and 8-year Treasuries and VM-20 Spreads using linear interpolation between the 7-year and 10-year Treasuries to determine the 8-year Treasury rate
***Average of 12-year and 13-year VM-20 Spreads using linear interpolation between the 10-year and the 20-year Treasuries to determine the 12.5 year Treasury rate

F. **Frequency for Updating Valuation Rates**—Regarding frequency of updates, the work group recommends making a distinction between "jumbo" annuities and "non-jumbo" annuities. "Jumbo" annuities are defined as single premium group annuities with the following characteristics:

- Issued to a group/institution
- Greater than $100 million in initial reserve

Furthermore, the work group recommends consolidation of contracts issued to the same party within three months for the initial reserve test described above. The rationale for this is to avoid any incentive for an insurer to arbitrage the valuation rate by breaking up a transaction into smaller pieces. For a "jumbo" annuity issued on multiple dates, each premium would be assigned the appropriate daily valuation rate based on date of receipt.

By definition, then, non-jumbo annuities are all annuities in scope not categorized as jumbo annuities.

1. **For "non-jumbo" annuities, the work group recommends that valuation rates be updated quarterly using the average index rate over the quarter of issue.**

Assuming a daily valuation rate (Principle 6: Daily valuation rate is ideal), the proposed approach greatly improves accuracy relative to the current approach. Accuracy is measured by absolute error, which is defined as the absolute value of the difference between the actual historical daily rate and the average rate over each of the three periods described below. Three absolute error metrics were calculated using historical data: maximum absolute error, 80^{th} percentile absolute error (80 percent of absolute errors are smaller than this number), and average absolute error. The three metrics were calculated for:

- The time period for the current method (for example, 7/1/14–6/30/15 for 2015 issues)
- One-quarter average with a one-quarter lag (for example Jan/Feb/Mar for Q2)
- One-quarter average with no lag (for example, Jan/Feb/Mar for Q1)

As can be seen below, all three metrics are minimized by using the one-quarter average with

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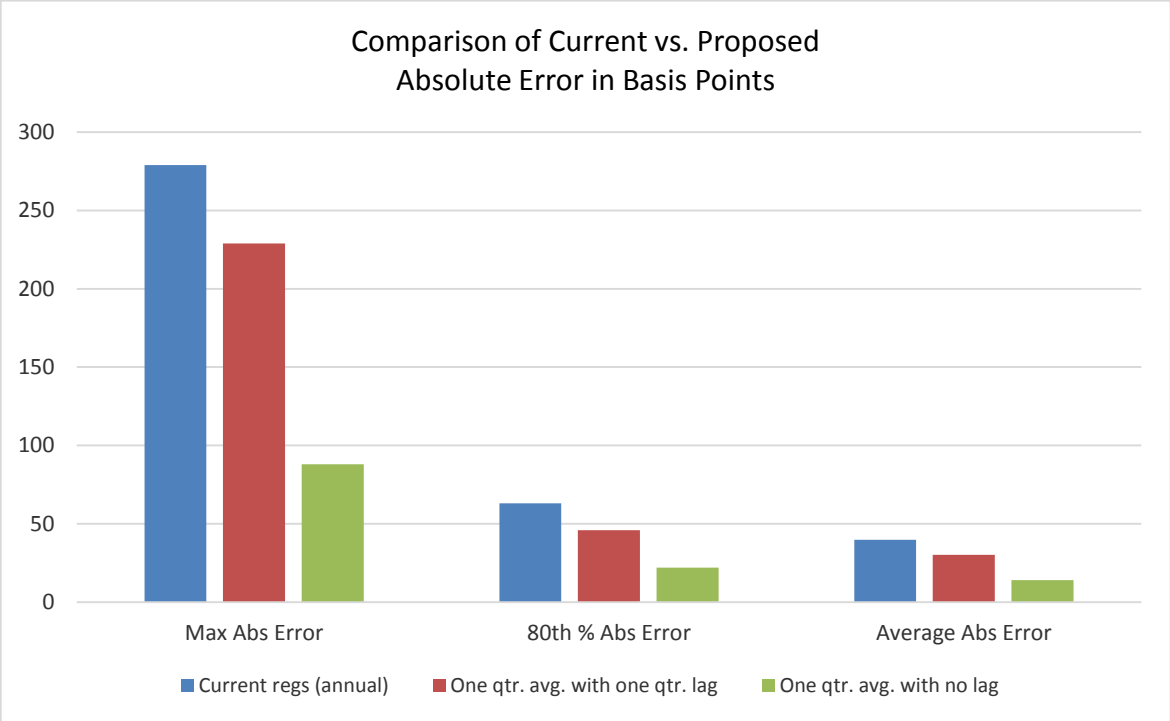
no lag.



Index Moody's Seasoned Baa Corporate Bond Yield© (from St. Louis Fed website)
Date Range: 1987-01-02 to 2015-07-02
Daily Rates rounded to the nearest basis points, current (annual) and quarterly rates rounded to the nearest 25 basis points
Compiled by SVL Interest Rate Modernization Work Group from aforementioned sources

This approach balances precision and simplicity (Principle 7: Optimal tradeoff of accuracy and effort) in addition to being consistent with VM-20 since VM-20 spreads represent the average spread over the prior quarter (Principle 5: Consistency with other recent statutory frameworks). Note: Treasuries should be averaged over the prior quarter as well. A potential disadvantage is that the valuation rate would not be known in advance for pricing purposes (although the valuation rate is also not known with certainty under the current methodology during the first six calendar months of a year). Note: If this consideration is deemed to be of significant importance, adoption of quarterly updates with a one-quarter lag would still result in a substantial improvement in accuracy relative to the current methodology.

2. For "jumbo" annuities, the work group recommends that valuation rates be updated on a daily basis and that rates not be rounded.

Although updating valuation rates on a daily basis is ideal (Principle 6: Daily valuation rate is ideal), it also introduces additional complexity. The work group deemed the additional burden to be warranted given that a small difference in the valuation interest rate can make a material difference in reserves (Principle 7: Optimal tradeoff of accuracy and effort). For example, a 10-basis-point difference for $1 billion in liabilities with a duration of 10 years results in a reserve change of $10 million. In addition, because jumbo transactions are

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relatively rare, very few contracts should be affected.

Logistical Issues with Daily Rates

Currently, the NAIC only calculates VM-20 spreads on a quarterly basis. This obviously presents problems for updating the valuation rate on a daily basis.

Accordingly, the work group recommends that the daily rate during the quarter be calculated as follows:

> Daily Valuation Rate = prior quarter end valuation rate by duration bucket(unrounded) + change in Bank of America U.S. corporate effective yields by term to maturity*
>
> *From St. Louis Federal Reserve website (https://research.stlouisfed.org/fred2/categories/32347)
> Note: Another suitable index could be used as well.
>
> See Appendix B for a detailed sample calculation.

G. **Multiple Premiums**—The work group recommends using the quarterly valuation rate based on when each premium is received for "non-jumbo" annuities. For "jumbo" annuities, including annuities designated as "jumbo" through consolidation of contracts issued to the same entity within three months, the work group recommends using the daily rate corresponding to when each premium was received (Principle 1: Valuation rates based on asset portfolios).

H. **Rounding**—The work group recommends continuing to round the nearest 25 basis points for "non-jumbo" annuities. For "jumbo" annuities, the work group recommends rounding to the nearest basis point because, as noted earlier, a small change in the valuation rate can result in a material change in the reserve for large cases. These recommendations are in line with Principle 7: Optimal tradeoff of accuracy and effort.

Analysis

Below is a chart comparing the current methodology with the proposed methodology for non-jumbo annuities:

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Proposed Methodology vs. Current for Non-Jumbo Annuities									
		Proposed Methodology WAL**				Differences (Proposed - Current) WAL**			
Quarter	Current*	1-5	5-10	10-15	15+	1-5	5-10	10-15	15+
2014-4	4.50%	1.50%	3.00%	3.50%	3.75%	-3.00%	-1.50%	-1.00%	-0.75%
2015-1	4.00%	1.50%	2.75%	3.25%	3.75%	-2.50%	-1.25%	-0.75%	-0.25%
2015-2	4.00%	1.50%	3.00%	3.50%	4.25%	-2.50%	-1.00%	-0.50%	0.25%
2015-3	4.00%	1.75%	3.00%	3.75%	4.25%	-2.25%	-1.00%	-0.25%	0.25%

*Source: Towers Watson "Prescribed U.S. Statutory and Tax Interest Rates for the Valuation of Life Insurance and Annuity Products," October 2015
**WAL = Weighted Average Life

Note: See Appendix C for a sample calculation of a proposed valuation rate.

From the above, it is clear that proposed valuation rates for shorter-duration contracts are significantly lower than the rates under the current methodology for these historical periods. The primary reason for this is that the current Moody's reference rate index is comprised of 20- to 30-year bonds. Thus, given an upward sloping yield curve, it is to be expected that valuation rates based on shorter durations would be lower than those based on longer durations.

Below is an attribution that steps through changes to move from the current methodology to the proposed methodology for the Q4 2014 '15+ Year' Duration Bucket valuation rate:

Attribution of Changes between Current Method and Proposed Method for Q4 2014 Rate		
Current	$I_c = 3\% + (.8) \times (R_1 - 3\%)$	R_1 = Moody's Long Term Corporate Bond Index*
Proposed	$I_p = R_2$ - Margins	R_2 = VM-20 Spreads (plus Treasuries)

Current Q4 2014 Valuation Rate	**4.5%**

Step	Change	Notes
Undo Rounding	-0.08%	On average, expected impact of zero
Move to Current Quarter	-0.44%	Impact may be positive or negative
New Reference Index	0.12%	Moving from Moody's to Treasuries + VM-20 spreads
Change Margins	-0.34%	Use VM-20 defaults and investment expenses
Final Rate with Rounding	-0.01%	3.75% is proposed rate for 15+ year duration bucket
	-0.75%	

*Used 60/40 blend of Moody's AAA and BBB, respectively, as a proxy for Moody's index used by NAIC from St. Louis federal reserve website

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From the above, it appears that the proposed method contains greater provisions for adverse deviation than the current method.
It is important to note that the illustration above tracks the differences between the current valuation rate and the proposed rate only for the >15 Year duration bucket. Proposed valuation rates for shorter-duration contracts are lower than the 3.75 percent rate illustrated above.

In order to compare the current and proposed methodologies for additional historical periods, it is necessary to have a proxy for the VM-20 spreads because these spreads are only available going back to the fourth quarter of 2014. Using the Bank of America yields from the St. Louis Federal Reserve website as a proxy, actual historical valuation rates are compared with valuation rates calculated under the proposed method back to the first quarter of 1997 (see Appendix D). This proxy allows for comparison during periods of relatively high rates, relatively low rates and inverted yield curves.

Similar to the most recent periods, the proposed rates for shorter-duration contracts are lower for most quarters going back to 1997. Only during the financial crises of 2000-2001 and 2008-2009 are proposed valuation rates higher at all durations than the actual historical rate.

Conclusion

While the proposed methodology presents some implementation challenges, it also satisfies the principles established by the work group:

- The proposed valuation rates reflect the characteristics of the credit quality, duration, and time of assets purchased by the average life insurance company to back SPIA liabilities (Principle 1).
- The provisions for adverse deviation; i.e., default cost assumptions and investment expenses, are transparent. The default cost assumption is consistent with a CTE 70 level and thus provides an element of prudence (Principle 2).
- By using the average credit quality distribution of life insurer bond portfolios in determining the valuation rate, all companies will use the same valuation rate and will not have an incentive to invest in a riskier manner than they would otherwise (Principles 3 and 4).
- The reference rate index, quarterly updates, and provisions for adverse deviation are consistent with VM-20 (Principle 5).
- The work group recommends daily rates for "jumbo" annuities (Principle 6) and quarterly rates with no lag for non-jumbo annuities. Quarterly rates with no lag greatly improve precision relative to the current method and should be relatively easy to implement (Principle 7).

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Appendix A
Sample Calculations of Provisions for Adverse Deviation

PBR credit rating	Moody's	Credit Quality Distribution	Proposed Baseline Annual Default Costs (in bps) Using Moody's Data as of December 2014 1970-2014 raw data									
			WAL									
			1	2	3	4	5	6	7	8	8	10
1	Aaa	3.4%	0.02	0.02	0.05	0.08	0.11	0.12	0.13	0.15	0.16	0.17
2	Aa1	2.4%	0.13	0.36	0.66	0.99	1.14	1.29	1.40	1.51	1.62	1.74
3	Aa2	4.2%	0.31	0.96	1.72	2.22	2.49	2.72	2.88	3.04	3.24	3.48
4	Aa3	6.1%	0.67	2.28	3.91	4.77	5.21	5.61	5.89	6.13	6.48	6.97
5	A1	8.2%	1.30	4.44	7.76	8.94	9.59	10.14	10.56	10.86	11.40	12.25
6	A2	14.2%	2.44	8.41	14.74	16.34	17.20	17.97	18.55	18.84	19.65	21.14
7	A3	15.1%	4.89	11.03	17.12	19.44	21.11	21.83	22.94	23.62	24.65	26.31
8	Baa1	15.4%	11.31	20.61	26.68	29.95	31.92	33.03	34.72	36.06	37.13	38.36
9	Baa2	16.5%	22.25	36.07	41.27	45.26	47.99	49.78	52.61	54.87	55.82	55.97
10	Baa3	8.1%	57.17	84.10	89.06	94.40	97.80	99.06	100.45	102.01	102.62	101.71
11	Ba1	2.1%	102.06	138.44	146.15	153.95	159.48	156.91	154.86	154.15	153.50	151.93
12	Ba2	1.5%	161.20	210.26	226.16	239.13	247.83	237.96	228.20	221.98	219.20	216.67
13	Ba3	1.1%	226.34	265.80	284.74	302.71	323.26	310.19	298.46	291.66	287.48	285.62
14	B1	0.7%	376.96	408.50	427.77	441.27	456.39	429.01	409.14	394.94	385.77	380.68
15	B2	0.5%	470.72	468.91	479.56	485.65	498.49	466.35	441.29	421.79	409.08	399.85
16	B3	0.4%	763.94	677.89	666.64	670.29	687.02	638.71	611.56	593.13	577.21	567.42
17	Caa1	0.2%	984.17	810.67	782.19	788.37	817.60	766.71	741.56	730.63	727.58	735.32
18	Caa2	0.1%	1127.78	864.95	819.53	813.84	844.70	801.62	780.85	776.11	785.17	806.41
19	Caa3	0.0%	2211.76	1608.35	1441.08	1394.89	1424.35	1332.79	1283.03	1264.73	1276.08	1321.70
20	Ca	0.0%	6993.14	6993.14	6993.14	6993.14	6993.14	6993.14	6993.14	6993.14	6993.14	6993.14

	Credit Quality Distribution x Proposed Baseline Default Costs									
	WAL									
	1	2	3	4	5	6	7	8	8	10
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01
	0.00	0.01	0.02	0.02	0.03	0.03	0.03	0.04	0.04	0.04
	0.01	0.04	0.07	0.09	0.10	0.11	0.12	0.13	0.14	0.15
	0.04	0.14	0.24	0.29	0.32	0.34	0.36	0.37	0.39	0.42
	0.11	0.36	0.63	0.73	0.78	0.83	0.86	0.88	0.93	1.00
	0.35	1.19	2.09	2.32	2.44	2.55	2.63	2.67	2.79	3.00
	0.74	1.66	2.58	2.93	3.18	3.29	3.46	3.56	3.72	3.97
	1.74	3.17	4.11	4.61	4.92	5.09	5.35	5.55	5.72	5.91
	3.67	5.96	6.81	7.47	7.92	8.22	8.69	9.06	9.22	9.24
	4.64	6.82	7.22	7.66	7.93	8.03	8.15	8.27	8.32	8.25
	2.16	2.93	3.10	3.26	3.38	3.33	3.28	3.27	3.25	3.22
	2.43	3.17	3.42	3.61	3.74	3.59	3.45	3.35	3.31	3.27
	2.42	2.84	3.05	3.24	3.46	3.32	3.19	3.12	3.08	3.06
	2.68	2.90	3.04	3.13	3.24	3.05	2.90	2.80	2.74	2.70
	2.26	2.25	2.30	2.33	2.39	2.24	2.12	2.02	1.96	1.92
	2.75	2.44	2.40	2.41	2.47	2.30	2.20	2.14	2.08	2.04
	1.48	1.22	1.17	1.18	1.23	1.15	1.11	1.10	1.09	1.10
	0.90	0.69	0.66	0.65	0.68	0.64	0.62	0.62	0.63	0.65
	0.44	0.32	0.29	0.28	0.28	0.27	0.26	0.25	0.26	0.26
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wtd. Avg. Default Costs (bps)	**28.82**	**38.13**	**43.19**	**46.23**	**48.50**	**48.38**	**48.79**	**49.22**	**49.66**	**50.21**
Investment Expenses (bps)	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**
TOTAL PADs (bps)	**38.82**	**48.13**	**53.19**	**56.23**	**58.50**	**58.38**	**58.79**	**59.22**	**59.66**	**60.21**

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Appendix B
Illustrative Calculations of Daily 'Jumbo' Annuity Valuation Rates for Various Duration Buckets as of a Sample Date (2/20/15)

	WAL				
	Date	**1 - 5****	**5 - 10*****	**10 - 15**	**15+**
Proposed Method (unrounded)	12/31/14	1.53%	2.94%	3.38%	3.76%
B of A Yields*	12/31/14	2.06%	3.47%	4.09%	4.51%
	2/20/15	1.98%	3.34%	3.99%	4.49%
	Change	-0.09%	-0.13%	-0.10%	-0.02%
Jumbo Daily Rate	**2/20/15**	**1.44%**	**2.81%**	**3.28%**	**3.74%**

*Source: St. Louis Federal Reserve website https://research.stlouisfed.org/fred2/categories/32347
**Average of 1Y-3Y and 3Y-5Y Bank of America US Corporate Effective Yields
***Average of 5Y-7Y and 7Y-10Y Bank of America US Corporate Effective Yields

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Appendix C
Details of Calculation of Q4 2014 Valuation Rate Under Proposed Method (1.50%)

Treasuries		VM-20 Spreads				Interest Rates (Treasuries + Spreads)		Assumed Credit Quality Distribution	Rates x Credit Quality Distribution	
2Y	3Y	Rating		2Y	3Y	2Y	3Y		2Y	3Y
0.69%	1.13%	1	Aaa	0.23%	0.31%	0.92%	1.43%	3.4%	0.03%	0.05%
0.69%	1.13%	2	Aa1	0.32%	0.40%	1.01%	1.52%	2.4%	0.02%	0.04%
0.69%	1.13%	3	Aa2	0.40%	0.49%	1.09%	1.61%	4.2%	0.05%	0.07%
0.69%	1.13%	4	Aa3	0.47%	0.55%	1.16%	1.68%	6.1%	0.07%	0.10%
0.69%	1.13%	5	A1	0.53%	0.62%	1.23%	1.74%	8.2%	0.10%	0.14%
0.69%	1.13%	6	A2	0.60%	0.68%	1.29%	1.81%	14.2%	0.18%	0.26%
0.69%	1.13%	7	A3	0.80%	0.90%	1.49%	2.03%	15.1%	0.23%	0.31%
0.69%	1.13%	8	Baa1	1.01%	1.12%	1.70%	2.25%	15.4%	0.26%	0.35%
0.69%	1.13%	9	Baa2	1.21%	1.34%	1.90%	2.47%	16.5%	0.31%	0.41%
0.69%	1.13%	10	Baa3	1.98%	2.05%	2.68%	3.18%	8.1%	0.22%	0.26%
0.69%	1.13%	11	Ba1	2.76%	2.76%	3.45%	3.88%	2.1%	0.07%	0.08%
0.69%	1.13%	12	Ba2	3.34%	3.34%	4.04%	4.47%	1.5%	0.06%	0.07%
0.69%	1.13%	13	Ba3	3.93%	3.93%	4.62%	5.06%	1.1%	0.05%	0.05%
0.69%	1.13%	14	B1	4.52%	4.52%	5.21%	5.64%	0.7%	0.04%	0.04%
0.69%	1.13%	15	B2	5.10%	5.10%	5.79%	6.23%	0.5%	0.03%	0.03%
0.69%	1.13%	16	B3	6.37%	6.37%	7.06%	7.49%	0.4%	0.03%	0.03%
0.69%	1.13%	17	Caa1	7.64%	7.64%	8.33%	8.76%	0.2%	0.01%	0.01%
0.69%	1.13%	18	Caa2	8.90%	8.90%	9.59%	10.03%	0.1%	0.01%	0.01%
0.69%	1.13%	19	Caa3	10.17%	10.17%	10.86%	11.29%	0.0%	0.00%	0.00%
0.69%	1.13%	20	Ca	11.43%	11.43%	12.13%	12.56%	0.0%	0.00%	0.00%
						Weighted Average=			**1.77%**	**2.29%**
						PADs			**0.48%**	**0.53%**
						Net			**1.29%**	**1.76%**
						Rounded Average of 2Y and 3Y =				**1.50%**

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Appendix D

Proposed Methodology vs. Current for Non-Jumbo Annuities Note: Used Bank of America Yields since VM-20 spreads only available back to Q4 2014									
Current Actual	Quarter	Proposed Method Duration Bucket				Differences			
		1-5	5-10	10-15	15+	1-5	5-10	10-15	15+
6.75%	1997-1	6.00%	6.25%	6.50%	6.75%	-0.75%	-0.50%	-0.25%	0.00%
6.75%	1997-2	6.25%	6.50%	6.75%	6.75%	-0.50%	-0.25%	0.00%	0.00%
6.75%	1997-3	6.00%	6.00%	6.25%	6.25%	-0.75%	-0.75%	-0.50%	-0.50%
6.75%	1997-4	5.75%	6.00%	6.00%	6.00%	-1.00%	-0.75%	-0.75%	-0.75%
6.25%	1998-1	5.50%	5.75%	5.75%	6.00%	-0.75%	-0.50%	-0.50%	-0.25%
6.25%	1998-2	5.75%	5.75%	5.75%	6.00%	-0.50%	-0.50%	-0.50%	-0.25%
6.25%	1998-3	5.50%	5.50%	5.75%	5.75%	-0.75%	-0.75%	-0.50%	-0.50%
6.25%	1998-4	5.25%	5.25%	5.50%	5.75%	-1.00%	-1.00%	-0.75%	-0.50%
6.25%	1999-1	5.50%	5.50%	5.75%	5.75%	-0.75%	-0.75%	-0.50%	-0.50%
6.25%	1999-2	5.75%	6.00%	6.25%	6.25%	-0.50%	-0.25%	0.00%	0.00%
6.25%	1999-3	6.25%	6.50%	6.75%	6.75%	0.00%	0.25%	0.50%	0.50%
6.25%	1999-4	6.50%	6.75%	7.00%	7.00%	0.25%	0.50%	0.75%	0.75%
7.00%	2000-1	7.00%	7.25%	7.25%	7.25%	0.00%	0.25%	0.25%	0.25%
7.00%	2000-2	7.25%	7.50%	7.50%	7.50%	0.25%	0.50%	0.50%	0.50%
7.00%	2000-3	7.00%	7.25%	7.25%	7.25%	0.00%	0.25%	0.25%	0.25%
7.00%	2000-4	6.75%	6.75%	7.00%	7.00%	-0.25%	-0.25%	0.00%	0.00%
6.75%	2001-1	5.75%	6.00%	6.25%	6.50%	-1.00%	-0.75%	-0.50%	-0.25%
6.75%	2001-2	5.25%	6.00%	6.25%	6.50%	-1.50%	-0.75%	-0.50%	-0.25%
6.75%	2001-3	4.75%	5.50%	6.00%	6.25%	-2.00%	-1.25%	-0.75%	-0.50%
6.75%	2001-4	4.25%	5.25%	5.75%	6.25%	-2.50%	-1.50%	-1.00%	-0.50%
6.50%	2002-1	4.75%	5.50%	6.00%	6.50%	-1.75%	-1.00%	-0.50%	0.00%
6.50%	2002-2	4.75%	5.50%	6.00%	6.50%	-1.75%	-1.00%	-0.50%	0.00%
6.50%	2002-3	4.25%	5.00%	5.50%	6.00%	-2.25%	-1.50%	-1.00%	-0.50%
6.50%	2002-4	4.00%	4.50%	5.25%	5.75%	-2.50%	-2.00%	-1.25%	-0.75%
6.00%	2003-1	3.00%	4.00%	4.75%	5.00%	-3.00%	-2.00%	-1.25%	-1.00%
6.00%	2003-2	2.50%	3.25%	4.00%	4.50%	-3.50%	-2.75%	-2.00%	-1.50%
6.00%	2003-3	2.50%	3.50%	4.25%	4.75%	-3.50%	-2.50%	-1.75%	-1.25%
6.00%	2003-4	2.50%	3.50%	4.25%	4.75%	-3.50%	-2.50%	-1.75%	-1.25%
5.50%	2004-1	2.25%	3.25%	4.00%	4.50%	-3.25%	-2.25%	-1.50%	-1.00%
5.50%	2004-2	3.00%	4.00%	4.75%	5.00%	-2.50%	-1.50%	-0.75%	-0.50%
5.50%	2004-3	3.00%	3.75%	4.25%	4.75%	-2.50%	-1.75%	-1.25%	-0.75%
5.50%	2004-4	3.25%	3.75%	4.25%	4.50%	-2.25%	-1.75%	-1.25%	-1.00%
5.25%	2005-1	3.75%	4.00%	4.25%	4.50%	-1.50%	-1.25%	-1.00%	-0.75%
5.25%	2005-2	4.00%	4.25%	4.50%	4.75%	-1.25%	-1.00%	-0.75%	-0.50%
5.25%	2005-3	4.00%	4.25%	4.50%	4.75%	-1.25%	-1.00%	-0.75%	-0.50%

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Appendix D

(Continued)

5.25%	2005-4	4.50%	4.75%	4.75%	5.00%	-0.75%	-0.50%	-0.50%	-0.25%
5.25%	2006-1	4.75%	4.75%	5.00%	5.00%	-0.50%	-0.50%	-0.25%	-0.25%
5.25%	2006-2	5.25%	5.25%	5.50%	5.50%	0.00%	0.00%	0.25%	0.25%
5.25%	2006-3	5.00%	5.25%	5.25%	5.50%	-0.25%	0.00%	0.00%	0.25%
5.25%	2006-4	4.75%	4.75%	5.00%	5.25%	-0.50%	-0.50%	-0.25%	0.00%
5.50%	2007-1	4.75%	4.75%	5.00%	5.25%	-0.75%	-0.75%	-0.50%	-0.25%
5.50%	2007-2	5.00%	5.00%	5.25%	5.50%	-0.50%	-0.50%	-0.25%	0.00%
5.50%	2007-3	5.00%	5.25%	5.50%	5.50%	-0.50%	-0.25%	0.00%	0.00%
5.50%	2007-4	4.75%	5.00%	5.25%	5.50%	-0.75%	-0.50%	-0.25%	0.00%
5.50%	2008-1	4.25%	4.75%	5.25%	5.50%	-1.25%	-0.75%	-0.25%	0.00%
5.50%	2008-2	4.75%	5.25%	5.75%	6.00%	-0.75%	-0.25%	0.25%	0.50%
5.50%	2008-3	5.50%	5.75%	6.25%	6.50%	0.00%	0.25%	0.75%	1.00%
5.50%	2008-4	7.75%	7.75%	8.25%	8.25%	2.25%	2.25%	2.75%	2.75%
6.00%	2009-1	7.00%	7.00%	7.50%	7.50%	1.00%	1.00%	1.50%	1.50%
6.00%	2009-2	5.75%	6.00%	6.75%	7.00%	-0.25%	0.00%	0.75%	1.00%
6.00%	2009-3	3.75%	4.50%	5.25%	5.75%	-2.25%	-1.50%	-0.75%	-0.25%
6.00%	20094	3.00%	3.75%	4.50%	5.00%	-3.00%	-2.25%	-1.50%	-1.00%
5.25%	2010-1	2.50%	3.50%	4.50%	5.00%	-2.75%	-1.75%	-0.75%	-0.25%
5.25%	2010-2	2.50%	3.50%	4.25%	4.75%	-2.75%	-1.75%	-1.00%	-0.50%
5.25%	2010-3	2.00%	3.00%	3.75%	4.25%	-3.25%	-2.25%	-1.50%	-1.00%
5.25%	2010-4	1.75%	2.75%	3.50%	4.00%	-3.50%	-2.50%	-1.75%	-1.25%
5.00%	2011-1	2.00%	3.00%	4.00%	4.50%	-3.00%	-2.00%	-1.00%	-0.50%
5.00%	2011-2	1.75%	2.75%	3.75%	4.25%	-3.25%	-2.25%	-1.25%	-0.75%
5.00%	2011-3	1.75%	2.75%	3.50%	4.00%	-3.25%	-2.25%	-1.50%	-1.00%
5.00%	2011-4	2.25%	3.25%	3.75%	4.00%	-2.75%	-1.75%	-1.25%	-1.00%
4.25%	2012-1	1.75%	2.50%	3.25%	3.75%	-2.50%	-1.75%	-1.00%	-0.50%
4.25%	2012-2	1.75%	2.25%	3.00%	3.50%	-2.50%	-2.00%	-1.25%	-0.75%
4.25%	2012-3	1.25%	2.00%	2.50%	3.25%	-3.00%	-2.25%	-1.75%	-1.00%
4.25%	2012-4	1.00%	1.50%	2.25%	2.75%	-3.25%	-2.75%	-2.00%	-1.50%
4.00%	2013-1	1.00%	1.50%	2.25%	3.00%	-3.00%	-2.50%	-1.75%	-1.00%
4.00%	2013-2	1.00%	1.75%	2.50%	3.25%	-3.00%	-2.25%	-1.50%	-0.75%
4.00%	2013-3	1.50%	2.25%	3.25%	4.00%	-2.50%	-1.75%	-0.75%	0.00%
4.00%	2013-4	1.25%	2.25%	3.00%	3.75%	-2.75%	-1.75%	-1.00%	-0.25%
4.50%	2014-1	1.00%	2.00%	3.00%	3.75%	-3.50%	-2.50%	-1.50%	-0.75%
4.50%	2014-2	1.00%	2.00%	2.75%	3.50%	-3.50%	-2.50%	-1.75%	-1.00%
4.50%	2014-3	1.25%	2.00%	2.75%	3.25%	-3.25%	-2.50%	-1.75%	-1.25%
4.50%	2014-4	1.25%	2.25%	2.75%	3.25%	-3.25%	-2.25%	-1.75%	-1.25%
4.00%	2015-1	1.50%	2.00%	2.75%	3.00%	-2.50%	-2.00%	-1.25%	-1.00%
4.00%	2015-2	1.25%	2.00%	2.75%	3.25%	-2.75%	-2.00%	-1.25%	-0.75%
4.00%	2015-3	1.50%	2.25%	3.00%	3.50%	-2.50%	-1.75%	-1.00%	-0.50%

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