

# Impact of VM-20 on Life Insurance Product Development—Phase 2





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## Section 1: Background

The new principle-based framework for U.S. statutory reserves as defined in Chapter 20 of the National Association of Insurance Commissioners (NAIC) Valuation Manual (VM-20) may be used for life products issued starting in 2017. While there have been research and educational materials produced to help actuaries and others better understand the implications and implementation of the new requirements from a valuation perspective, little has been developed emphasizing the product development actuary's perspective.

The Society of Actuaries' (SOA) Product Development Section, Smaller Insurance Company Section, Reinsurance Section and the Committee on Life Insurance Research engaged Milliman to examine the impact of the new reserve standard for the product development actuary. The research examines the impact of VM-20 from a product development actuarial perspective to help actuaries and others enhance current practices to optimize pricing and product development activities within a VM-20 framework as well as enhance intracompany communication and efficiencies related to VM-20.

## Section 2: Disclaimer of Liability

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With the January 1, 2017, effective date of VM-20, we expect that actuarial practice in calculating VM-20 reserves will evolve over time as companies, actuaries and regulators gain experience in calculating such reserves. The evolving actuarial practice may differ from what is assumed in the case studies. The methodology and assumptions used in developing VM-20 reserves for the case studies are illustrative and should not be viewed as recommendations of Milliman or the SOA with respect to the application of VM-20. Further, future changes are expected in VM-20, including changes to certain prescribed assumptions such as defaults and spread assumptions as well as potential re-parameterization of the Net Premium Reserves (NPR). In addition, there is a lack of guidance from the U.S. Treasury concerning the appropriate tax reserves after VM-20 becomes effective. The reserves deductible for federal income taxes may differ from what is portrayed in the case studies.

## Section 3: Research Phases and Report Content

The research is organized in two phases. The objective of Phase 1 was to investigate the changes to the product development process as a result of VM-20 through the development of case studies for term and universal life with secondary guarantees (ULSG) products. The case studies were intended to illustrate profitability changes from current statutory reserving methods for hypothetical products and identify issues and considerations for the product development actuary. The Phase 1 report was published in November 2016 and is available at SOA.org. Elements of the Phase 1 report are referenced in this report.

Phase 2 of the research expands on the Phase 1 case studies and includes additional case studies focused on smaller companies and the impact of reinsurance. Phase 2 also discusses the industry's preparedness for pricing under VM-20 and identifies pricing and product design issues through interviews and discussions with product development actuaries. This report constitutes Phase 2 of the research.

The Phase 1 and Phase 2 reports are not intended to provide a primer on VM-20, and the reader is expected to be familiar with the basic requirements of VM-20. Background information on VM-20 is provided in some of the entries included in the References section at the end of the Phase 2 report.

The structure of the Phase 2 report is as follows:

- Section 4 provides an executive summary of the Phase 2 results
- Section 5 recaps the VM-20 term and ULSG results (Situation 5) from the Phase 1 report and provides an attribution analysis of the Deterministic Reserve (DR)
- Section 6 provides small company case studies for term and ULSG
- Section 7 provides guaranteed yearly renewable term (YRT) case studies for term and ULSG
- Section 8 provides other term and ULSG case studies
- Section 9 provides a summary of the interviews with product development actuaries

## Section 4: Executive Summary

Our Phase 2 research included pricing case studies and interviews with industry participants.

The key conclusions from our Phase 2 case studies are as follows, but these results are dependent on the specific case study assumptions and may not apply under different assumptions:

- When we analyzed the factors contributing to the excess of the DR over a best estimate gross premium reserve for the Phase 1 VM-20 case studies (Situation 5), we found that for both term and ULSG, moving from anticipated experience mortality to VM-20 mortality assumptions had the most significant impact on the level of reserve.
- For the small company case studies, our assumptions of less credible mortality experience and shorter sufficient data period increased the DR significantly above the level for the large company case study of the Phase 1 research. Under our assumptions, which assumed no change in premiums, for the term products the DR is as great as, or greater than, the Model 830 XXX Reserve in many durations. Compared to the large company case study, the higher acquisition expenses and reserves resulted in considerable additional surplus strain and noticeably lower profit margins. Our analysis suggests that small companies may continue to look to coinsurance to manage the surplus strain on new business.
- The guaranteed YRT case studies produced different results for the term and ULSG products. For the term products, there was a tension between the cost of the assumed increase in YRT premiums versus the impact of the guaranteed premiums on the VM-20 reserves, producing varying impacts on profitability, depending on the product and profit metric under consideration. For the ULSG block, the increase in YRT premiums on its own decreases profitability, but it is more than offset by the decreased reserve strain realized by not including margins on the YRT reinsurance premiums. The profit margins are increased marginally, but the decreased surplus strain results in considerably higher internal rates of return (IRRs).

- Under the case study of specified post-level term assumptions, the post-level term period cash flows are clearly beneficial to the profitability metrics.
- For a company issuing a term product under a simplified issue (SI) underwriting program, the single-cell example in this report indicated that the adoption of VM-20 reserving methods together with current expectations for policy size and premium amounts imply a similar and perhaps improved IRR when compared to the IRR under Model 830 reserving methods. However, this outcome is dependent upon the chosen VM-20 assumption set, product design and premium levels.
- For the 30-year term single cell, the tax impacts together with the reduction in reserve requirements and material surplus relief make for a significant increase in profitability under VM-20.
- For the ULSG product, the case study indicated that a 10-pay premium pattern is less profitable than the level-pay situation, but the single-pay is more profitable. The higher single-pay profitability is driven largely by the initial strain, which is quite small in the single-pay situation. The reduced initial strain in the single-pay case is largely due to the commission level relative to the initial premium, which is a phenomenon not unique to a VM-20 pricing situation.

We spoke to pricing and product development actuaries at 14 companies of varying size that issue individual life business. Key comments from those interviews are summarized below:

- There was an even mix between the pricing and valuation areas regarding where VM-20 expertise resided and which area leads or led the effort to be VM-20-ready. Generally, companies that had executed or worked on Actuarial Guideline 48 reserve financing transactions were more prepared than companies that had not, and at those companies, the VM-20 knowledge in the valuation area was ahead of the pricing area. On the flip side, at companies that were looking to roll out VM-20 products in 2017 or early 2018, the pricing area led the learning curve. In companies where the corporate structure was organized across product lines rather than function, term was generally more VM-20-ready than ULSG.
- Many companies expressed concern over a now higher level of unpredictability and fluctuation in their reserves and anticipated profits under VM-20. This concern stems from the potential unlocking of assumptions (in particular, the interest assumptions), as well as potential regulatory changes in VM-20 methodology. There was consistent concern among interviewees regarding the future definition of tax reserves. One participant commented on the positive side of the fluctuation issue, in that it will allow for faster reactions or corrections than in the past.
- More than half the participants raised concerns regarding the intensiveness and complexity of the computations necessary for VM-20.
- Several companies commented on lower anticipated profitability upon moving to VM-20 reserving. This was particularly true for small companies with limited or near-zero mortality credibility, as well as for companies already engaged in reserve financing.
- While most companies acknowledged that there could be reasons to change their term or ULSG product designs under VM-20, no interviewee indicated they had worked through the details of changing product design under VM-20. Most companies were taking a “wait-and-see” approach.
- Most companies were at a beginning stage of thinking about how their use of reinsurance may change under VM-20. Some companies described themselves as listening to reinsurers’ thoughts and waiting for ideas from the reinsurers.
- In our discussions, companies generally indicated that their plates were full enough with term and ULSG, and that they had not given much thought to other products in a VM-20 context.



## Section 5: Recap VM-20 Results from Phase 1

In Phase 1 we developed case studies that began with profit metrics for hypothetical products under the 2001 CSO table, assuming Model 830 statutory reserves, which are commonly referred to as XXX for term or Actuarial Guideline 38 (AG38) for ULSG. Because many market participants have used reserve financing to improve profits on currently issued term and ULSG products, we also examined profits after reflecting reserve financing in accordance with Actuarial Guideline 48 (AG48). We then showed the impact of the introduction of the 2017 CSO table, both with and without reserve financing according to AG48. Finally, we showed profits after the introduction of VM-20. It was this final iteration (Situation 5) from Phase 1 that generally provides the starting point for the sensitivities examined in Phase 2.

The Phase 1 case studies showed that:

- For term business that was not financed, VM-20 increases IRRs, as a combined result of lower statutory and tax reserves.
- For ULSG business that was not financed, VM-20 did not have a material impact on IRRs, as the statutory reserve decrease under VM-20 was largely offset by the lower tax reserve deduction under VM-20.
- For term or ULSG business that was financed under AG48 prior to VM-20, and assuming no financing after VM-20, VM-20 lowers IRRs as a result of the loss of tax benefits.

In the Phase 1 report, we described the three components of VM-20 reserves and how we modeled each for purposes of the case studies. A summary of the modeling approach is included here for reference, but more detail is available in the Phase 1 report:

- The NPR is a closed-form solution formula prescribed in VM-20. Our models calculated the NPR at issue and at each node. We assumed no variation in future valuation interest rates, valuation lapse rates or valuation mortality for the NPR determination.
- The DR at each node is based on a projection of cash flows that reflect pricing assumptions up until the node and prudent estimate valuation assumptions after the node. The projection system develops these reserves in a single pass, using the pricing assumptions to project the in-force as of the valuation date in the outer loop and using the DR assumptions after the valuation date in the inner loop reserve calculation.
- The Stochastic Reserve (SR) must be calculated through the projection of a number of stochastic scenarios from the Academy's generator. At a present valuation date, this is a seemingly straightforward task, but in a pricing or projection exercise it creates a need for a nested stochastic projection that entails additional calculation challenges. One possible approach, which we employed for the case studies, is the use of deferred valuation projections. For these projections, the model runs forward to a node using pricing assumptions and then branches off into the set of stochastic interest rate paths with the application of the VM-20 prudent estimate assumptions. The greatest present values of negative assets are then discounted back to each node, added to the starting asset amount, and the conditional tail expectation is determined for the node.

In the Phase 1 analysis for ULSG, we used the approach described above to calculate the SR explicitly at six nodes: durations 1, 5, 10, 20, 30 and 50. We determined the ratio of the SR to the DR at these nodes. We then interpolated this ratio between the nodes and applied those ratios to the DR to calculate the SR at the intermediate nodes. We used 200 stochastic scenarios at each of the six valuation nodes in order to keep run times manageable for this level of analysis. We believed that the six future nodes provided a reasonable picture for how the SR will progress relative to the DR.

Throughout this Phase 2 report, we have inserted reference tables with assumptions from the Phase 1 analysis, contrasted with the changes to assumptions that are relevant for the Phase 2 analysis. Some of these tables will show the reader assumptions from the outer loop contrasted with assumptions from the inner loop. The outer loop assumptions, or projection assumptions, are used to project the inforce and cash flows of the business. The inner loop assumptions, or valuation assumptions, are used to calculate reserves. A current valuation date DR is determined by applying inner loop VM-20 prudent estimate assumptions to the

group of policies in scope of valuation. A future valuation date DR is determined by applying outer loop projection assumptions up to the future valuation date, or node, and adopting inner loop VM-20 prudent estimate assumptions, to project the cash flows from the node forward to calculate the DR at that future node for the expected population at that future valuation date. As this process is repeated annually, a future forecast of DRs is developed together with the company's forecasted financial performance. This process relies on an actuarial projection system with outer loop and inner loop capability.

The remainder of this section analyzes the forecasted DR calculated for term and ULSG in the Phase 1 case study to understand the contributions to the DR from the various assumptions and margins relevant to VM-20.

#### **Deterministic Reserve Attribution—20-Year Term \$350,000**

The foundation for the term model office in the Phase 1 case studies was a top-quartile 10- and 20-year level premium term plan with an insurance benefit period to attained age 95. Anticipated experience for mortality and lapse was developed based on representative experience from top-quartile companies or experience from available industry studies specific to this type of term insurance. Mortality improvement is included in the pricing assumption. Pricing Situation 5 from Phase 1 assumed full VM-20 implementation without financing.

This section focuses on decomposing the DR from Situation 5 by removing specific components of conservatism layer by layer. Attribution steps defined in the list below were designed to quantify the impact of mortality improvement, margins, and discount rates on the forecast DR. The 20-year product at the \$350,000 band size was used as the subject for this demonstration. In this analysis, the DR is not floored at \$0. The NPR is also shown.

**DR Baseline:** DR from the Phase 1 Situation 5

**DR1 Remove Mortality Margins:** For each future DR calculation, mortality improvement is included in cash flows beyond the valuation date, or node, and the VM-20 margin is omitted. This effectively brings the mortality assumption back to the company's anticipated experience. Note that for Phase 1 term, because of the assumed availability of credible mortality data, there was no grading to industry tables over the level term period.

**DR2 Remove Lapse Margins:** Starting with DR1 assumptions, the lapse margin is omitted from the inner loop cash flows.

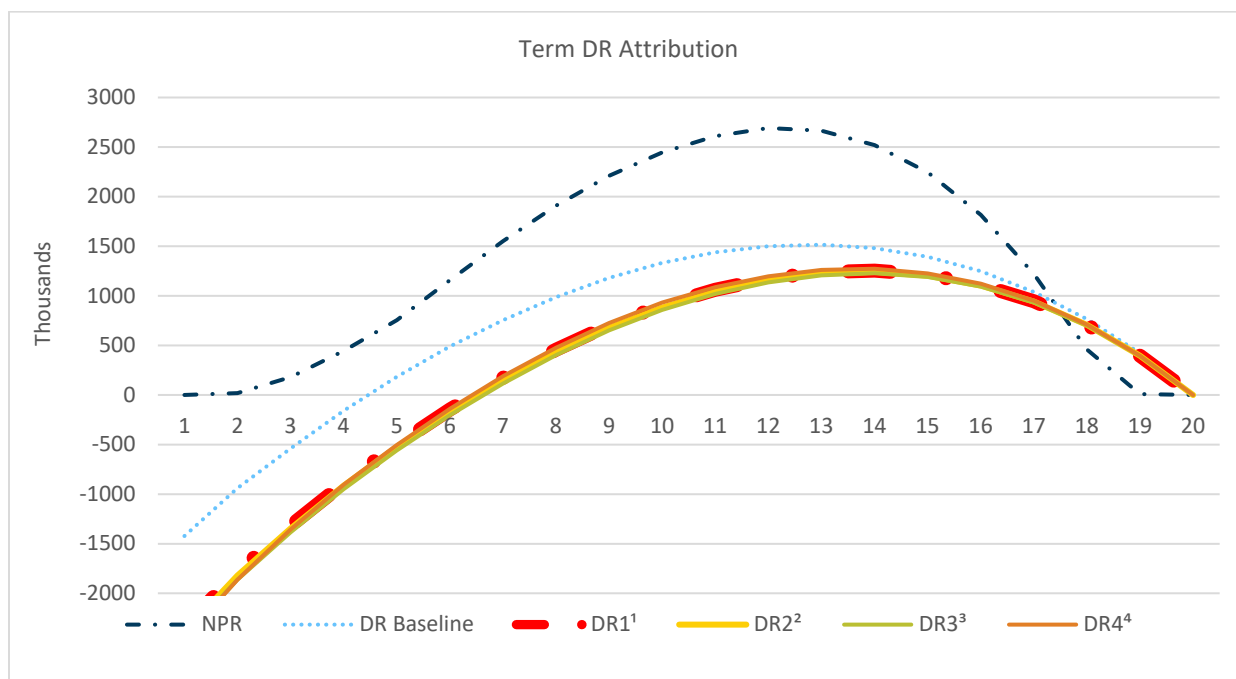
**DR3 Remove Expense Margin:** Starting with DR2 assumptions, the expense margin is omitted from the inner loop cash flows.

**DR4 4% Discount Rate:** Starting with DR3 assumptions, the DR discount rate is assumed to be 4% level; whereas, for Phase 1, the discount rate was derived from the assumed pretax earnings rate, starting at approximately 4.25% and grading up to 5.10% over the study period.

Figure 1 shows us that the first attribution step related to moving from VM-20 mortality assumptions back to anticipated experience assumptions (DR Baseline to DR1 Remove Mortality Margins) has the biggest impact. Since it is difficult to see the impact of steps DR2 Remove Lapse Margins, DR3 Remove Expense Margins and DR4 4% Discount Rate in Figure 1, Figure 2 is provided, which shows the DR for each attribution step by policy year.



Figure 1: Deterministic Reserve Attribution—20-Year Term, Low-Band



<sup>1</sup>DR1: Remove Mortality Margins

<sup>2</sup>DR2: Remove Lapse Margins

<sup>3</sup>DR3: Remove Expense Margin

<sup>4</sup>DR4: Level Discount Rate (4%)

Period 1 is not shown for DR1, DR2, DR3 or DR4 data points to improve readability of the graph.

**Figure 2: Deterministic Reserve—20-Year Term, Low-Band**

Policy Year	Term Deterministic Reserve—20-Year Term \$350,000 DR In Thousands				
	Baseline	DR1 Remove Mortality Margins	DR2 Remove Lapse Margins	DR3 Remove Expense Margins	DR4 Apply 4% Discount Rate
1	\$ (1,423)	\$ (2,343)	\$ (2,389)	\$ (2,433)	\$ (2,458)
2	(941)	(1,786)	(1,821)	(1,862)	(1,862)
3	(540)	(1,318)	(1,347)	(1,384)	(1,355)
4	(159)	(890)	(916)	(951)	(906)
5	185	(501)	(525)	(558)	(503)
6	488	(146)	(172)	(203)	(140)
7	755	172	146	117	188
8	987	456	431	403	477
9	1,181	701	677	651	726
10	1,332	904	881	857	931
11	1,438	1,061	1,040	1,019	1,088
12	1,499	1,173	1,155	1,136	1,198
13	1,515	1,239	1,224	1,207	1,262
14	1,482	1,254	1,242	1,227	1,273
15	1,393	1,212	1,203	1,191	1,227
16	1,247	1,110	1,104	1,094	1,121
17	1,040	944	940	933	951
18	766	707	706	700	710
19	422	395	395	393	396
20	0	0	0	0	0

The 4% level discount rate of Step 4 is lower than the projected earnings rate in Baseline DR for nodes after the second year. This impact works to move the Deterministic Reserve for DR4 above that of DR3.

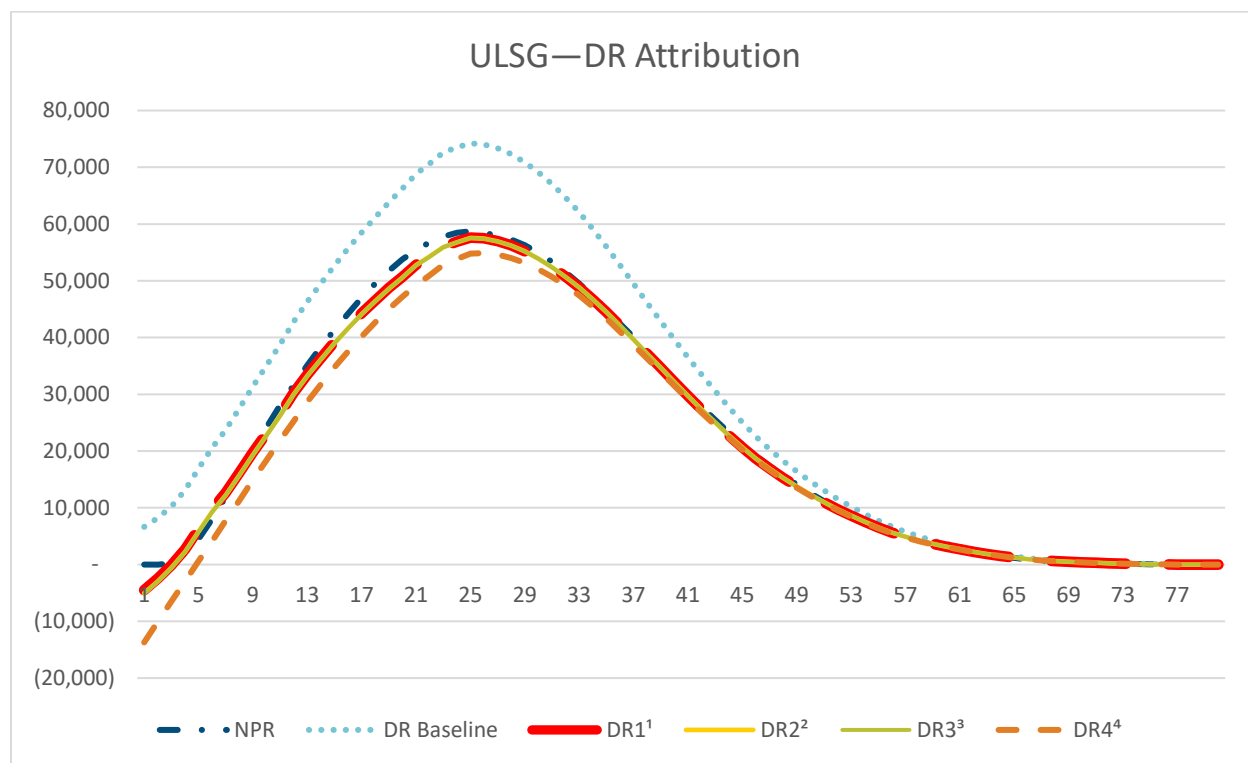
For term insurance, the most material risk factor is clearly mortality. For this case study, the NPR is driving the reserve requirements. Only changes made to the DR that would cause it to exceed the NPR would impact the profitability outcomes.

#### Deterministic Reserve Attribution—Low-Band ULSG

The foundation for the ULSG model office in Phase 1 was a multitiered shadow account design that was intended to be representative of a product that is competitive at the top quartile of carriers as of early 2016. Anticipated experience for mortality and lapse was developed based also on representative experience from top-quartile companies or experience from available industry studies. Mortality improvement is included in the pricing assumption. Pricing Situation 5 from Phase 1 assumes full VM-20 implementation without financing.

This section focuses on decomposing the DR for the low-band ULSG product using the same steps defined above for the term demonstration.

Figure 3: Deterministic Reserve Attribution—ULSG, Low-Band



- <sup>1</sup>DR1: Remove Mortality Margins
- <sup>2</sup>DR2: Remove Lapse Margins
- <sup>3</sup>DR3: Remove Expense Margin
- <sup>4</sup>DR4: Level Discount Rate (5.2%)

Figure 3 shows that the first attribution step related to moving from VM-20 mortality assumptions back to anticipated experience assumptions (DR Baseline to DR1) has the biggest impact.

In Figure 3, the lines for DR1 Remove Mortality Margins, DR2 Remove Lapse Margins and DR3 Remove Expense Margins essentially overlap. This indicates that the lapse margins and expense margins are relatively small.

Figure 4 shows the DR for each attribution step for the first 20 policy years.

**Figure 4: Deterministic Reserve—ULSG, Low-Band**

Policy Year	ULSG Deterministic Reserve—Low-Band DR In Thousands				
	Baseline	DR1 Remove Mortality Margins	DR2 Remove Lapse Margins	DR3 Remove Expense Margins	DR4 Apply 5.2% Discount Rate
1	\$ 6,669	\$ (4,496)	\$ (5,040)	\$ (5,086)	\$ (13,715)
2	8,218	(2,441)	(2,946)	(2,989)	(10,074)
3	10,193	(128)	(604)	(645)	(6,499)
4	13,111	2,684	2,229	2,189	(2,941)
5	16,877	6,246	5,788	5,749	605
6	20,646	9,793	9,337	9,298	4,164
7	23,744	12,680	12,248	12,210	7,742
8	27,547	16,219	15,795	15,758	11,322
9	31,367	19,751	19,340	19,304	14,904
10	35,093	23,182	22,812	22,777	18,430
11	38,781	26,565	26,235	26,201	21,922
12	42,821	30,317	30,017	29,984	25,324
13	46,310	33,479	33,229	33,197	28,666
14	49,570	36,424	36,204	36,173	31,800
15	52,724	39,225	39,025	38,994	34,766
16	55,727	41,866	41,679	41,650	37,578
17	58,527	44,292	44,119	44,091	40,210
18	61,232	46,585	46,434	46,407	42,701
19	63,833	48,739	48,605	48,579	45,045
20	66,239	50,674	50,560	50,535	47,176

We originally used a 4% level discount rate, like term, for Step 4. Because 4% is lower than the projected earnings rate in Baseline DR, this change offset a considerable amount of the margin released in the prior steps. In other words, the 4% level discount rate introduced a margin compared to the best estimate assumption. For illustration purposes, we changed the 4% discount rate to 5.2% to better reflect the long-term earned rate in the outer loop projection. The 5.2% is between the average earned rate over the course of the projection (roughly 5.16%) and the ultimate rate (5.23%). Using a level rate results in an uneven estimate of the margin impact. As a percentage of the total margin, the DR4 discount rate step is relatively high during the early projection years when best estimate earned rates are expected to be lower. The margin is diminished over time as the best estimate earned rate approaches and then exceeds the level discount rate.

Like term, the most material margin for ULSG is clearly the margin on underlying mortality. The impact of each step could be different depending on the order in which they were removed, but mortality is still likely the driving factor.

## Section 6: Small Company Case Studies

The Phase 1 case studies reflected characteristics of a large company in that the mortality experience was assumed to be fully credible, with a 15-year sufficient data period (SDP). Fully allocated expense factors were in line with large company profiles, and the company wrote enough business to justify financing excess statutory reserves. This Phase 2 small company sensitivity presents the situation for a small company by changing relevant assumptions and demonstrating the impact on VM-20 pricing for term insurance and ULSG.

### Term Small Company Case Study

Figure 5 outlines the stepwise assumption changes from Phase 1 Situation 5 to the Phase 2 small company sensitivity for term. The item highlighted in bold in each row is the assumption being changed in that step. Step 1 shows the impact of higher

acquisition expenses for small companies. Step 2 shows the impact of less credible mortality experience. Step 3 shows the impact of coinsurance, a tool small insurers often consider to address surplus strain.

**Figure 5: Term Small Company Assumption Changes**

Step	Acquisition Expense per Unit	Mortality Credibility and Sufficient Data Period	Reinsurance
Phase 1	\$0.20	100% and 15 years	Non-Guaranteed YRT, \$1,000,000 Retention
Step 1	<b>\$1.00</b>	100% and 15 years	Non-Guaranteed YRT, \$1,000,000 Retention
Step 2	\$1.00	<b>28% and 3 years</b>	Non-Guaranteed YRT, \$1,000,000 Retention
Step 3	\$1.00	28% and 3 years	<b>80% Coinsurance with \$100,000 limit on retention* Expense allowances are 100% first year, 11% renewal years</b>

\*For the \$350,000 policy size, \$70,000 is retained while \$280,000 (80%) is ceded.

\*For the \$1,200,000 policy size, \$100,000 is retained while \$1,100,000 (91.667%) is ceded.

The changes described in Figure 5 impact the projections for a small company in the following ways:

- The acquisition cost per policy has gone from \$70 to \$350 for the \$350,000 policy. For the \$1,200,000 policy, acquisition costs have gone from \$240 to \$1,200 per policy. These costs are based on 2016 GRET (Generally Recognized Expense Table), which is a proxy for fully allocated expenses and may not be indicative of actual pricing assumptions.
- Lower credibility and shorter SDP mean the small company must grade into an industry table by the seventh policy year and use industry margins on the industry rates. At 28% credibility, margins on company experience will increase from Phase 1 levels. These changes are applicable for the inner loop mortality, the mortality on which the DR calculation is based. The outer loop mortality remains unchanged from baseline. For this case study, the small company's selection of industry mortality table assignments for the inner loop mortality are assumed to be the following:

Nonsmoker class N1: RR60

Nonsmoker class N2: RR80

Nonsmoker class N3: RR110

Nonsmoker class N4: RR125

Smoker class S1: RR75

Smoker class S2: RR125

Starting with the Situation 5 pricing results from Phase 1, Figures 6 and 7 show the stepwise implementation of each of the characteristics noted above. Each row of the table includes the changes in the preceding steps.

Figure 6: Pricing Results—Small Company—10-Year Term

Small Company 10-Year Level Term	Pretax Profit Margin <sup>1</sup>	After-Tax Profit Margin <sup>2</sup>	Adjusted After-Tax Profit Margin <sup>3</sup>	Surplus Strain	IRR Adjusted After-Tax
<u>Low-Band Model Office</u>					
Phase 1 Situation 5	15.7%	8.8%	2.8%	-128%	9.1%
Step 1: Increase Per Unit Acquisition to \$1.00	10.9%	5.7%	-0.3%	-147%	4.3%
Step 2: Inner Loop Mortality 28% Credibility; Three-Year SDP	10.9%	4.4%	-1.6%	-147%	3.7%
Step 3: Coinsurance	-1.1%	-3.7%	-7.3%	-76%	-2.4%
<u>High-Band Model Office</u>					
Phase 1 Situation 5	16.2%	8.8%	1.7%	-112%	7.6%
Step 1: Increase Per Unit Acquisition to \$1.00	10.5%	5.1%	-2.1%	-134%	1.8%
Step 2: Inner Loop Mortality 28% Credibility; Three-Year SDP	10.5%	2.5%	-4.7%	-201%	2.7%
Step 3: Coinsurance	1.4%	-3.2%	-6.7%	-57%	-2.2%
<sup>1</sup> Pretax profit margin is calculated with discount at the pretax net investment earnings rate (NIER). <sup>2</sup> After-tax profit margin is calculated with discount at the pretax NIER. <sup>3</sup> Adjusted after-tax profit margin includes target capital effects and is calculated with discount at the pretax NIER.					

Figure 7: Pricing Results—Small Company—20-Year Term

Small Company 20-Year Level Term	Pretax Profit Margin <sup>1</sup>	After-Tax Profit Margin <sup>2</sup>	Adjusted After-Tax Profit Margin <sup>3</sup>	Surplus Strain	IRR Adjusted After-Tax
<u>Low-Band Model Office</u>					
Phase 1 Situation 5	18.4%	11.1%	6.7%	-172%	9.9%
Step 1: Increase Per Unit Acquisition to \$1.00	13.9%	8.2%	3.8%	-200%	7.3%
Step 2: Inner Loop Mortality 28% Credibility; Three-Year SDP	13.9%	4.1%	-0.5%	-316%	4.8%
Step 3: Coinsurance	3.3%	-0.4%	-3.0%	-103%	3.4%
<u>High-Band Model Office</u>					
Phase 1 Situation 5	19.9%	11.9%	6.7%	-147%	10.4%
Step 1: Increase Per Unit Acquisition to \$1.00	14.7%	8.5%	3.3%	-178%	7.1%
Step 2: Inner Loop Mortality 28% Credibility; Three-Year SDP	14.7%	1.0%	-4.5%	-472%	4.2%
Step 3: Coinsurance	8.1%	1.9%	-0.5%	-75%	4.5%
<sup>1</sup> Pretax profit margin is calculated with discount at the pretax net investment earnings rate (NIER). <sup>2</sup> After-tax profit margin is calculated with discount at the pretax NIER. <sup>3</sup> Adjusted after-tax profit margin includes target capital effects and is calculated with discount at the pretax NIER.					

Changes observed in Figures 6 and 7 include the following:

1. Step 1 drives profitability lower by introducing additional Year 1 expenses. In all four studies, this increases surplus strain, reduces profit margin metrics and reduces IRR.
2. Step 2 changes the level and pattern of VM-20 statutory reserves because the DR is affected by the much lower credibility measurement and shorter SDP of the smaller company sensitivity.

The pretax profit margins are unaffected because the pattern of statutory reserves remains \$0-to-\$0 over the level term period.

The impact of the lower credibility and shorter SDP on the after-tax profit measures involves complex interactions between investment income and statutory and tax reserve patterns. In general, tax inefficiency has increased because the DR now exceeds the NPR in more durations than for the prior step. Surplus strain is increased because the statutory reserve requirement now starts out at a higher level than for Step 1. More tax inefficiency (DR > NPR) means a reduction to after-tax and adjusted after-tax profit metrics.

There are two exceptions to these general outcomes:

- For the 10-year plan low band, the surplus strain has not changed from Step 1 to Step 2. This is because the NPR prevails and remains the statutory reserve requirement in the first year in both Step 1 and Step 2. After the first year, for Step 2, the DR pattern is much higher than for Step 1.
- For the 10-year plan high band, the Step 2 IRR is higher than the Step 1 IRR. The IRR depends on the relationship of the change in surplus strain from Step 1 to Step 2 and the change in renewal profit patterns from Step 1 to Step 2.

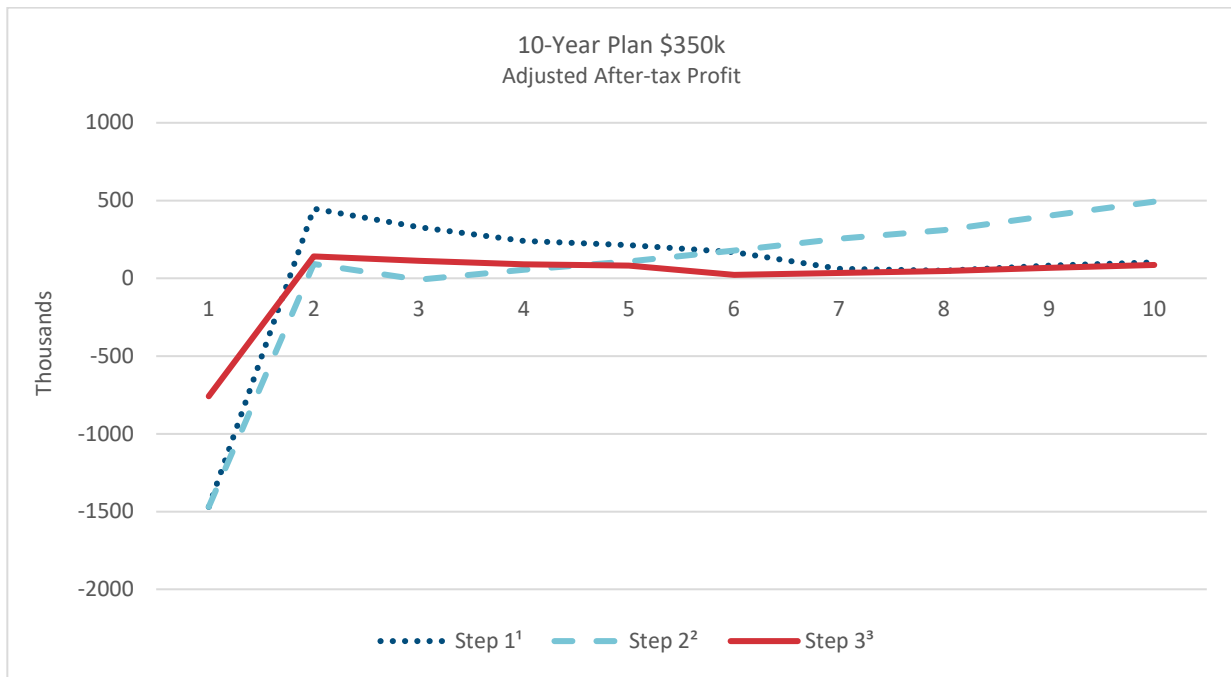
Later in this section, all the reserve graphs for each of the four plan groups are shown and discussed.

3. Step 3 reflects the implementation of a coinsurance agreement that small companies might consider to lower surplus strain. Step 3 assumes 80% coinsurance with a maximum retention of \$100,000. The coinsurance expense allowances are 100% in the first year and 11% in renewal years. Coinsurance changes the shape of the profit pattern by reducing the surplus strain (increasing first year profits) and reducing renewal profits. By implementing coinsurance in Step 3, surplus strain is reduced in all four plan groups. Pretax profit margins are lower for all four plan groups. After-tax profit margins and IRRs are lower for three of the four plan groups. For the 20-year plan \$1,200,000 policy size, the after-tax profit margins and IRR are higher than for Step 2 because, after coinsurance is implemented, the tax basis reserve is equal to the statutory basis reserve for all but the longest durations, whereas for the Step 2 situation, the statutory basis reserve was considerably higher than the tax basis reserve.

Graphs of after-tax profit patterns for all four plan groups for Steps 1, 2 and 3 are shown in Figures 8, 9, 10 and 11.

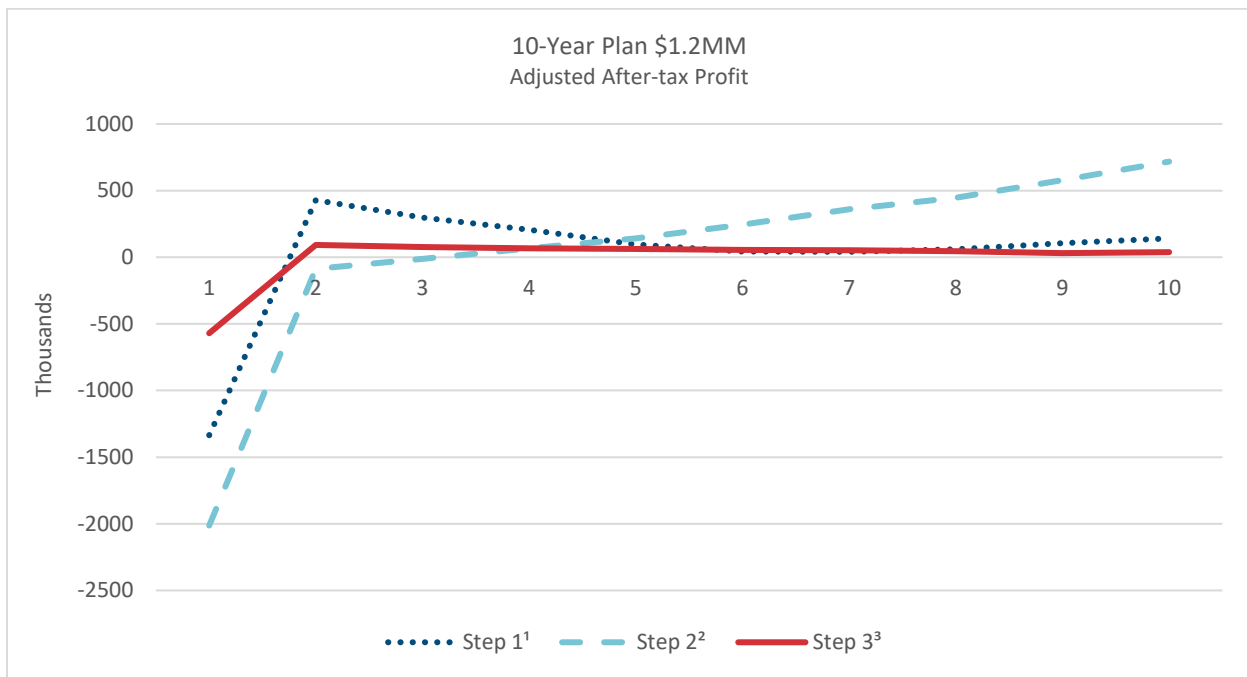


Figure 8: Profit Pattern—Small Company 10-Year Term, Low-Band



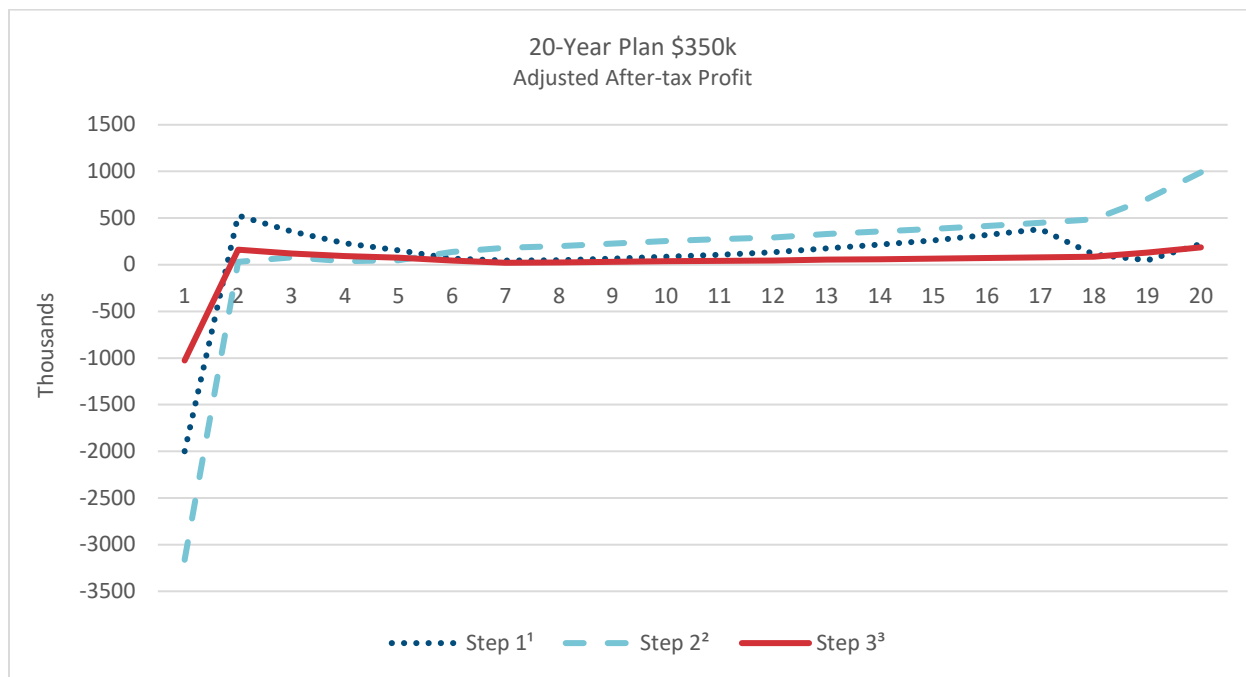
<sup>1</sup>Step 1: Higher Acquisition Expenses    <sup>2</sup>Step 2: Lower Mortality Credibility    <sup>3</sup>Step 3: Coinsurance

Figure 9: Profit Pattern -Small Company 10-Year Term, High-Band



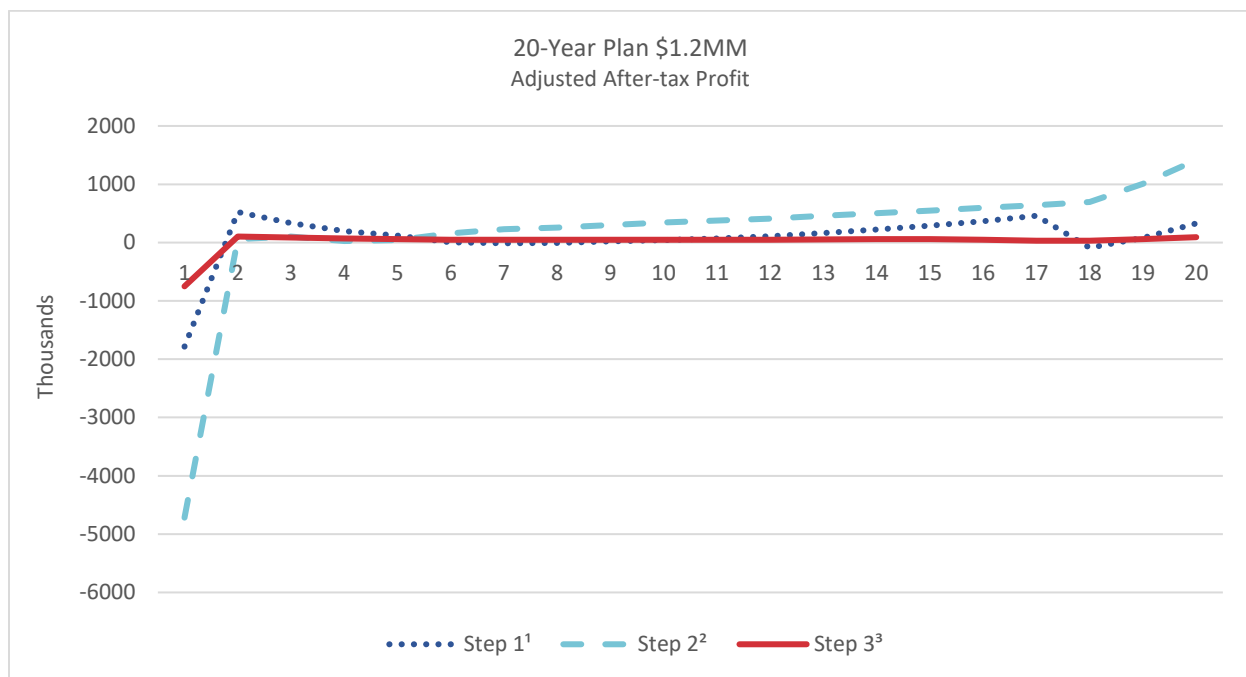
<sup>1</sup>Step 1: Higher Acquisition Expenses    <sup>2</sup>Step 2: Lower Mortality Credibility    <sup>3</sup>Step 3: Coinsurance

Figure 10: Profit Pattern—Small Company 20-Year Term, Low-Band



<sup>1</sup>Step 1: Higher Acquisition Expenses    <sup>2</sup>Step 2: Lower Mortality Credibility    <sup>3</sup>Step 3: Coinsurance

Figure 11: Profit Pattern—Small Company 20-Year Term, High-Band



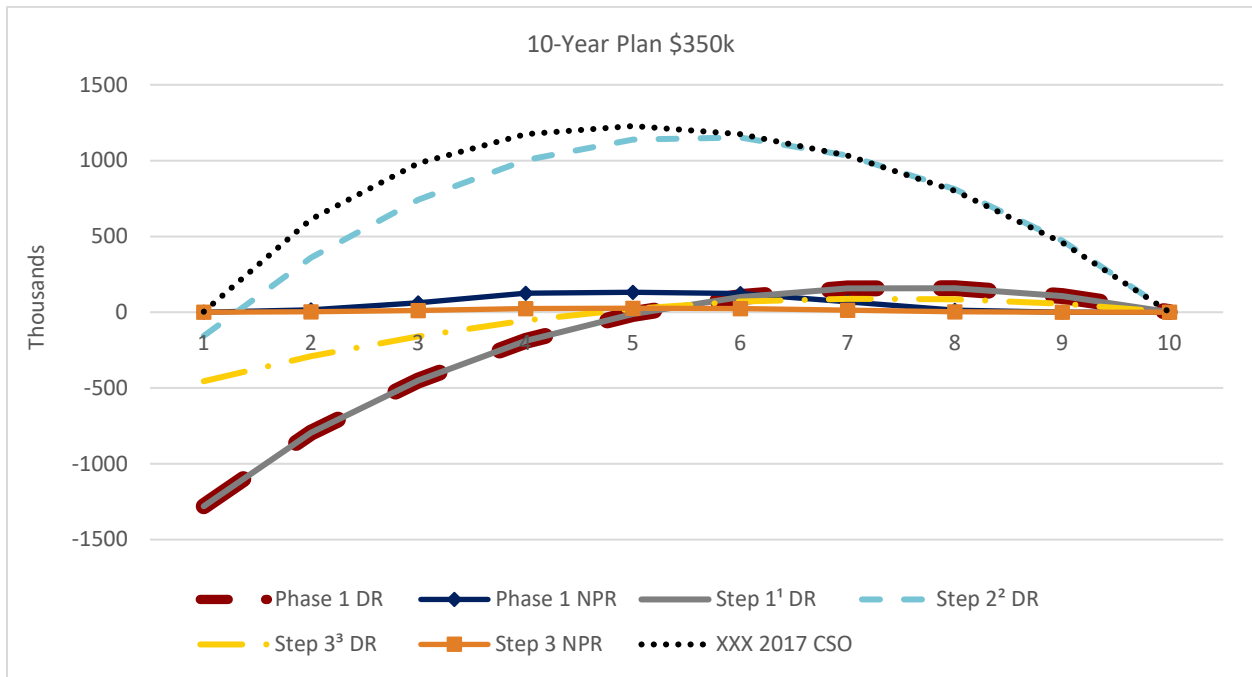
<sup>1</sup>Step 1: Higher Acquisition Expenses    <sup>2</sup>Step 2: Lower Mortality Credibility    <sup>3</sup>Step 3: Coinsurance

In this small company sensitivity, reserve relationships change from the Phase 1 case studies. This section looks at the change in reserves under each of the steps implemented for the small company sensitivity.

- Step 1 does nothing to change the NPR or DR, because acquisition costs are assumed to be incurred at time of issue and are not included in the cash flows for the DR forecast for the end of the first year. In the graphs that follow, the NPR for Phase 1 (Phase 1 NPR) represents the NPR for Step 1 of the small company sensitivity as well.
- Step 2 illustrates the impact of lower mortality credibility and shorter SDP. The NPR for Step 2 is the same as the Phase 1 NPR, because mortality credibility and SDP do not impact the determination of the NPR. The characteristic of less credible mortality experience and shorter SDP for the smaller company increase the Step 2 DR as compared to the Phase 1 (and, as noted above, the Step 1 DR) higher credibility DR. In fact, under these conditions, the Step 2 DR is as great as, or greater than, XXX method reserves in many durations for each of the four plan groups. For informational purposes only, the XXX 2017 CSO line on each of the four graphs depicts the XXX-method reserve using the 2017 CSO valuation mortality table. The XXX-method reserves did not factor into the small company profit studies under VM-20.
- Step 3 is where 80% coinsurance with \$100,000 limit on retention is implemented. The coinsurance expense allowances are 100% in the first year and 11% in all renewal years. Because the majority of the risk is now ceded away, and a coinsurance expense allowance becomes part of the DR cash flows, the level of the DR changes in a material way. The NPR is affected as well, because the NPR needs to allow for only the insurance amount retained.

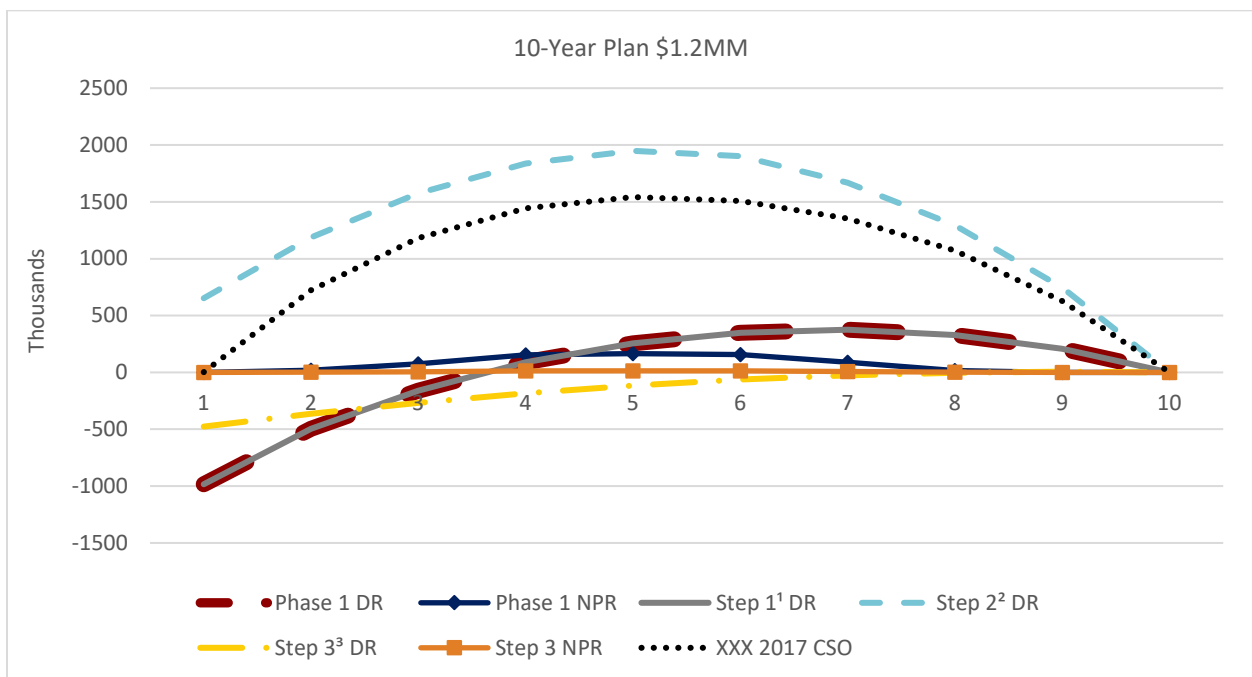
Graphs of all the reserve streams for each plan group are shown in Figures 12–13 (10-year plan, both sizes) and Figures 14–15 (20-year plan, both sizes). In these graphs, the DR is unfloored, consistent with the graphical presentations of DR in Phase 1.

Figure 12: Reserve Levels—10-Year Term, Low-Band



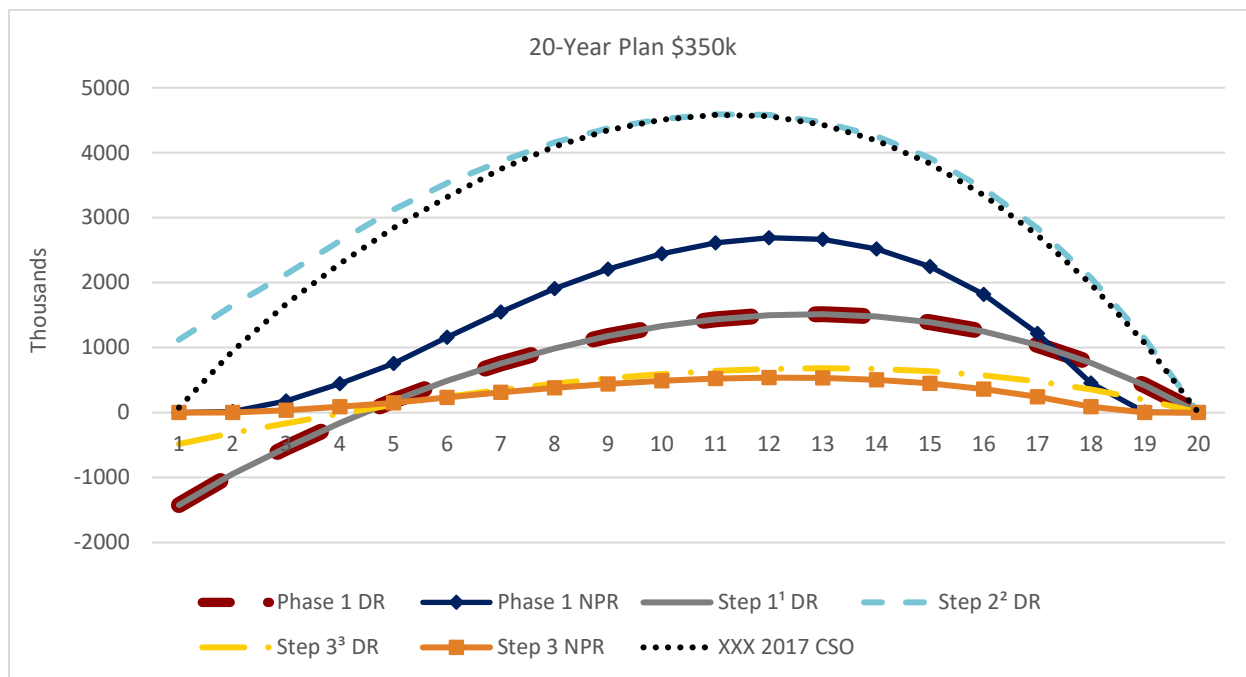
<sup>1</sup>Step 1: Higher Acquisition Expenses    <sup>2</sup>Step 2: Lower Mortality Credibility    <sup>3</sup>Step 3: Coinsurance

Figure 13: Reserve Levels—10-Year Term, High-Band



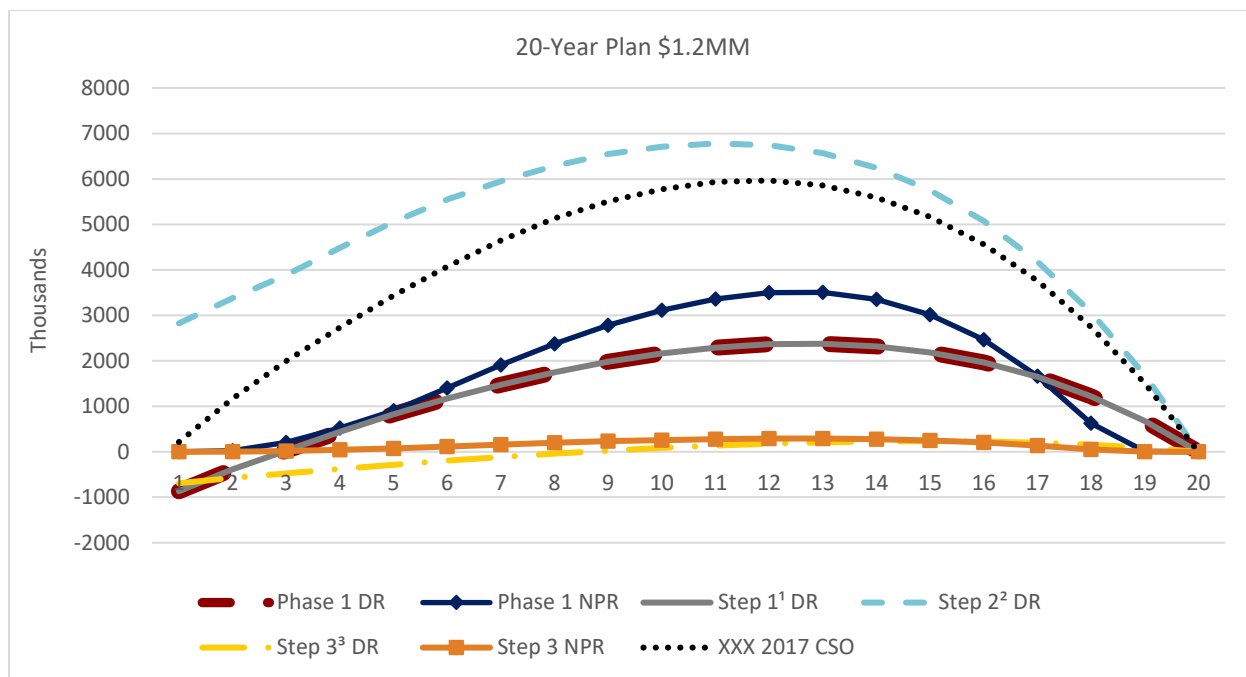
<sup>1</sup>Step 1: Higher Acquisition Expenses    <sup>2</sup>Step 2: Lower Mortality Credibility    <sup>3</sup>Step 3: Coinsurance

Figure 14: Reserve Levels—20-Year Term, Low-Band



<sup>1</sup>Step 1: Higher Acquisition Expenses    <sup>2</sup>Step 2: Lower Mortality Credibility    <sup>3</sup>Step 3: Coinsurance

Figure 15: Reserve Levels—20-Year Term, High-Band



<sup>1</sup>Step 1: Higher Acquisition Expenses    <sup>2</sup>Step 2: Lower Mortality Credibility    <sup>3</sup>Step 3: Coinsurance

### ULSG Small Company Case Study

Figure 16 outlines the stepwise assumption changes from Phase 1 to the Phase 2 small company sensitivity for ULSG. The small company assumption changes are the same as shown for term except that the acquisition expense step is not shown because its impact was minimal relative to the following two steps. The per unit acquisition cost was increased to 2016 GRET direct distribution channel rates of \$1.00 per unit. YRT reinsurance was changed to coinsurance.

**Figure 16: Assumption Changes—Small Company—ULSG**

Step	Acquisition Expense per Unit	Mortality Credibility and Sufficient Data Period	Reinsurance
Phase 1	\$0.20	100% and 15 years	Non-Guaranteed YRT, \$1,000,000 Retention
Step 2	<b>\$1.00</b>	<b>28% and 3 years</b>	Non-Guaranteed YRT, \$1,000,000 Retention
Step 3	\$1.00	28% and 3 years	<b>80% Coinsurance with \$100,000 limit on retention*</b> <b>Expense allowances are 100% first year, 11% renewal years</b>

\*For the \$350,000 policy size, \$70,000 is retained while \$280,000 (80%) is ceded.

\*For the \$1,200,000 policy size, \$100,000 is retained while \$1,100,000 (91.667%) is ceded.

The changes described above impact the projections for a small company in the following ways:

- Acquisition expenses are about 60% higher than in Phase 1.
- Lower credibility and shorter SDP mean the company must grade into an industry table by the seventh policy year and use industry margins on the industry rates. At 28% credibility, margins on company experience will increase from Phase 1 levels. These changes are applicable for the inner loop mortality, the mortality on which the DR calculation is based. The outer loop mortality remains unchanged from baseline. For this sensitivity case study, the company’s selection of industry mortality table assignments is assumed to be the following:

Nonsmoker class N1: RR70

Nonsmoker class N2: RR90

Nonsmoker class N3: RR125

Smoker class S1: RR75

Smoker class S2 RR100

Starting with the Situation 5 pricing results from Phase 1, Figure 17 shows the stepwise implementation of each of the characteristics noted above. Each row of the table includes the changes in the preceding steps.

**Figure 17: Pricing Results—Small Company—ULSG**

Small Company ULSG	PT Profit Margin*	AT Profit Margin**	Adjusted AT Profit Margin***	Surplus Strain	IRR Adjusted After-Tax
<b><u>Low-Band Model Office</u></b>					
Phase 1 Pricing Situation 5	23.7%	8.6%	6.9%	-196%	7.3%
Step 2: Small Company Acquisition and Reserve Assumptions	22.7%	3.1%	1.1%	-431%	5.5%
Step 3: Small Company with Coinsurance	6.3%	2.1%	1.7%	-56%	6.9%
<b><u>High-Band Model Office</u></b>					
Phase 1 Pricing Situation 5	19.5%	4.4%	2.6%	-285%	5.9%
Step 2: Small Company Acquisition and Reserve Assumptions	18.5%	-1.1%	-3.0%	-503%	4.9%
Step 3: Small Company with Coinsurance	4.9%	2.5%	2.3%	-31%	13.4%
*Pretax profit margin is calculated with discount at the pretax NIER.					
**After-tax profit margin is calculated with discount at the pretax NIER.					
***Adjusted after-tax profit margin includes target capital effects and is calculated with discount at the pretax NIER.					

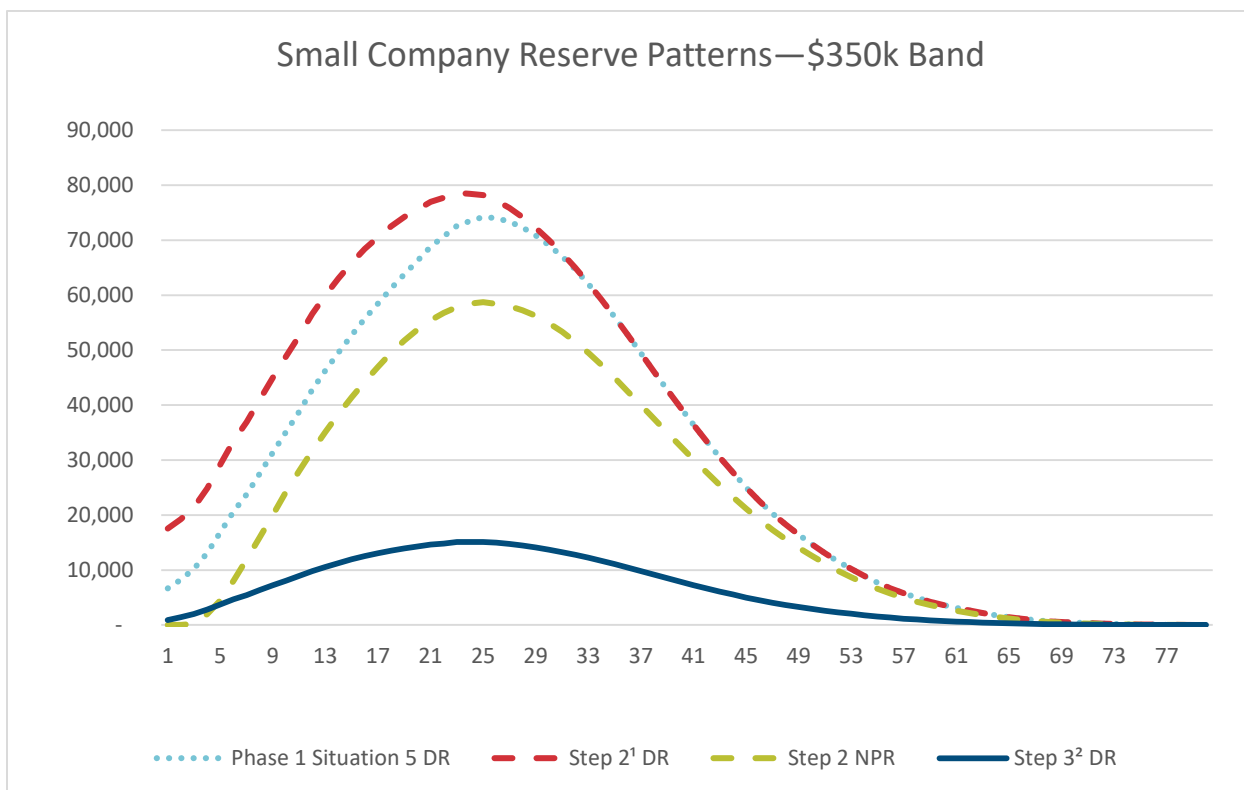
Changes observed in the projections summarized in Figure 17 include the following:

- In Phase 1, the DR or SR was prevailing in all time periods of the projection. This continues to be the case for the small company sensitivity for the low band, but the NPR prevails in some early durations for the higher band cell.
- Similar to Phase 1, the SR prevails in early years on the high band, and the amount of the additional SR over the NPR is minimal.
- Although the acquisition expenses have increased considerably, the change pales in comparison to the overall decrease in initial surplus strain ultimately realized in Step 3. The relative size of the acquisition expense to other income statement items for ULSG means that the acquisition expense change is of little significance. The acquisition cost also does not impact the projected reserve, as it is incurred at the moment of issue and has transpired by the end of the first year when the reserve is first calculated. The coinsurance approach reduces the net reserve of the direct company.
- Moving from Phase 1 Situation 5 to the Step 2 small company assumptions increases the DR, resulting in considerable additional surplus strain and noticeably lower profit margins.
- The Step 3 reflection of coinsurance reduces surplus strain considerably. For step 3, the impact to IRR is noticeably different between the low band and high band. The DR per unit of face in the high band is lower than in the low band because the coinsurance allowance is the same, while the high band has a higher ceded percentage but lower expenses to cover (as a percent of premium). As a result, the low band experiences only a modest IRR increase while the high band shows a considerable increase in IRR.
- The impacts on profit margins in the high band and low band are more similar than the IRR impacts, indicating that the IRR is a more sensitive profit measure at the lower retained amounts in these studies.

In this small company sensitivity, reserve relationships change from the Phase 1 case studies. Figures 18 and 19 look at the change in reserve under each of the steps implemented for the small company sensitivity. Because the excess of the SR over the DR is minimal, we focus on the impact to the DR.



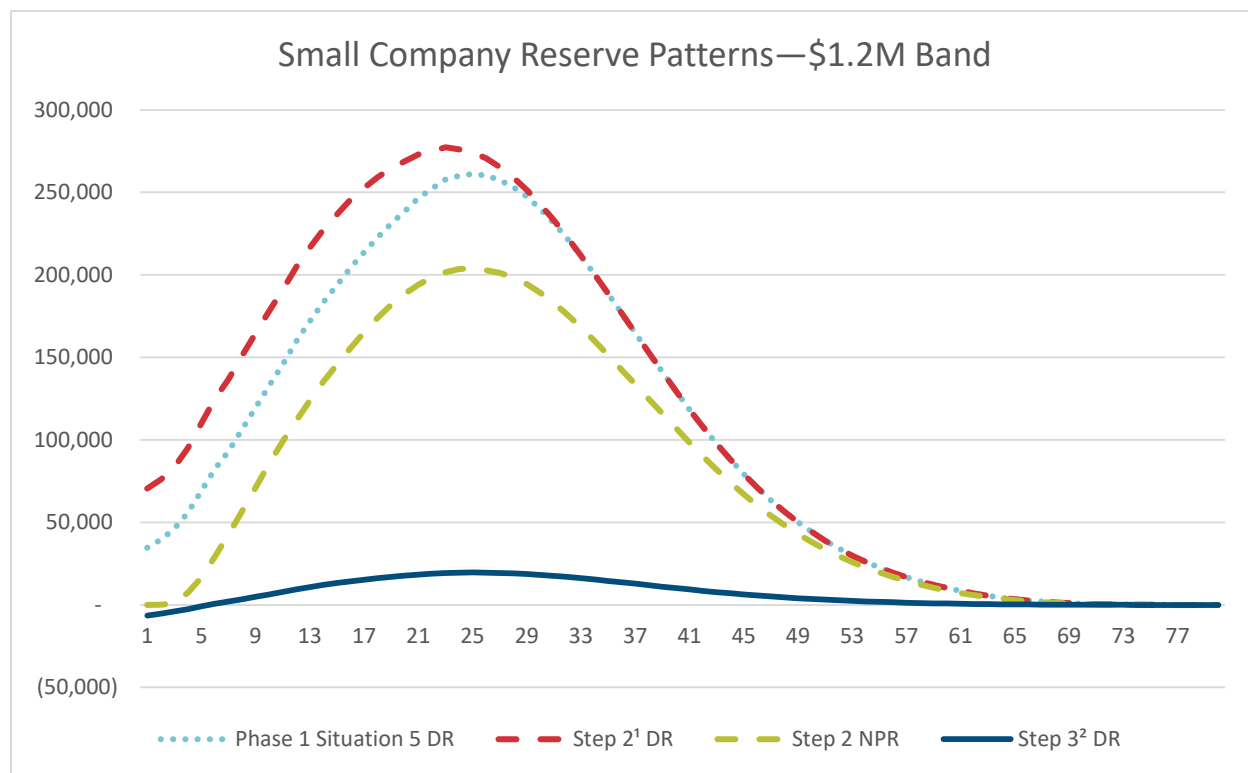
Figure 18: Reserve Levels—ULSG, Low-Band



<sup>1</sup>Step 2: Small Company Acquisition and Reserve Assumptions

<sup>2</sup>Step 3: Small Company with Coinsurance

Figure 19: Reserve Levels—ULSG, High-Band

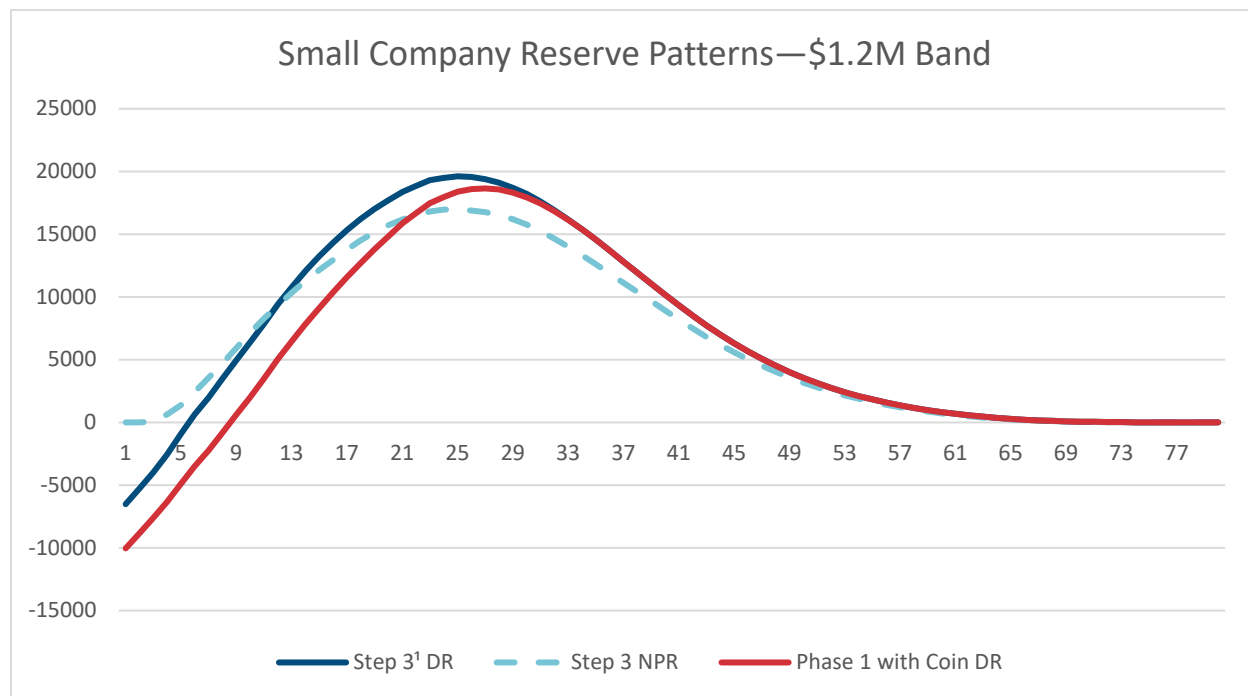


<sup>1</sup>Step 2: Small Company Acquisition and Reserve Assumptions

<sup>2</sup>Step 3: Small Company with Coinsurance

Figure 20 shows the Step 3 NPR and DR compared to the projection of the Phase 1 DR using the same coinsurance approach applied to the small company sensitivity in Step 3. Figure 20 demonstrates the additional DR margin due to the small company reserve assumptions by comparing the small company DR to the Phase 1 DR on the same reinsurance basis. It also shows that the small company NPR exceeds the DR for the first several policy years—the first time this has been observed in the ULSG case studies.

Figure 20: Reserve Levels—ULSG, High-Band



<sup>1</sup>Step 3: Small Company with Coinsurance

## Section 7: Guaranteed YRT Case Studies

In the Phase 1 report, the case studies reflect nonguaranteed yearly renewable term (YRT) reinsurance on insurance amounts in excess of a \$1,000,000 retention limit. As a proxy for reinsurer pricing, YRT premiums were set at 110% of the pricing mortality assumption, and the first-year expense allowance was set equal to 100% of the first-year reinsurance premium. For the modeled VM-20 components (DR and SR), the YRT premiums were treated as a nonguaranteed element. We assumed the reinsurer would raise YRT premium rates to offset the higher mortality assumed in the reserve calculations. Specifically, we countered the impact of mortality margins and omission of mortality improvement required by VM-20 by making the same considerations in the YRT premium rates. For the DR and SR calculations, YRT premiums are 110% of the VM-20 mortality assumption. For the Phase 1 case studies, we did not assume any delay in the reinsurer’s premium increase.

The purpose of this sensitivity is to examine the potential impact to pricing results should the YRT reinsurance agreement guarantee the YRT premium rates. The change made in this Phase 2 sensitivity is to assume that the agreement has a guaranteed premium provision. To be able to better observe the impact of this change, however, the Phase 1 Situation 5 VM-20 pricing needs to be restated assuming a lower ceding company retained amount. As noted above, in the Phase 1 studies, the retained amount was \$1,000,000, and the impact of reinsurance on the pricing results was negligible and only impacted the \$1,200,000 policy size. We ran this Phase 2 case study for high band, and the retained amount is assumed to be \$200,000.

The final change made within this sensitivity is to test the impact of setting the guaranteed YRT rates at specified levels. For term, we ran sensitivities assuming YRT premiums equal to 115% and 120% of expected mortality. For ULSG, we ran only a sensitivity assuming YRT premiums equal to 120% of expected mortality. These sensitivities assumed no additional increase in YRT premiums associated with the higher VM-20 mortality as a result of the mortality margin. The 115% and 120% of expected mortality are proxies for guaranteed YRT premium rates, but are illustrative only and not indicative of the level of rates that would be available in the market. The case studies do not reflect any reduction in capital requirements that might be considered in response to the decreased volatility of results under guaranteed YRT rates.

**Guaranteed YRT Term Case Study**

Figure 21 provides the pricing result for this series of runs for term.

**Figure 21: Pricing Results—Guaranteed YRT Term, High-Band**

Guaranteed YRT Term	Pretax Profit Margin <sup>1</sup>	After-Tax Profit Margin <sup>2</sup>	Adjusted After-Tax Profit Margin <sup>3</sup>	Surplus Strain	IRR Adjusted After-Tax
<u>High-Band Model Office</u>	10-Year Term				
Situation 5 from Phase 1 Report	16.2%	8.8%	1.7%	-112%	7.6%
Revised Baseline with \$200,000 Retention	11.2%	5.6%	3.8%	-44%	23.0%
YRT Premiums at 115% of Expected Mortality	8.5%	3.9%	2.2%	-44%	17.3%
YRT Premiums at 120% of Expected Mortality	5.8%	2.0%	0.3%	-44%	6.0%
<u>High-Band Model Office</u>	20-Year Term				
Situation 5 from Phase 1 Report	19.9%	11.9%	6.7%	-147%	10.4%
Revised Baseline with \$200,000 Retention	12.9%	7.1%	5.8%	-55%	15.0%
YRT Premiums at 115% of Expected Mortality	10.1%	5.6%	4.4%	-55%	23.6%
YRT Premiums at 120% of Expected Mortality	7.2%	3.6%	2.4%	-55%	11.7%
<sup>1</sup> Pretax profit margin is calculated with discount at the pretax net investment earnings rate (NIER). <sup>2</sup> After-tax profit margin is calculated with discount at the pretax NIER. <sup>3</sup> Adjusted after-tax profit margin includes target capital effects and is calculated with discount at the pretax NIER.					

In moving from Situation 5 from the Phase 1 report to the revised baseline with \$200,000 retention:

- Surplus strain is reduced because first-year loss under Phase 1 the baseline is mitigated by the reinsurance claim reimbursements together with a \$0 first-year YRT premium
- After the first year, reinsurance premiums are nonzero, producing a higher reinsurance cost from the lower retention amount. The lower retention (higher reinsured amount) changes the pattern of profits. For the 20-year plan, this means lower profit margins but improved IRR due to the lower initial investment. For the 10-year plan, profit margins before cost of capital are reduced but increased on the after-cost-of-capital basis. IRR is improved as a result of the lower initial investment.

Having reestablished results under a Revised Phase 2 Baseline with \$200,000 retention, we move on to the Guaranteed YRT Premium sensitivities. For this sensitivity series, it is helpful to compare and contrast the outer and inner loop assumptions with respect to mortality rates and YRT premiums, because these are directly related. Figure 22 provides this comparison.

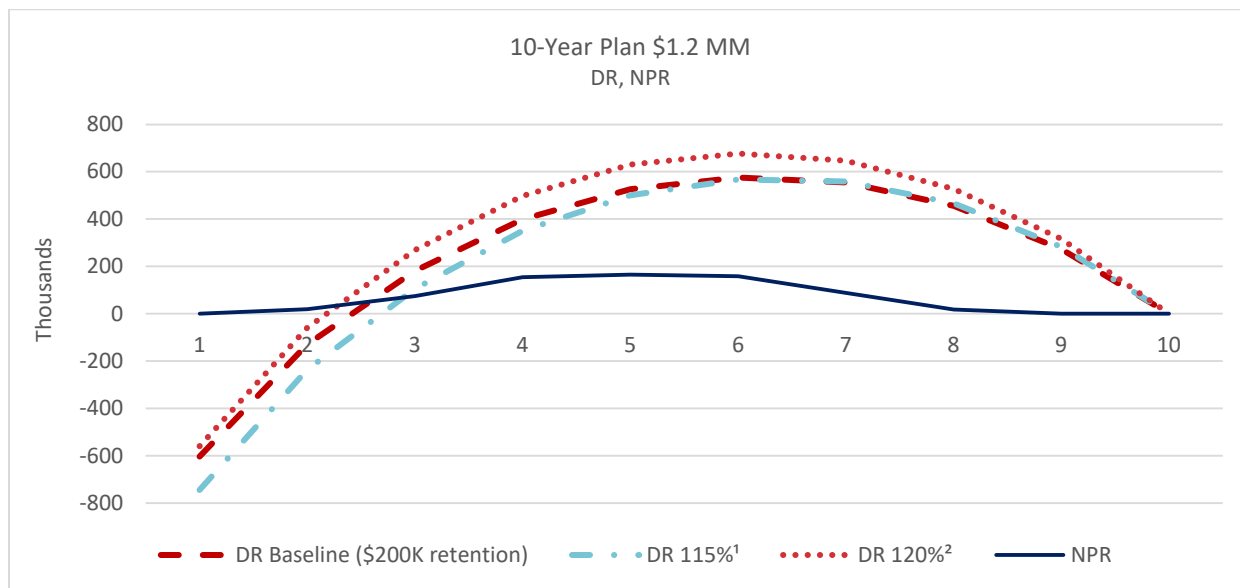
Figure 22: Assumptions—Guaranteed YRT—Term (Description Also Applies to ULSG Sensitivities)

Term	Outer Loop (Projection Assumptions)	Inner Loop (Modeled Reserve Assumptions)
<b>Mortality</b>	Company-anticipated experience, includes improvement into future	Company-anticipated experience with VM-20 margin, but assuming improvement only to the point of valuation, i.e., the future node
<b>YRT Premiums—Baseline with \$200,000 retention (YRT premiums not guaranteed)</b>	YRT premiums are assessed at a level equal to 110% of the mortality rates in the outer loop	DR calculation assumes YRT premiums equal to 110% of the mortality level in the <i>inner</i> loop, which includes the VM-20 margin and improvement only to the point of valuation, i.e., the future node
<b>YRT Premiums—Guaranteed 115%</b>	YRT premiums are assessed at a level equal to 115% of the mortality rates in the outer loop	DR calculation assumes YRT charge level equal to 115% of the best estimate mortality rates; therefore the inner loop YRT premiums are the same as the outer loop YRT premiums
<b>YRT Premiums—Guaranteed 120%</b>	Same rule as directly above, with 115% changed to 120%	Same rule as directly above, with 115% changed to 120%

In this series, as we move from a 10% reinsurer profit in the revised baseline to guaranteed YRT rates of 115% and 120% of expected mortality, the profit margin metrics in Figure 21 decrease with each increase in the guaranteed YRT premium rates. The IRR is influenced by the relationship of surplus strain to the revised pattern of profits.

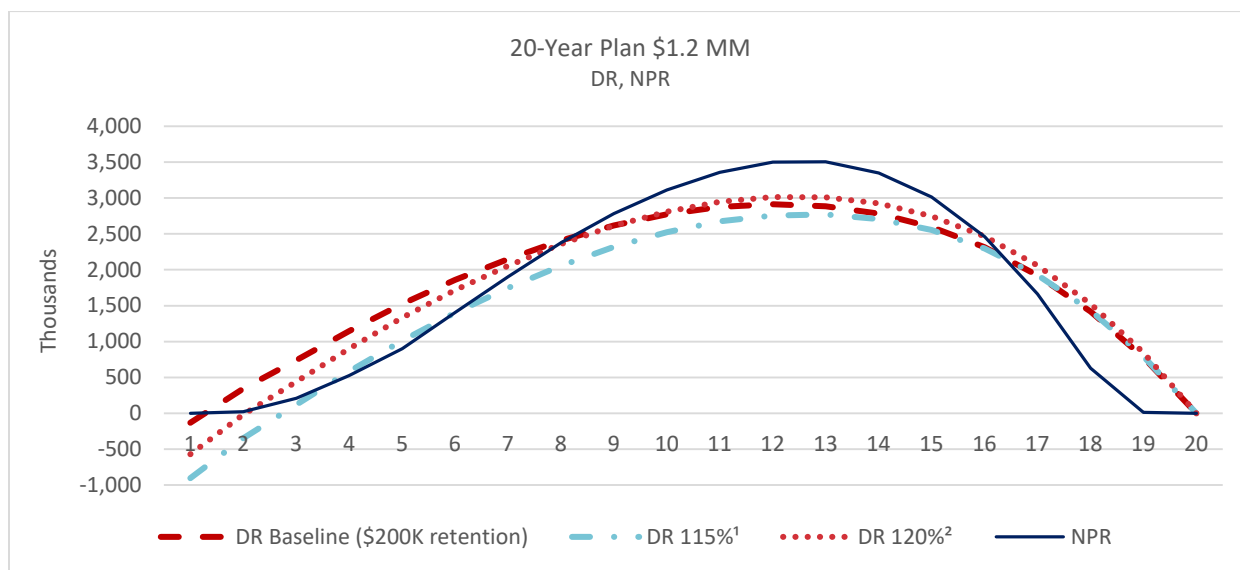
In the inner loop, the interaction of the assumed mortality and the YRT rates is the main driver for the reserve level and pattern. Because the DR calculation includes reinsurance cash flows, the level of YRT premium rates in the inner loop affects the forecast DR. In the Phase 2 revised baseline, it is assumed that YRT premiums are set equal to the insurer's anticipated mortality for the inner loop (i.e., improved only to the node), increased by the VM-20 mortality margin and further increased by a 10% profit margin for the reinsurer. For the 115% guarantee YRT premium sensitivity, the YRT premiums in the inner loop are equal to the outer loop guaranteed YRT rates.

Figure 23: Reserve Levels—Guaranteed YRT, 10-Year Term, High-Band



<sup>1</sup>115%: Guaranteed YRT Premiums Equal to 115% of Expected Mortality  
<sup>2</sup>120%: Guaranteed YRT Premiums Equal to 120% of Expected Mortality

Figure 24: Reserve Levels—Guaranteed YRT, 20-Year Term, High-Band



<sup>1</sup>115%: Guaranteed YRT Premiums Equal to 115% of Expected Mortality  
<sup>2</sup>120%: Guaranteed YRT Premiums Equal to 120% of Expected Mortality

Figures 23 and 24 show the DR 115% as lower than the DR revised baseline (\$200,000 retention) until the latter part of the term period. For the DR 115% sensitivity, surplus strain does not change from the revised baseline because the prevailing reserve in Year 1 has not changed. IRR is improved for the 20-year plan and is lower for the 10-year plan. The DR under the 120% sensitivity is lower than the revised baseline for the 20-year plan in early years, crossing over in later years. For the 10-year plan, the DR 120% is higher than the revised baseline for all years. Because the NPR continues to prevail in the first year under all sensitivities,

the surplus strain is unchanged from the revised baseline. For both plans, the IRR declines when going from DR 115% to DR 120% because the pattern of VM-20 reserves over time has increased as compared to the DR 115% sensitivity.

So, if the reserve requirement is lower in some durations of these various runs, as we have just noted, why do the profit margin metrics show a decline as compared to the revised baseline with \$200,000 retention? The answer to this question is best summarized by looking at the present value of net reinsurance cost (i.e., cost to the direct writer). Figure 25 shows the present value of net reinsurance cash flows (reinsurance premiums less reinsurance claim reimbursements) divided by the present value of direct premiums (which is the same denominator used for the profit margins in Figure 21). As you can see, there is an increasing cost to the direct writer as the sensitivity moves from the revised baseline with \$200,000 retention to each of the two YRT premiums guaranteed at 115% of expected and 120% of expected scenarios. This increasing cost is the cause for declining profit margins.

**Figure 25: Net Cost of Reinsurance—10-Year and 20-Year Term**

Present Value of Net Cost of Reinsurance	10-Year Term	20-Year Term
Revised Baseline with \$200,000 Retention	2.4%	4.1%
YRT Premiums at 115% of Expected	4.9%	6.9%
YRT Premiums at 120% of Expected	7.5%	9.6%

**ULSG Guaranteed YRT Case Study**

The changes in this Phase 2 sensitivity case study are the same as those described for the term case study. The Phase 1 Situation 5 VM-20 pricing is first restated assuming a lower retained amount for the ceding company. As noted above, in the Phase 1 studies, the retained amount was \$1,000,000 and the impact of reinsurance on the pricing results was negligible. In this Phase 2 case study, the retained amount is assumed to be \$200,000.

The second change made within this sensitivity is to set the YRT premiums to 120% of the expected mortality, with no assumed increase in YRT premiums to go along with the higher VM-20 mortality as a result of the mortality margin. The 120% of expected mortality is a proxy for a “guaranteed” YRT premium.

Figure 26 provides the pricing result for this series of runs.

**Figure 26: Pricing Results—Guaranteed YRT ULSG, High-Band**

Guaranteed YRT ULSG	PT Profit Margin*	AT Profit Margin**	Adjusted AT Profit Margin***	Surplus Strain	IRR Adjusted After-Tax
<b>High-Band Model Office</b>					
Situation 5 from Phase 1 Report	19.5%	4.4%	2.6%	-285%	5.9%
Revised Baseline with \$200,000 Retention	14.0%	-2.6%	-4.2%	-393%	4.6%
YRT Premiums at 120% of Expected Mortality	10.1%	4.9%	3.7%	-64%	13.9%
*Pretax profit margin is calculated with discount at the pretax net investment earnings rate (NIER).					
**After-tax profit margin is calculated with discount at the pretax NIER.					
***Adjusted after-tax profit margin includes target capital effects and is calculated with discount at the pretax NIER.					

In moving from Situation 5 from the Phase 1 report to the Revised Baseline with \$200,000 retention:

- Surplus strain is increased because reinsurance has a net cost, and the net cost of ceding additional business is reflected in the initial DR and SR.

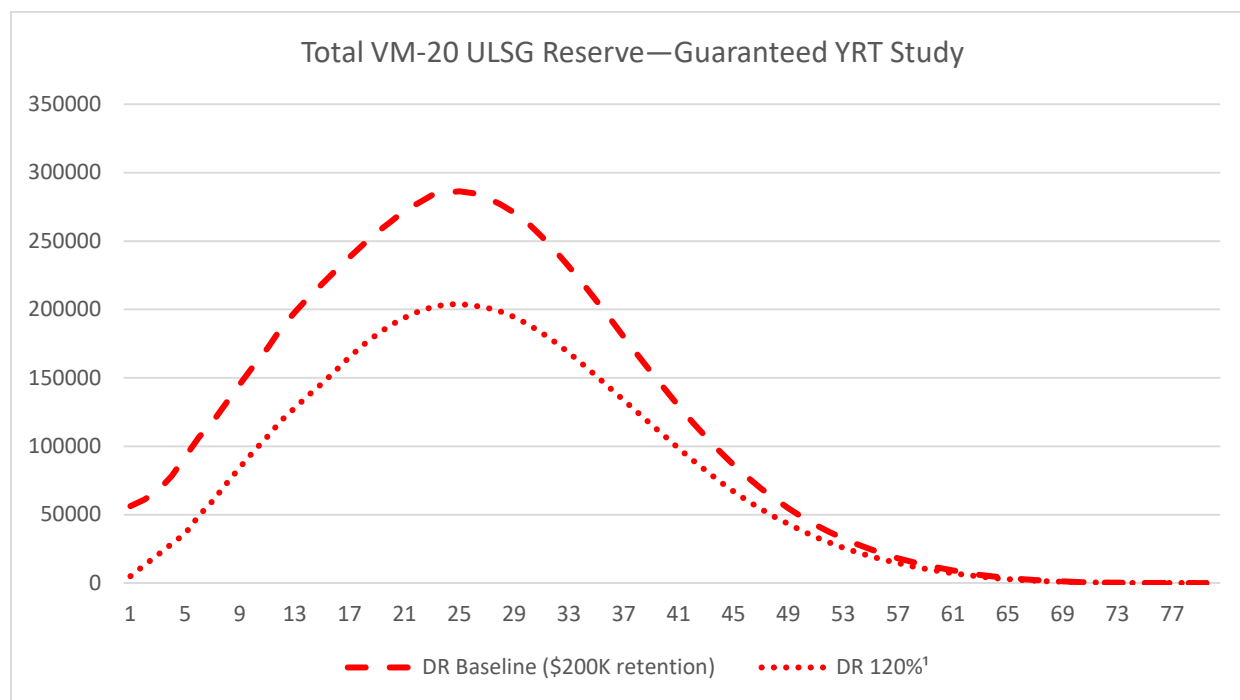


- Increased investment income on the higher reserve levels helps offset the total impact, but profitability is still down across all measures due to the additional cost of ceding the business.
- The long-term nature of ULSG results in considerable long-term DR and SR mortality margins (in particular, assuming no mortality improvement beyond each valuation date), which are reflected in the nonguaranteed YRT rates in Phase 1. Guaranteeing the YRT rates effectively removes these considerable margins from the DR and SR calculations, so the IRR impact of the 10% increase in YRT premium compared to Phase 1 is more than offset by the reserve relief due to the guaranteed YRT rates.

Moving from the revised baseline to YRT premiums guaranteed at 120% of best estimate mortality, profitability improves considerably. The increase in YRT premiums on its own decreases profitability, but it is more than offset by the decreased reserve strain realized by not including margins on the YRT reinsurance premiums. The profit margins are increased marginally, but the decreased surplus strain results in considerably higher IRRs. We did not perform the 115% sensitivity on ULSG, as it seems clear that the results would be slightly more favorable than the 120% situation (more reserve relief at lower cost).

Figure 27 shows the VM-20 reserve on the revised baseline compared to the guaranteed YRT premium situation for the high-band (\$1.2M) cell. The total reserve continues to be driven by the DR with a small excess SR.

**Figure 27: Reserve Levels—Guaranteed YRT—ULSG**



<sup>1</sup>120%: Guaranteed YRT Premiums Equal to 120% of Expected Mortality

Note the difference in the relative position of the DR revised baseline and DR 120% lines in the term versus the ULSG guaranteed YRT case studies (compare Figures 23 and 24 to Figure 27). For the term products, there was a tension between the cost of the assumed increase in YRT premiums versus the impact of the guaranteed premiums on the VM-20 reserves, producing varying impacts on profitability and depending on the product and profit metric under consideration. For the ULSG block, the increase in YRT premiums on its own decreases profitability, but it is more than offset by the decreased reserve strain realized by not including margins on the YRT reinsurance premiums. The profit margins are increased marginally, but the decreased surplus strain results in considerably higher IRRs. The impact on VM-20 reserves and profitability in general would depend on the interplay between plan characteristics and the level of guaranteed YRT premiums as well as projection and reserve assumptions.

## Section 8: Other Case Studies

### 10 Years of Post-Level Term Cash Flows

In the Phase 1 analysis, we assumed a pricing horizon equal to the level premium period. For the 10-year plan, this meant all profit metrics used 10 years of profit results, and for the 20-year plan, we used 20 years of profit results. This was accomplished by assuming 100% shock lapse at the end of the level premium period. As noted in the Phase 1 report, following the 10- and 20-year level premium period, the premiums increase to 250% of the 2017 CSO age nearest birthday ultimate mortality rates per \$1,000 on the preferred table basis.

The objective of this sensitivity is to show how the profitability of Situation 5 from Phase 1 would change if the company included post-level premium period cash flows in its analysis. Ten years of post-level term period cash flows are recognized in the pricing exercise, with appropriate changes to baseline assumptions. Figure 28 summarizes the Phase 1 assumptions as compared to this Phase 2 sensitivity.

Figure 28: Assumption Changes—Post-Level Term Case Study

Situation	Shock Lapse	Mortality Deterioration
Phase 1 Situation 5	100% at end of Level Premium Period	Not applicable
<b>Phase 2: Include 10 Years Post-Level Term Period Cash Flows Sensitivity</b>		
10-Year Term	80/60/45/10%	300% grading to 100% over 10 years
20-Year Term	90/75/45/10%	450% grading to 100% over 10 years

Figure 29 provides a summary of the pricing results under this sensitivity.

Figure 29: Pricing Results—Post-Level Term

10 years of Post-Level Term Cash Flows	Pretax Profit Margin <sup>1</sup>	After-Tax Profit Margin <sup>2</sup>	Adjusted After-Tax Profit Margin <sup>3</sup>	Surplus Strain	IRR Adjusted After-Tax
<b>High-Band Model Office</b>					
<b>10-Year Term</b>					
Situation 5 from Phase 1 Report	16.2%	8.8%	1.7%	-112%	7.6%
Situation 5, Including Post-LT Period Cash Flows	22.5%	13.8%	12.6%	-112%	17.3%
<b>Low-Band Model Office</b>					
Situation 5 from Phase 1 Report	15.7%	8.8%	2.8%	-128%	9.1%
Situation 5, Including Post-LT Period Cash Flows	21.4%	13.2%	11.9%	-128%	16.0%
<b>High-Band Model Office</b>					
<b>20-Year Term</b>					
Situation 5 from Phase 1 Report	19.9%	11.9%	6.7%	-147%	10.4%
Situation 5, Including Post-LT Period Cash Flows	18.0%	11.0%	9.1%	-147%	11.7%
<b>Low-Band Model Office</b>					
Situation 5 from Phase 1 Report	18.4%	11.1%	6.7%	-172%	9.9%
Situation 5, Including Post-LT Period Cash Flows	18.7%	11.5%	9.5%	-172%	10.9%
<sup>1</sup> Pretax profit margin is calculated with discount at the pretax net investment earnings rate (NIER). <sup>2</sup> After-tax profit margin is calculated with discount at the pretax NIER. <sup>3</sup> Adjusted after-tax profit margin includes target capital effects and is calculated with discount at the pretax NIER.					

Under the stated assumptions, the post-level term period cash flows are clearly beneficial to the profitability metrics. By product, the 10% differential in the shock lapse between the Term 20 (90%) and Term 10 (80%) is noticeable. Both band sizes of the Term 10 are about twice as profitable from an IRR perspective. The Term 20 IRR increases by 1.4 and 1.0 points in this sensitivity. Part of this difference has to do with the difference in shock lapse (90% versus 80% for the Term 10), and part has to do with the term period being longer for the Term 20 product, thus discounting the post-level term period cash flows over a longer period.

Within the results for the 20-year term, two of the profit margins for the high-band model office are lower than the comparable Phase 1 studies (18.0% and 11.0%). This occurs because, for the combination of assumptions used, although the present value of profits has improved by 6.4% by including 10 additional years of post-level term period cash flows, the present value of premium has increased 17.5% for the same reason of including 10 additional years of post-level term period cash flows. Specifically, if we look at the pretax profit margins in Figure 29 of 19.9% from the Phase 1 results and 18.0% from the Phase 2 sensitivity and break these ratios down into their numerator and denominator components, the reason for this relationship becomes clear and is detailed in Figure 30.

**Figure 30: Profits—Post-Level Term**

Present Value	Phase 1	Phase 2 Sensitivity	Percentage Increase
Pretax Profits	\$1,779,175	\$1,893,150	6.4%
Premium	\$8,935,652	\$10,501,691	17.5%
Profit Margin	19.9%	18.0%	

For this sensitivity, statutory and tax reserves during the level premium period remain the same as Phase 1 statutory and tax reserves. This is true for the NPR, because we have not changed the gross premium structure. This is also true for the DR, because during the level premium period, the present value of post-level period cash inflows in excess of cash outflows are not permitted, per VM-20 Section 9D6, leading to the 100% shock lapse assumption.

For the 10 years *after* the level premium period that are included in the profit study of this sensitivity, this sensitivity continues to need a statutory and tax reserve. When a policy persists beyond the level premium period, as in this case study, and the assumed cash inflows are greater than the assumed cash outflows, this produced a negative DR. The NPR method produces a negative terminal reserve, and the floor on the NPR is the remaining cost of insurance for the period. As the sensitivity assumes all policies are issued at the start of the projection, policy anniversaries are coincident with the end of each profit study year, producing zero remaining cost of insurance. Therefore, for this sensitivity, the greater of the NPR and DR for years following the level premium period is \$0.

For a company that includes post-level period profits in its pricing, the following points are considerations introduced by VM-20 requirements:

- As noted above, Section 9D6 disallows, in the calculation of the DR for durations in the level premium period, recognition of cash inflows in excess of cash outflows arising from durations beyond the level premium period. However, the exact language of this section indicates that for the period following the level premium period the cash inflows or outflows shall be adjusted such that the present value of cash inflows does not exceed the present value of cash outflows. The implication is that the DR during the level premium period would include the present value of cash outflows in excess of cash inflows, i.e., cash losses, which would increase the DR over one that does not consider such cash losses.
- In the context of the above, a company's credibility of experience lapse and mortality during the post-level premium period will impact the VM-20 prudent estimate assumptions. Many companies lack credible experience in these later durations, particularly for 20- and 30-year term plans.
- A term product's premium design will impact the NPR because of the prescribed lapse assumption for NPR calculations. Premium structure, particularly the structure after the level premium period, drives the lapse rate assumed at the end of the level premium period.

**Simplified Issue Single Cell**

In the Phase 1 analysis, the company experience mortality was assumed to be consistent with that of a full underwriting program. The purpose of this Phase 2 Simplified Issue Single-Cell sensitivity is to examine the impacts introduced by SI underwriting for level term products in the context of VM-20. In this sensitivity, we assume the type of SI program typical in the industry, represented by the inclusion of a handful of medical questions and prescription checking protocols and resulting in accept or reject outcomes. In SI programs such as this, there would typically be a limited number of additional tables of mortality built into the standard class. To be clear, the SI program represented here is not the “express issue” or “accelerated underwriting” that is more recently becoming popular. However, this latter type of underwriting is discussed in this section.

In this sensitivity, we begin with a single cell from Situation 3, Phase 1, which assumes underwriting consistent with a fully underwritten program, Model 830 (XXX, AG 38) reserves using 2017 CSO valuation mortality and no financing. We then move the analysis to an SI product situation via a stepwise process. The cell used for this demonstration is a 20-year level term policy, issue age 45, Male Nonsmoker Class 3, \$350,000 band size. The premium per unit in Phase 1 is \$1.91 with a \$60 policy fee. Because we are starting with the low-band cell, there is no reinsurance in this sensitivity. It is from this Phase 1 Situation 3 platform that we begin to make stepwise changes, explained in the following paragraphs.

The first stepwise change is titled “SI\_1.” In this step, changes are made exclusively to expense, mortality and lapse assumptions to reflect experience assumptions typically used in pricing a SI product. The X-factors are set at 100%. There are no changes to policy size or premium in this step. Figure 31 summarizes the SI\_1 assumption changes and compares these to the comparable Phase 1 Situation 3 baseline assumptions.

**Figure 31: Assumption Changes—Simplified Issue Step 1**

SI_1		
Simplified Issue Assumptions, Model 830 Reserves, 2017 CSO		
Experience Assumption Summary	From: Phase 1 Situation 3	To: SI_1
Commission	Year 1: 105% Years 2+: 0%	Year 1: 135% Years 2+: 2%
Acquisition Expense	\$250 per policy; \$0.20 per unit	\$150 per policy; \$0.20 per unit
Maintenance Expense	\$45 per policy; 1.5% premium	\$35 per policy; 2.0% premium
Experience Mortality	2008 VBT ANB S&U with scalars representative of top-quartile term insurance writers	100% of 2008 VBT Limited Underwriting S&U
Experience Lapse	Yr 1 6% Yr 2 6% Yr 3 5% Yr 4 4% Yr 5 4% Yr 6+ 3%	Yr 1 20% Yr 2 15% Yr 3 10% Yr 4 7% Yr 5 7% Yr 6+ 7%
X-Factor	Ratio of experience mortality rates to 2017 CSO valuation mortality rates	100%

The second stepwise change is titled “SI\_2.” In this step, changes are made to the cell’s average policy size and policy premium amount to represent a typical SI size and return profitability to levels like that of Phase 1, Situation 3. In this sensitivity, we use a \$100,000 face amount as representative of a reasonable face amount for the SI product under study. We use a policy premium that better represents premiums charged in the SI marketplace. In step SI\_2, the reserving method remains unchanged from SI\_1, Method 830 (XXX, AG 38) reserves with X-factors of 100%.

SI\_2 represents the profitability for a company that chose not to implement VM-20 reserves through exclusion testing or companywide exemption; see Figure 32.

Figure 32: Assumption Changes—Simplified Issue Step 2

SI_2		
Simplified Issue Assumptions, Model 830 Reserves, 2017 CSO		
	From: SI_1	To: SI_2
Average Policy Size	\$350,000	\$100,000
Policy Premium	$\$1.91 \times 350 + \$60 \text{ fee}$ = \$728.50	$\$4.115 \times 100 + \$60 \text{ fee}$ = \$471.50

The third stepwise change is titled “SI\_3.” In this step, the analysis moves to a VM-20 reserving regime. The reserving methods for every step in this process are summarized in Figure 33. In SI\_3, the mortality credibility and SDP remain the same as in Phase 1; therefore, the mortality margins and the grading rules from Phase 1 continue to apply.

SI\_3 represents the profitability for a company that chose to implement VM-20 reserves for the SI product.

Figure 33: Assumption Changes—Simplified Issue Step 3

SI_3	
Simplified Issue Assumptions, Implement VM-20	
Phase 1 Situation 3	Model 830 (XXX; AG 38); X-factors are ratio of experience mortality rates to 2017 CSO valuation mortality rates
SI_1	Model 830 (XXX; AG 38); X-factors are 100%
SI_2	Model 830 (XXX; AG 38); X-factors are 100%
SI_3	VM-20 assuming same mortality credibility and SDP as Phase 1

Figure 34 shows the progression of profitability as the cell moves through each step of the sensitivity. Directly following Figure 34, a discussion of the profitability outcomes is provided.

Figure 34: Pricing Results—Simplified Issue- 20-Year Term Single Cell

Simplified Issue (Single Cell) 20-Year Term	Pretax Profit Margin <sup>1</sup>	After-Tax Profit Margin <sup>2</sup>	Adjusted After-Tax Profit Margin <sup>3</sup>	Surplus Strain	IRR Adjusted After-Tax
	20-Year Term				
Phase 1, Situation 3	20.9%	12.8%	8.5%	-164%	8.3%
SI_1: SI Experience Assumptions	-53.1%	-37.3%	-40.7%	-368%	-13.6%
SI_2: \$100,000 Average Policy Size; Higher Per Unit Premium	10.9%	6.3%	4.8%	-120%	8.8%
SI_3: Implement VM-20 Reserves	10.9%	6.1%	4.6%	-120%	10.6%
<sup>1</sup> Pretax profit margin is calculated with discount at the pretax net investment earnings rate (NIER). <sup>2</sup> After-tax profit margin is calculated with discount at the pretax NIER. <sup>3</sup> Adjusted after-tax profit margin includes target capital effects and is calculated with discount at the pretax NIER.					

Starting with the Phase 1 Situation 3 and adopting SI assumptions in step SI\_1:

- Resetting the X-factor to 100% without a change in premium has introduced deficiency reserves, thus increasing capital strain.
- The assumed experience mortality and lapse rates have increased. Both are a drag on profitability since the policy premium has not yet been adjusted.
- Commission rates under SI\_1 are higher, another drag on profitability.
- Acquisition and maintenance expenses have been reduced, reflecting the savings that SI programs provide. However, these savings are not enough to offset the items above.

Continuing on to SI\_2, where the policy size and premium amount are synched up with industry expectations for SI business:

- The policy size for the SI single cell is set at \$100,000, which is typical in the industry for this type of underwriting program.
- To solve for the appropriate SI premium amount, we targeted an IRR in the 8–9% range since the Phase 1, Situation 3 IRR is shown at 8.3%.
- For this cell, the premium required to achieve the 8–9% IRR objective is \$4.115 versus the \$1.91 per unit premium from Phase 1. On a policy level basis, the cost for SI is \$471.50 for \$100,000, whereas the cost for fully underwritten is \$728.50 for \$350,000 (see Figure 32).
- Deficiency reserves are eliminated due to the increased per unit premium amount. Reserve charts appear later in this section.

Last, moving to the SI\_3 iteration, VM-20 reserves are implemented, and the following characteristics influence the profitability metrics:

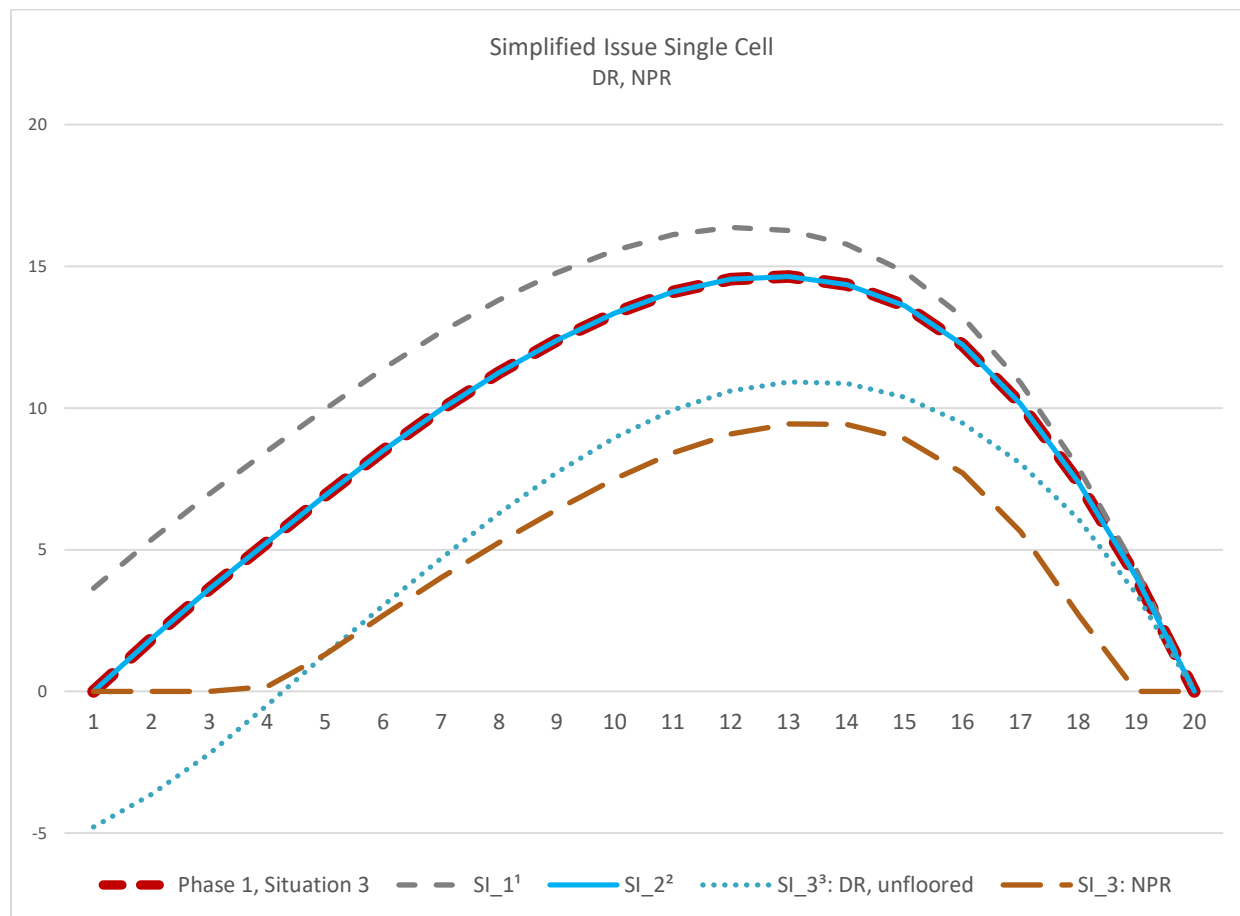
- Pretax profit margin is unchanged from SI\_2 to SI\_3 because the statutory reserve requirement continues to be a \$0-to-\$0 pattern.
- After-tax profit margins show a slight decline, because the VM-20 tax reserve of NPR for this cell is slightly lower than the DR at policy durations 6 and later. Reserve charts appear later in this section. Remember that for SI\_2 (the step just prior to SI\_3), the reserve method was Model 830, where the statutory and tax basis reserves are the same. In SI\_3, the VM-20 implementation step, some tax inefficiency is introduced, which means that the after-tax profit metrics will be slightly lower than the prior step.
- The IRR has improved from SI\_2 (10.6% versus 8.8%). Why is this? The VM-20 reserve in this cell is the greater of the NPR and the DR. In this case study, specifically in step SI\_2, we solved for a premium that would return the profitability of the cell to earlier levels. This implies that the cell demonstrates positive profitability—that is, that the premium supports the obligations of the cell as well as returns an after-tax profit to the issuer. As a result, in SI\_3, the early DR amounts are negative (from issue to duration 4). For policy years through duration 4, there is reserve relief when compared to the reserving paradigm of SI\_2 (based on Model 830). The VM-20 reserve still builds up over the first half of the insurance period and releases during the latter half of the insurance period, but it does so under a different pattern than Model 830. Whenever the reserve pattern changes for the better, the IRR improves.
- For a company issuing a term product under a SI underwriting program, this single-cell example indicates that the adoption of VM-20 reserving methods together with current expectations for policy size and premium amounts imply a similar and perhaps improved IRR when compared to Model 830 reserving methods. However, this outcome is dependent upon the chosen VM-20 assumption set, product design and premium levels.

The VM-20 reserve for any product (term or otherwise) is highly dependent upon the company's actual VM-20 assumption set, product design and premium levels. The case study presented here is specific to its set of experience assumptions and product characteristics and may not be indicative of results that might be expected in the SI market.

To compare reserve levels and patterns, the projected reserves for the cell under each step are divided by the lives in force at each duration of the pricing projection. This allows a comparison of the reserves for Phase 1 Situation 3 and SI\_1, which both

assume a \$350,000 policy size to the SI\_2 and SI\_3, which both assume a \$100,000 policy size. A chart of reserves per unit inforce is presented in Figure 35, followed by a discussion of the reserving outcomes.

Figure 35: Reserve Levels—Simplified Issue—20-Year Term Single Cell



<sup>1</sup>SI\_1: Simplified Issue Assumptions

<sup>2</sup>SI\_2: Simplified Issue Average Size and Premiums

<sup>3</sup>SI\_3: Simplified Issue VM-20

Phase 1, Situation 3: The Phase 1, Situation 3 line depicts Model 830 reserves for this case study single cell whereby the X-factors used in the minimum valuation basis calculations are a ratio of the experience mortality rate to the valuation mortality rate. As described in Section 7 of the Phase 1 report, these X-factors are designed to minimize or eliminate any deficiency reserves. For this cell, the approach eliminates any deficiency reserve requirement. The Model 830 (XXX; AG 38) reserve takes a \$0-to-\$0 pattern. The policy is assumed issued at the beginning of the year, January 1.

SI\_1: The SI\_1 line depicts the Model 830 reserves for this case study single cell whereby the X-factors used in the minimum valuation basis calculations are set at 1.000. With no increase to the fully underwritten top-quartile premium (the Phase 1 premium) yet, the Model 830 method reserves on the minimum basis produce a higher starting value than under Phase 1, Situation 3, that is, a deficiency reserve.

SI\_2: The SI\_2 line depicts the Model 830 reserves for this case study single cell whereby the X-factors used in the minimum valuation basis calculations are set at 1.000 and the premium per unit has increased. As a result, the deficiency reserves of SI\_1 have been eliminated, and the reserves are back to the level and pattern of Phase 1, Situation 3.



SI\_3: The SI\_3 lines represent implementation of VM-20 method reserves. The SI\_3 NPR line is the NPR for this single cell. The SI\_3 DR line is the DR for this single cell. Note the following:

- Because the cell has been priced in step SI\_2 for a statutory profit, the DR (implemented in SI\_3) at issue is negative.
- The NPR prevails from issue until the sixth policy year, when the DR begins to prevail.
- The VM-20 reserve builds up during the first half of the insurance period and releases during the latter half of the insurance period. Like the Model 830 method, the VM-20 method follows a \$0-to-\$0 pattern; however, the build-up is delayed until policy year 5, and the level of build-up is lower than under Model 830. This pattern and overall level provide reserve relief as compared to SI\_2, and thus a higher IRR metric.
- The NPR drives the tax basis profit results for all policy years, since NPR is the assumed tax reserve. Since the NPR is a smaller reserve than DR for most durations of this single-cell case study, there are tax inefficiencies during those years. This condition is cause for after-tax profit margin metrics to be slightly lower than similar metrics under SI\_2.

### Significant Other Considerations

It is important to understand some additional issues regarding company mortality experience and industry table mapping and partial credibility, which, while applicable to SI products, are not unique to SI products. Such considerations would apply to any VM-20 exercise where products are issued in new markets or under new practices.

In this case study, we use 2017 CSO as the valuation mortality basis throughout all the various steps. The development of SI basic and valuation tables has been under development for some time. This development, however, has been fraught with challenges, not the least of which is to define the category of business for which the SI tables would apply. Companies have taken a variety of approaches for business that is issued with other than fully underwritten processes. Early SI programs started as an application with limited health condition and avocation questions and perhaps a telephone interview, but those evolved into programs that also include automated prescription database queries, motor vehicle report queries, medical information bureau checking, and credit and other financial information checks. As a result, recent issues of SI business have been more frequently on a smoking-distinct basis and at ever-increasing policy sizes. This variety of in-force policy characteristics, all labeled “SI,” makes the development of a single SI table difficult.

Further complicating this situation is the emerging underwriting technology where data collection other than home office specimens are used as proxies for other predictors of life expectancy. Processes of this type include those commonly referred to as “automated,” “accelerated,” “express” or “efficient” underwriting, where the mortality outcomes are expected to mirror those of fully underwritten programs rather than traditional SI programs. There are very limited data for this type of business at this early stage of the market.

Companies in either of these markets (traditional simplified and the emerging underwriting technology) may or may not be using the 2017 CSO valuation mortality table for the NPR component of VM-20 reserves in the future.

In this case study, we assumed that the writing company maintains a high level of credibility around its experience mortality—with a SDP long enough that grading into an industry table for a 20-year term product is unnecessary. But what considerations would a company need to sort through if this were not the case?

- With partial credibility, the company must choose an industry table to supplement its own limited experience. Currently the 2015 Valuation Basic Table (VBT) series is the set of tables VM-20 points to for this purpose. There are relative risk levels within this series from which to choose. Nonsmoker risks have tables from RR50 to RR175, smoker risks cover RR75 to RR150. However, there is no Limited Underwriting (LU) table within the 2015 VBT series. The most recent LU table is included with the 2008 VBT series.
- How would the actuary demonstrate a mapping to the industry table? The Underwriting Criteria Scoring Tool (or RR Tool) is a method to map to industry tables, but this tool is best used for traditionally fully underwritten, preferred risk class categories. The company writing SI or business using emerging underwriting technology must use another actuarially sound method to map into the industry tables (Section 9.C.3.e).
- And what if the company’s mortality expectation is higher than any of the available industry tables? There is language in VM-20 Section 9.C.7.b that requires the resulting anticipated experience assumption to be no lower than the mortality rates that are actually expected to emerge and that the company can justify. This language suggests that the modeled reserve components be based on anticipated experience rates that align with the higher expectation and then appropriate margins be applied.

Clearly, actuarial practice regarding these issues will continue to develop over time as these markets and VM-20 experience mature.

**30-Year Level Premium Term Single Cell**

The Phase 1 analysis was based on a model of 10- and 20-year level term plans. This sensitivity examines the change in profitability for a longer level premium period product in moving from Model 830 XXX reserves to VM-20 reserves.

Using a single cell from Phase 1, specifically a 20-year term plan cell, appropriate design changes were made to reflect a 30-year term plan. The cell used for this demonstration is issue age 45 Male Nonsmoker Class 3, \$350,000 size. We first use this cell to demonstrate profitability under *Situation 3* of Phase 1, which uses XXX (Model 830) reserve methods and 2017 CSO mortality for statutory and tax basis reserves. There are no reinsurance and no reserve financing in this sample cell case study. Profitability under this reserving schematic is then compared to the same cell under *Situation 5*, which is the full PBR pricing situation.

Changes to Phase 1 baseline product design and assumptions are listed below. The prudent estimate mortality assumption remains unchanged from Phase 1. Should a company need to grade in to industry mortality rates, given the longer level term period, there would be an impact to the profitability outcome of this sensitivity:

- Level premium period changed from 20 years to 30 years
- Gross premium per unit: \$2.99 (from \$1.91 for 20-year term)
- Pricing horizon extended to 30 years
- Model 830 XXX reserves calculated consistent with a 30-year level premium term to 95 structure
- VM-20 lapse margin: +10% for (t = 1–10); –10% for (t = 11–30)

Figure 36 provides the profitability metrics, Figure 37 provides a reserve comparison graph and Figure 38 provides a graph of the profit pattern over time. Commentary about this sensitivity analysis appears following Figure 38.

**Figure 36: Pricing Results—30-Year Term, Low-Band Single Cell**

30-Year Term (Single Cell)	Pretax Profit Margin <sup>1</sup>	After-Tax Profit Margin <sup>2</sup>	Adjusted After-Tax Profit Margin <sup>3</sup>	Surplus Strain	IRR Adjusted After-Tax
<u>Cell: Issue Age 45 Male N3, \$350,000 Size</u>					
Situation 3) XXX Stat/Tax, 2017 CSO	25.2%	14.8%	12.4%	–351%	7.5%
Situation 5) VM-20 NPR+DR Excess Stat, NPR Tax, 2017 CSO	25.2%	15.7%	13.5%	–112%	15.0%
<sup>1</sup> Pretax profit margin is calculated with discount at the pretax net investment earnings rate (NIER). <sup>2</sup> After-tax profit margin is calculated with discount at the pretax NIER. <sup>3</sup> Adjusted after-tax profit margin includes target capital effects and is calculated with discount at the pretax NIER.					

Figure 37: Reserve Levels—30-Year Term, Low-Band Single Cell

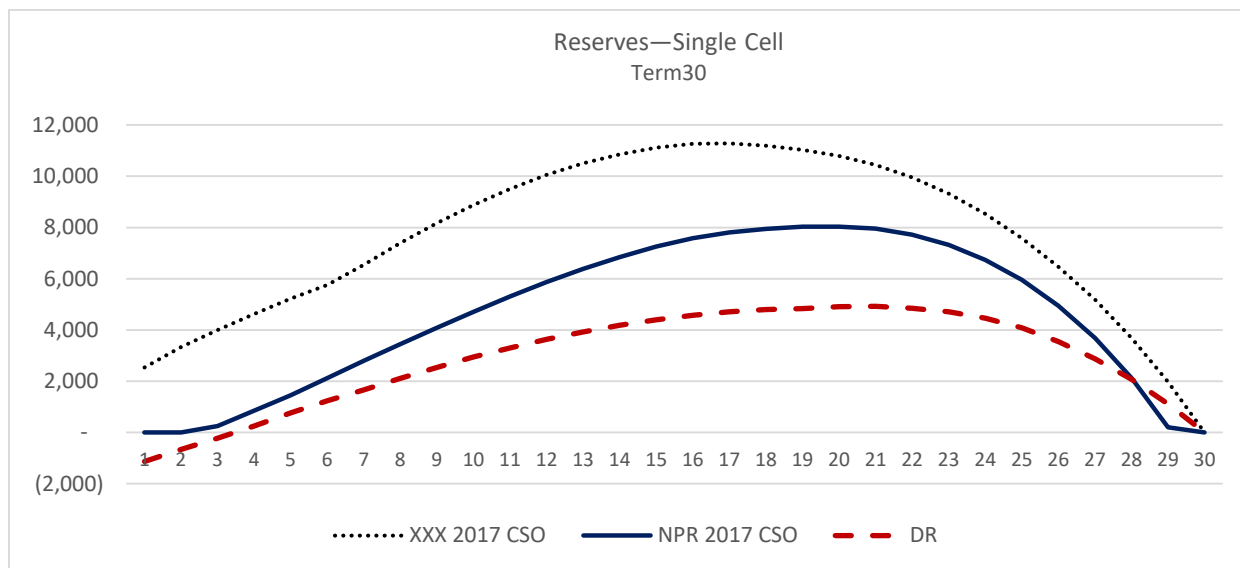
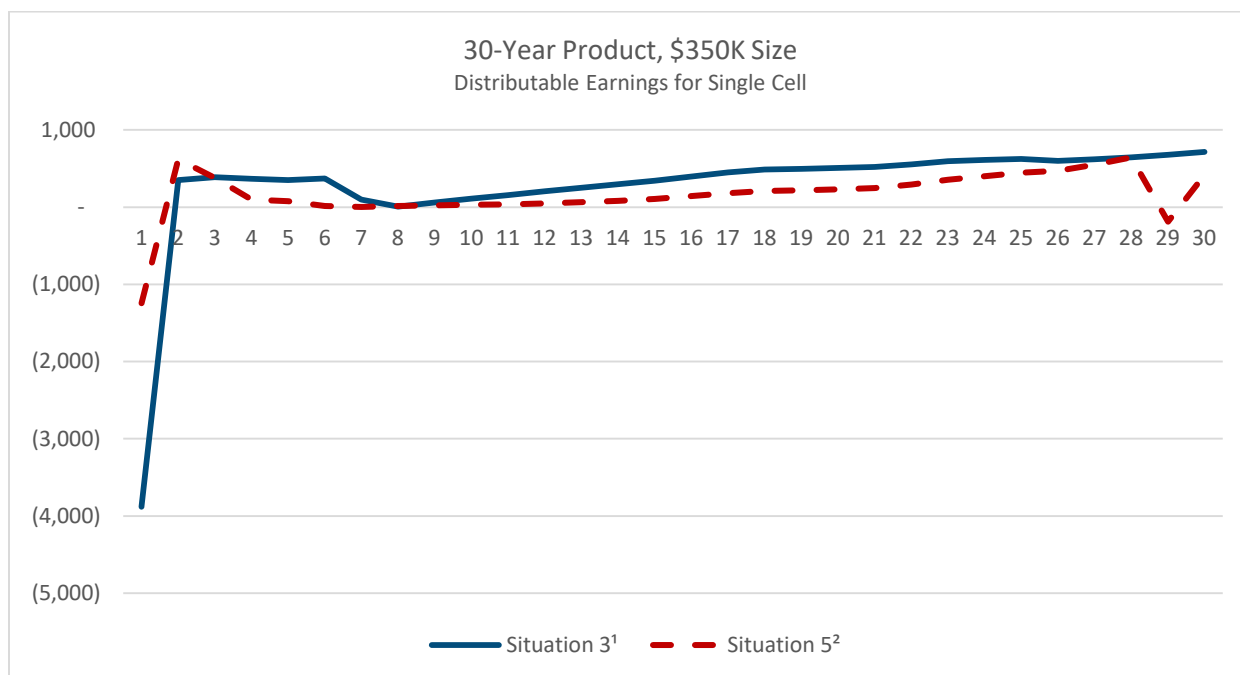


Figure 38: Profit Pattern—30-Year Term, Low-Band Single Cell



<sup>1</sup>Situation 3: XXX (Model 830) Reserve Methods and 2017 CSO Mortality

<sup>2</sup>Situation 5: Full PBR Pricing Situation

This single-cell analysis depicts the impact to longer level term period products in moving from Model 830 reserves to VM-20 reserves. For our case study, as with the 20-year term product, Figure 37 shows that the NPR drives the VM-20 reserve until the very last durations in the term period. While this case study demonstrates significant reductions in reserve requirements between these two reserving regimes, this outcome will be company-specific. Note the following:

- The NPR method of VM-20 produces significant reserve relief for the case study single-cell 30-year term product, thus reducing the initial surplus strain and improving the IRR profit metric significantly as compared to a similar analysis using XXX reserves.
- The pattern of profits under Situation 5 (PBR) has higher profits early and lower profits later, as compared to the Situation 3 (XXX) pattern.
- The pretax profit margin is the same between the two situations, as the reserve is a \$0-to-\$0 pattern. On an after-tax basis, the reserves of Situation 3 (XXX) introduce some inefficiency because the case study design does have a measure of deficiency reserves. Situation 5 (VM-20) demonstrates very little tax inefficiency because the VM-20 reserve is equal to the NPR reserve until the very end.
- For this 30-year term single cell, the tax impacts, together with the reduction in reserve requirements and material surplus relief make for a significant increase in profitability under Situation 5 (VM-20).

**Short-Pay ULSG Single Cell**

This case study illustrates the pricing for a short-pay ULSG policy. The example starts with 2017 CSO VM-20 pricing for a single level-pay cell, based on Phase 1 Pricing Situation 5, and shows changes in pricing and reserves for the same sample cell under shorter pay period assumptions.

The pricing cell is an issue age 55, male nonsmoker, \$350,000 face amount cell. Our original level premium was based on a competitive target of the top quartile of the market. For this study we chose to follow a different approach in setting the single-pay and 10-pay premiums, since there is typically a competitive trade-off between various premium patterns. We used competitive data to develop an estimate of the relationship of the single-pay and 10-pay premiums when compared to the level premium for a top-quartile company. The results were a 10-pay premium of 2.2 times the level premium and a single-pay premium 20.9 times the level premium. It is assumed that a short-pay buyer is more interested in permanent coverage than the level-pay buyer. Therefore, we adjusted the ULSG mechanics for the short-pay policies to persist until age 121, rather than the target age of 110 in Phase 1. The example includes dynamic logic to set lapses to zero once the product becomes paid up and there is no cash value. When the policy is paid up with cash value, the lapse rates are half of the level-pay assumed rate.

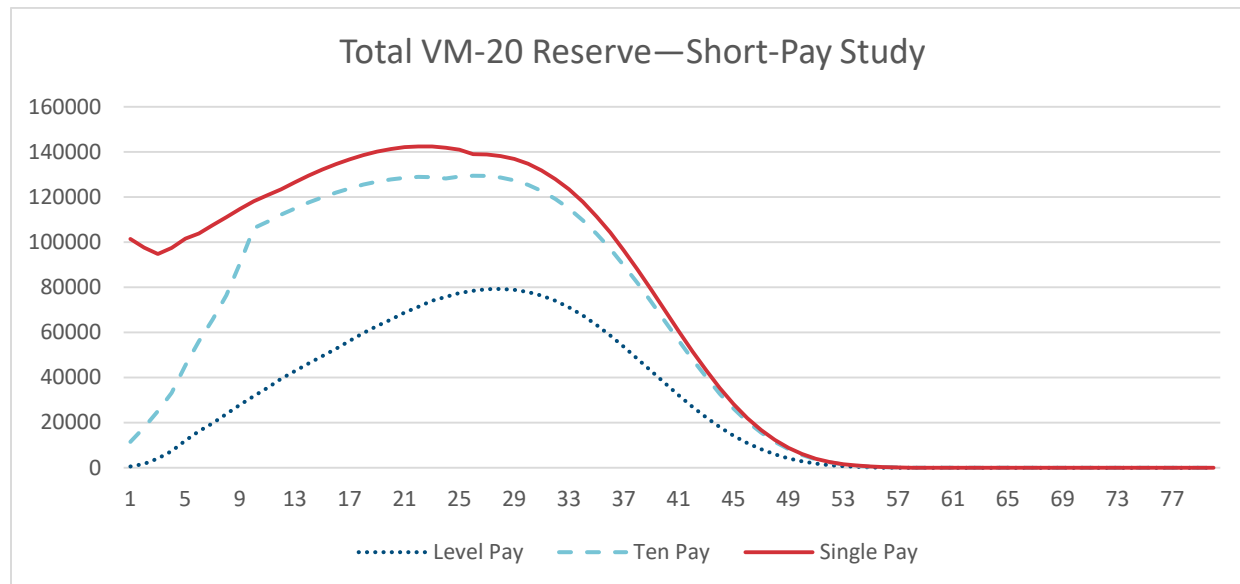
Figure 39 shows the pricing results for each of the three premium patterns.

**Figure 39: Pricing Results—Short-Pay ULSG Single Cell**

ULSG—Short-Pay Single Cell	PT Profit Margin*	AT Profit Margin**	Adjusted AT Profit Margin***	Surplus Strain	IRR Adjusted After-Tax
1) Level-Pay 55 MN	30.4%	15.5%	14.0%	-61%	15.4%
2) 10-Pay 55 MN	22.3%	12.9%	10.9%	-94%	10.2%
3) Single-Pay MN	27.2%	16.9%	15.0%	-11%	19.8%
*Pretax profit margin is calculated with discount at the pretax NIER.					
**After-tax profit margin is calculated with discount at the pretax NIER.					
***Adjusted after-tax profit margin includes target capital effects and is calculated with discount at the pretax NIER.					

Figure 40 shows the VM-20 reserve levels for the three premium patterns.

**Figure 40: Reserve Levels—Short-Pay—ULSG Single Cell**



The following are observations on the profit impact and reserve levels:

- The 10-pay is less profitable than the level-pay situation, but the single-pay is more profitable. This is driven largely by the initial strain, which is quite small in the single-pay situation. The reduced initial strain in the single-pay case is largely due to the commission level relative to the initial premium, which is a phenomenon not unique to a VM-20 pricing situation.
- The choice of premium level drives the results more directly on the short-pay situations, especially the single-pay situation, than the level-pay. A different choice of premium could have easily produced different results.
- The 10-pay reserve increases quickly toward the single-pay reserve as each additional premium is paid. The margin between the 10-pay and single-pay reserve reflects the different lapse behavior assumed.
- The single-pay reserve decreases in the early durations. Essentially this is due to an early release of interest margin. More specifically, the best estimate earned rate increases early in the projection before reaching an ultimate rate. However, at any particular node, the VM-20 prescribed maximum reinvestment strategy results in DR discount rates that are relatively level within the inner loop reserve calculation. At each subsequent node, the level DR discount rate vector within the inner loop is higher than the vector at the prior year's node due to the increasing best estimate rates. This along with the pattern of cash outflows in early periods cause the DR to be reduced for a few years before following the typical pattern.
- This phenomenon does not appear in the level-pay situation because the cash inflows are also affected by the changing discount rate. The cash inflows would experience a similar phenomenon in the opposite direction. In the single-pay situation, there is no cash inflow to be impacted by the change, and so only the discounting effect on the cash outflow is perceived.
- For this analysis we assumed that the excess SR over the DR for the short-pay single cells is at the same ratio as calculated for the full model office. We made this assumption on the basis that these cells are part of a large block of a mix of payment patterns dominated by level payments. If a block of business skewed more heavily toward a focus on the short-pay pattern, the relationship of the SR to the DR may be different.
- For the short-pay cells we found that the NPR was often in excess of the DR calculated on the cell-level cash flows. The high funding level of the short-pay patterns causes the ULSG NPR to converge to a net single premium reserve less expense allowance, which can be larger than the present values of cash flows in the DR using the prudent estimate assumptions.

## Section 9: Industry Interviews

### Background

An element of this phase of our research involved interviews with company actuaries within the industry who are, or will be, involved in the real-life exercise of pricing and product development in the context of VM-20.

We covered the same basic topics in each interview using open-ended questions. The interviews were conducted as free-flowing conversations, rather than using a survey approach or following a precise script with the exact same questions asked of each company. While our approach may provide less quantitatively credible data, we felt the anecdotal information would provide a richer and more textured picture of the industry's thoughts. This approach also allowed us to minimize the extent to which researchers might introduce bias into the discussions, beyond selection of broad topics.

We spoke to actuaries at 14 companies of varying size that issue individual life business. For most of the conversations, several company actuaries participated. While the focus of the discussions was on pricing and product development, actuaries from valuation, corporate and modeling areas were often part of the conversations as well. For some small companies, these duties were represented by the same person.

In the following sections, we summarize the main findings from these interviews, categorized as follows:

- The industry's level of preparedness
- Particular concerns or issues that have been identified
- Collaboration and coordination between functional areas
- Changes to the pricing process and product design
- Anticipated simplifications
- Use of reinsurance
- Product lines other than level term and ULSG

### Preparedness

- There was an even mix between the pricing and valuation areas regarding where VM-20 expertise resided, and which area leads or led the effort to be VM-20-ready. Generally, companies that had executed or worked on reserve financing transactions were more prepared than companies that had not, and at those companies, the VM-20 knowledge in the valuation area was ahead of the pricing area. On the flip side, at companies that were looking to roll out VM-20 products in 2017 or early 2018, the pricing area led the learning curve. In companies where the corporate structure was organized across product lines rather than function, term was generally more VM-20-ready than ULSG.
- Companies gained expertise through attendance and participation in industry meetings (conferences, webinars, special PBR-focused seminars or "boot camps"), participation in industry pilot-studies, as well as through individual reading. Some companies, particularly smaller ones, hired outside consultants to assist in their VM-20 education and preparation.
- In some, but a minority of, cases, a specific individual or dedicated team was tasked with being the lead VM-20 expert. Many companies mentioned having regular PBR-focused meetings, sometimes involving multiple company departments.
- Most of the companies had done some form of VM-20 trial run, regardless of the company's timeline for moving to VM-20 reserves. In some cases, those were purely valuation exercises, and in other cases, they were more pricing-focused. Generally, companies expect their term business to pass the Stochastic Exclusion Test (SET).

- While some companies are planning to roll out products priced on a VM-20 basis in 2017 or early 2018, most companies are planning to wait until the end of the three-year transition period. Generally, companies expected to price and offer a VM-20 term product before ULSG.

### Concerns and Issues Regarding VM-20 Implementation

#### Fluctuation in Reserve Levels

- Many companies expressed concern over a now higher level of unpredictability and fluctuation in their reserves and anticipated profits under VM-20. This was regarding both the impact of unlocking assumptions (in particular, the interest assumptions) and potential regulatory changes in VM-20 methodology. There was consistent concern among interviewees regarding the future definition of tax reserves. One participant commented on the positive side of these fluctuation issues, in that it will allow for faster reactions or corrections than in the past.
- Some interviewees voiced concern regarding the need to explain anticipated future movements in reserves and profitability to others in the company such as senior management, particularly when such movements are nonintuitive.

#### Limited Guidance

- There was some concern regarding limited guidance within VM-20 and related PBR literature on appropriate assumptions, margin setting and covered risks (e.g., conversion privileges). This was true in general, and particularly regarding assumptions for new underwriting regimes with limited experience (e.g., accelerated underwriting).

#### Complexity

- More than half the participants raised concerns regarding the intensiveness and complexity of the computations necessary for VM-20. While most companies expressed satisfaction with their actuarial modeling system, it was clear that a significant effort needed to be exerted to make the systems VM-20-ready, either through customized coding, learning to use the VM-20 features or upgrading systems to take advantage of VM-20 capabilities. Other concerns around systems capabilities included the following:
  - Extensive runtime, particularly for stochastic calculations
  - Separate assumptions for inner-loop versus outer-loop projections
  - Auditability of projected VM-20 calculations
  - Coordinating between use of multiple systems (e.g., one system to calculate the NPR, and another to calculate the DR and/or SR)
  - Moving to an asset/liability pricing approach versus a liability-only approach
- A couple of companies expressed concern that moving to VM-20 would slow the speed at which they can bring products to market. However, they also thought the increase in time-to-market would be highest at first, but over time, while it still may take longer to introduce a new product than it does now, it would not take as long as for the first VM-20 products the company introduces.
- Additional model documentation is required.

#### Profitability

- Several companies commented on lower anticipated profitability upon moving to VM-20 reserving. This was particularly true for small companies with limited or near-zero mortality credibility, as well as for companies already engaged in reserve financing.

### Collaboration and Coordination between Functional Areas

Almost universally, companies indicated that VM-20 will increase collaboration, cooperation and communication between areas of the company, primarily the pricing and valuation areas, but also the modeling, corporate and tax areas as well. There was general agreement that assumptions should be the same, at least initially, in the reserve calculations performed in these areas.

- For about half the participants, the increased collaboration, cooperation and communication were facilitated by regularly scheduled meetings. Some companies even formed separate VM-20 task forces with representation from various company departments. In other cases, this was handled on a more informal basis.
- A common theme we heard was that companies were already planning to further improve and formalize their existing governance and collaboration structures, particularly in the areas of model control and assumption ownership. The operative date of VM-20 has encouraged and accelerated implementation of those plans. Small companies as well as a couple of larger companies have used outside consulting assistance in developing these governance and collaboration structures. A few companies are at a stage where they are deliberating what the new structures should be, and which areas would be responsible for each element of the VM-20 process. There was a wide spectrum in the level of formality around these governance structures.

### Changes to Pricing Process and Product Design

#### *Pricing Process*

Nearly all interviewees expressed the opinion that the pricing process would involve the same basic steps under VM-20 as currently. However:

- Most all companies interviewed acknowledged that VM-20 would initially slow the pricing process, but companies differed in their opinions regarding how much that would continue to be the case in the future. Items cited as contributing to the increased time to market included:
  - Increased collaboration and communication between company areas and other parties (e.g., reinsurers, regulators)
  - Deliberations regarding uncertainty in various aspects of the VM-20 calculations
  - Increased model runtime
  - More sensitivity testing
  - Increased number of calculations to validate
  - Updating to a new CSO table simultaneously with moving to VM-20
- Companies that perform, or have considered performing, stochastic pricing recognized the increased difficulty of such a task under VM-20, and no interviewees indicated that a company expects to implement stochastic pricing under VM-20 in the near future.

#### *Changes in Product Design*

While most companies acknowledged that there could be reasons to change their term or ULSG product designs under VM-20, few interviewees indicated they had worked through the details of changing product design under VM-20. Most companies were taking a “wait-and-see” approach.

#### *Allocation of VM-20 Excess Reserves to Profit Cells*

VM-20 excess reserves equal the excess of the aggregate modeled reserve (DR or SR) over the sum of the NPR for each policy. Only a couple of companies brought up the concern regarding how to allocate the aggregate reserve amount (the NPR plus the



excess reserve) to individual profit cells or subsets of business. However, when asked about this, there were a variety of responses:

- Some companies, including some that plan to introduce a VM-20 product in the near future, indicated they have not thought through those issues.
- Some companies indicated they plan to allocate the VM-20 excess reserves based on the NPR, and most of those companies understood and acknowledged the inherent pricing distortion that approach could produce.
- A few companies indicated they look at profitability under a variety of allocation methods. For example, a company might allocate the VM-20 excess reserve based on the NPR, based on the modeled reserve (DR and SR), and also perhaps based on the maximum of the NPR and modeled reserve. Other companies followed the approach of removing just a subset of business from their analyses and considering the impact on profitability.

### **Anticipated Simplifications**

Recognizing the additional complexities involved in VM-20, company actuaries had the following thoughts regarding anticipated simplifications in their pricing process under VM-20:

- Use *cluster modeling techniques* to reduce the size and runtime of the liability portion of their model.
- *Asset grouping* to reduce the size and runtime of the asset portion of the model.
- Setting certain assumptions (e.g., investment assumptions) in the *outer loop equal to the VM-20 compliant assumptions of the inner loop*.
- Using an *aggregate margin* on the final reserve, rather than applying a margin to each specific assumption.
- In calculating the DR and SR, assume *no increase to credibility or SDP over time*, and calculate the NPR assuming no future change in the prevailing valuation mortality table. A more robust approach could be to assume that the company's mortality studies are expanded over time to include more data and cover more durations, increasing credibility and the SDP, potentially resulting in lower margins and later grading to industry mortality assumptions.
- Several companies discussed *approximation methods in determining the DR discount rates*.
- Calculating DR and SR only at *selected future nodes* (e.g., every five or 10 years), and using an interpolation approach between those nodes.
- *Using relationships* between the DR and SR to approximate the SR based on the DR, particularly in sensitivity testing.
- In sensitivity testing *holding DR or SR assumptions constant*, and just change the outer loop assumptions.

About half of the participants indicated that they were reticent to take too many shortcuts at first, but instead, initially plan to work through all the complexities and details to get a sense of what simplifications would be appropriate in the future.

### **Reinsurance in VM-20 context**

Most companies were at a beginning stage of thinking about how their use of reinsurance may change under VM-20. Some companies described themselves as listening to reinsurers' thoughts and waiting for ideas from the reinsurers.

- A few companies mentioned the possibility of looking for reinsurance rate guarantees.
- There were some discussions regarding reinsurers helping companies increase the credibility of their mortality assumption (and therefore lower margins), but almost no concrete plans in that regard. This was especially true regarding mortality for new underwriting regimes such as accelerated underwriting.
- There was a mix of opinion regarding whether reinsurer input would be sought toward the end of the pricing process, or whether it would be earlier, more frequent and potentially an iterative element in the pricing process.
- There were few substantive comments regarding the company's use of reserve financing on new issues once VM-20 was implemented within a company, though some companies indicated they would evaluate the possibility later.

### **Product Lines other than Term and ULSG**

- In our discussions, companies generally indicated their plates were full enough regarding Term and ULSG, and that they have not given much thought to other products in a VM-20 context.
- Companies that had considered other products noted the following:

- Uncertainty regarding the details of how to apply VM-20 to Indexed Universal Life (IUL) and Variable Universal Life (VUL), particularly the treatment of separate account values in the reserves.
- Questions regarding aggregation. For example, can term riders be aggregated with Whole Life? Can IUL and VUL be grouped together?
- Whole Life and non-Secondary-Guarantee UL were expected to pass the Stochastic Exclusion Test.
- Slight product design changes may be useful in order to not inadvertently fail exclusion tests.
- There was some discussion, but no concrete plans or ideas, regarding how to think about assets backing multiple products.

As this is a new frontier within the industry, it will be fascinating to watch how pricing actuaries' thoughts and reactions to VM-20 change in the next few years.

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