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VM-20 Scenarios: An Observation

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Cash flow models have burst on the scene front and center. Models underpin solvency assessments for the major superpowers. These include China Risk Oriented Solvency System (C-ROSS), the EU's Solvency II Directive and Own Risk and Solvency Assessment (ORSA).

In the United States, the National Association of Insurance Commissioners (NAIC) Valuation Manual (VM),[1] including VM-20, has finally arrived in statutory financial reporting.[2] VM-20 is based on three reserves: one formulaic and two modeled reserves—a deterministic reserve based on a single scenario and a stochastic reserve based on stochastic scenarios.

VM-20 prescribes the economic scenario generator. The purpose of this article is not to peer into the black box and see how the innards of that generator works. Rather it's simply to look at some generator output and make an observation pertaining to VM-20. For information on generators in general, the reader is referred to Society of Actuaries' 2016 research paper *Economic Scenario Generators—A Practical Guide*.[3]

There are two primary inputs into the American Academy of Actuaries/SOA generator[4]—the yield curve and the mean reversion parameter as of the valuation date. Additional inputs include the length of the projection period, the number of scenarios (choices are 50, 200, 500, 1,000 and 10,000), and monthly/quarterly/annual rates. Technically, the mean reversion parameter is not an input but is based on historical rates calculated as follows:

- 20 percent of the median 20-year Treasury bond rate over the last 600 months
- + 30 percent of the average 20-year Treasury bond rate over the last 120 months
- + 50 percent of the average 20-year Treasury bond rate over the last 36 months

The parameter is heavily weighted to reflect recent experience.

The VM-20 stochastic reserve is based on a Greatest Present Value of Accumulated Deficiencies methodology, or GPVAD. The discount rates equal the path of 105 percent of one-year

Treasury rates. The scenario reserve equals GPVAD plus the sum of the starting asset values. The stochastic reserve is conditional tail expectation (CTE) 70 of the scenario reserves, that is, the average of the highest 30 percent scenario reserves. Thus, the one-year rates across the scenario are of particular interest.

What do our scenario discount factors look like? That is, what is the present value of 1 in year 10, 20, 30, 40 … until there is an immaterial amount of business still in force? How do these factors compare to factors using constant discount rates of 2 percent/3 percent/4 percent/5 percent? We consider projecting the stochastic reserve as of Dec. 31, 2015, at two points in time—Dec. 31, 2016, and Dec. 31, 2024. We assume inter-

Table 1
Dec. 31, 2016, Discount Factors

Policy Year	Percentile						
	5	10	15	20	25	30	35
10	86	84	87	90	84	88	82
20	71	74	66	75	66	68	62
30	57	62	52	57	51	51	46
40	49	54	45	48	41	41	35
50	42	42	37	37	31	34	28
60	34	31	29	27	26	25	24
70	29	20	22	19	20	17	18
80	22	15	16	16	16	12	13
90	18	11	13	13	12	9	9
100	11	8	8	10	9	5	7

Table 2
Dec. 31, 2024, Discount Factors

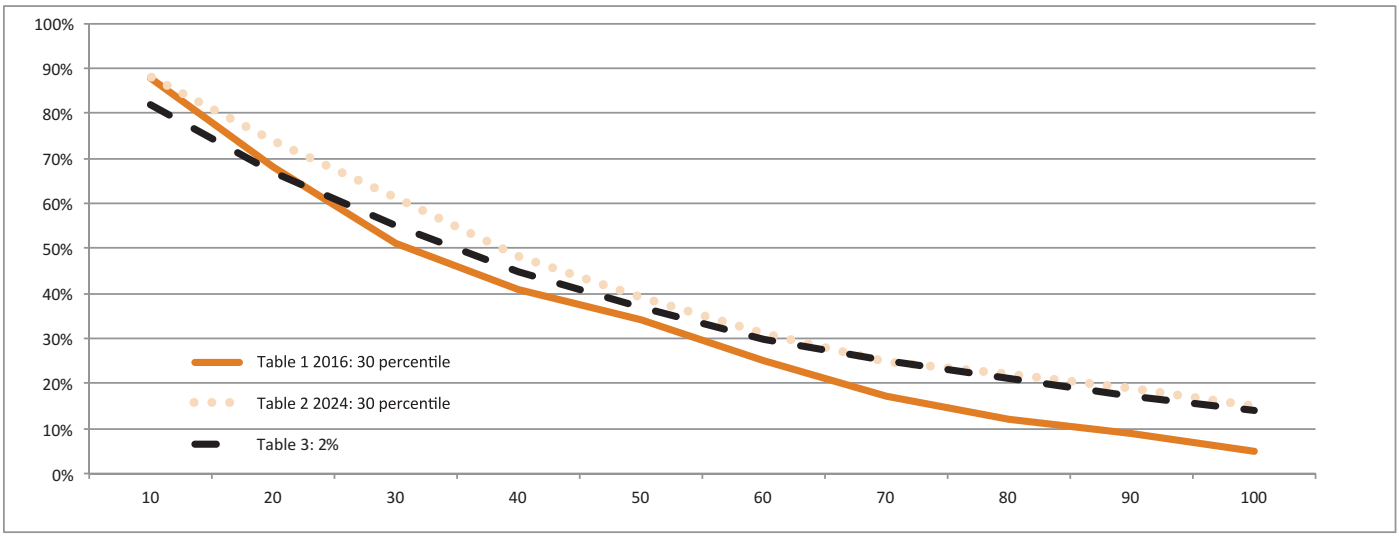
Policy Year	Percentile						
	5	10	15	20	25	30	35
10	87	86	88	88	85	88	88
20	71	66	79	69	74	74	73
30	60	51	67	58	67	61	56
40	53	46	54	48	60	48	47
50	45	44	43	42	48	39	36
60	41	38	35	33	32	31	30
70	35	31	26	29	24	25	26
80	30	24	23	25	20	22	23
90	25	16	19	19	17	19	21
100	20	13	17	14	14	15	18

est rates stay level during the entire projection (i.e., the outer loop). The yield curves are the same at both projection dates; however, the mean reversion parameter is 3.75 percent in 2016 and 3.25 percent in 2024.

For universal life with lifetime secondary guarantees (ULSG), high factors due to low rates exert pressure toward higher reserves. It is not necessarily the case that the highest discount factors correspond one-to-one with the highest reserve scenarios. VM-20 includes a guidance note to use "Lapse Experience Under Term-to-100 Insurance Policies" published by the Canadian Institute of Actuaries in October 2007[5] as the industry table for UL lapse rates[6]—these surrender rates are about 0.3 percent in years 15 and later. Thus, ULSG surrender rates will be zero or near zero after policy years 10 or 20. The higher the discount factor, the higher the present value of death benefits in the later policy years. Tables 1 and 2 present the discount factors corresponding to the lowest one-year rate scenarios based on policy year 60 discount factors.

With a constant 4 percent discount rate, a $1 benefit in policy year 40 is worth $0.21 today but worth $0.41 and $0.48 using 2016 and 2024 VM-20 discounts at the 30 percentile. (See Table 3.) With a constant 5 percent discount rate, a $1 benefit in policy year 50 is worth $0.09 today but worth $0.28 and $0.36 using 2016 and 2024 VM-20 discounts at the 30 percentile.

Figure 1
Discount Factor Comparison (by Policy Year)



As shown in Figure 1, in comparing the Table 1 factors to the Table 3 factors, we see that the 30 percentile lowest rate scenario approximates a 2 percent discount rate—initially VM-20 discount factors are slightly higher, then slightly lower. Table 2 factors are several percent greater than the Table 1 factors.

I will let the reader ponder these numbers further, but the observation is that long-tailed benefits can have high present values. It should be no surprise that low interest rates exert pressure to increase reserves, but the tables present the cold, hard facts. ■

Table 3
Discount Factors Using Constant Discount Rates

Policy Year	Percentile			
	2	3	4	5
10	82	74	68	61
20	67	55	46	38
30	55	41	31	23
40	45	31	21	14
50	37	23	14	9
60	30	17	10	5
70	25	13	6	3
80	21	9	4	2
90	17	7	3	1
100	14	5	2	1

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ENDNOTES

1 National Association of Insurance Commissioners, Valuation Manual (April 2016), *http://www.naic.org/documents/committees_a_latf_related_valuation_manual_apf_adopted_by_a_cmte.pdf.*

2 The VM operative date is Jan. 1, 2017.

3 Hal Pedersen, Mary Pat Campbell, Stephan L. Christiansen, Samuel H. Cox, Daniel Finn, Ken Griffin, Nigel Hooker, Matthew Lightwood, Stephen M. Sonlin and Chris Suchar, *Economic Scenario Generators—A Practical Guide* (Society of Actuaries and Conning Inc., 2016), *https://www.soa.org/Research/Research-Projects/Finance-Investment/2016-economic-scenario-generators.aspx.*

4 American Academy of Actuaries and Society of Actuaries, "Economic Scenario Generators" (2016), *https://www.soa.org/research/software-tools/research-scenario.aspx.*

5 Canadian Institute of Actuaries, Research Committee, Individual Life Subcommittee, "Lapse Experience Under Term-to-100 Insurance Policies" (Report, Document 207085, October 2007), *https://www.cia-ica.ca/docs/default-source/2007/207085e.pdf?sfvrsn=0.*

6 The Valuation Manual will no doubt be revised to refer to the later version of this study published in 2015.