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Impact of VM-20 on Life Insurance Product Development

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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 has 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 is to flesh out 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 are intended to illustrate profitability changes from current statutory reserving methods for hypothetical products and identify issues and considerations for the product development actuary. This report constitutes Phase 1 of the research.

Phase 1 is 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 references included in the References section at the end of this report.

The structure of the Phase 1 report is as follows:

- Section 4 provides an Executive Summary of the Phase 1 results
- Section 5 provides a high-level summary of VM-20 requirements
- Section 6 provides the parameters of the case studies that are common to both the term and ULSG case studies
- Section 7 describes the term case studies and results
- Section 8 describes the ULSG case studies and results
- Section 9 provides other observations on the impact on the product development process
- Section 10 describes what is coming in Phase 2 of the report

Additional details concerning the case studies are provided in the appendices:

- Appendix A provides details on the case study term product including sample premium rates and documents the pricing and VM-20 assumptions, including mortality and lapse assumptions
- Appendix B provides similar information for the ULSG case study
- Appendix C documents the asset assumptions for the illustrative pricing scenario
- Appendix D documents the development of the Deterministic Reserve discount rates for the pricing exercise, includes a description of the methodology to generate Deterministic Reserve scenarios and provides sample rates.
- Appendix E provides additional detail concerning the asset modeling for the Stochastic Reserves.

Phase 2 of the research, described in greater detail in Section 10, will expand on the Phase 1 case studies and include additional case studies focused on smaller companies and the impact of reinsurance. Phase 2 will also discuss the industry's preparedness for pricing under VM-20 and identify pricing and product design issues through interviews and discussions with product development actuaries.

Section 4: Executive Summary

This report summarizes changes to the product development process as a result of the introduction of principle-based reserves as required under VM-20 through the development of case studies for term and ULSG products. The products studied are hypothetical, and the illustrative results are applicable only to the specific products, premiums levels and assumptions used in the case studies. While similar results may not be expected for other products using different assumptions, the case studies highlight some of the issues of pricing under VM-20.

The case studies capture the impact on profitability of various changes in the pricing situation, starting with the Model 830 reserves and the 2001 Commissioners Standard Ordinary (CSO) mortality table with no reserve financing, then reflecting the impact of financing arrangements, the introduction of the 2017 CSO mortality table and the introduction of VM-20.

The term case studies show that:

- For business that was not financed, VM-20 increases internal rates of return (IRRs), as a result of lower statutory and tax reserves. This may result in term writers lowering premiums or maintaining higher profitability.

- For business that was financed prior to VM-20, and assuming no financing after VM-20, VM-20 lowers IRRs and may result in term writers raising premiums or accepting lower profitability. This is a result of the loss of tax benefits.

The ULSG case studies show that:

- For 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 business that was financed prior to VM-20, and assuming no financing after VM-20, VM-20 lowers IRRs and may result in ULSG writers raising premiums or accepting lower profitability. This is a result of the loss of tax benefits.

Assuming tax reserves under VM-20 are set at the level of NPRs, companies that finance statutory reserves may have incentive to delay implementation.

The pricing exercise and modeling will likely become more complicated as companies attempt to forecast future reserves under VM-20, where assumptions are not locked in at issue. Items that will impact VM-20 reserves after issue include:

- Emerging company experience for mortality, lapse, expenses and policyholder behavior, including flexible premium payments

- Earnings rates on assets in-force as of future valuation dates, which may include assets backing liabilities issued after the product was priced

- Newly adopted CSO valuation mortality tables

- Revisions to prescribed mortality margins

- Actual Treasury yield rates up to the valuation date that will impact the generation of the VM-20 Deterministic and Stochastic Reserve scenarios

We expect that as companies gain experience with this process, factors that will materially impact profitability will be identified and reflected in the pricing models. Modeling of other complicating factors of VM-20 that do not materially impact profitability may be simplified.

Section 5: High-Level Summary of VM-20 Requirements

This report will use the following terms as defined in VM-20 and the acronyms listed:

Net Premium Reserve (Section 3 of VM-20): NPR

Deterministic Reserve (Section 4 of VM-20): DR

Stochastic Reserve (Section 5 of VM-20): SR

The VM-20 reserve is equal to the NPR, plus the excess, if any, of the maximum of the DR and SR over the NPR adjusted for due and deferred premium.

The reader should refer to VM-20 for a complete description of these reserve amounts and required calculations. This section of the report provides a high-level description of these VM-20 reserve components and considers how the basis for those reserves

may change after a policy is issued. Changes subsequent to issue date may impact future reserves and may be considered in pricing under a VM-20 reserve framework.

Net Premium Reserves

The NPR is a seriatim formulaic calculation using specified CSO mortality tables, prescribed lapses and prescribed valuation interest rates. The NPR for a policy after issue may reflect valuation mortality tables and prescribed lapses different from those in effect when the policy was issued. The valuation interest rate does not change after policy issue.

Deterministic Reserves

The DR is an aggregate gross premium reserve developed as the present value of pretax liability cash flows at discount rates, using a prescribed scenario. Another way to think of the DR is the amount of general account assets at the valuation date that will fully satisfy the company's obligations for a group of policies over the lifetime of the policies under the specified DR scenario. The discount rate is developed using a model that projects existing assets and reinvestments under VM-20 assumptions. The timing and amount of cash flows are based on actual company experience with margins for conservatism. Certain assumptions are more prescribed than others. For example, mortality used in the DR starts with company experience rates increased by a margin and grades to industry mortality tables with margins. Items that will impact the DR calculated after issue include:

- Emerging company experience for mortality, lapse, expenses and policyholder behavior, including flexible premium payments
- Earnings rates on assets in force as of future valuation dates, which may include assets backing liabilities issued after the product was priced
- Newly adopted CSO valuation mortality tables
- Revisions to prescribed mortality margins
- Actual Treasury yield rates up to the valuation date that will impact the generation of the DR scenario
- Changes in reinsurance

Stochastic Reserve

The SR is an aggregate reserve calculation using an asset liability model developed as a starting asset amount plus the greatest present value of accumulated deficiencies over a range of stochastic scenarios, with the SR set at the 70th conditional tail expectation (CTE). The liability cash flows reflected in the SR calculation are projected under the same assumptions used in the DR calculation and subject to change from the items listed above. Prudent estimate assumptions within the SR vary from scenario to scenario where appropriate, reflecting scenario-dependent risks. Like the DR, assets in-force as of the valuation date will impact the SR calculation, and the actual Treasury rates up to the valuation date will affect the generation of the stochastic scenarios. In the SR calculation the asset modeling is critical because the variation of the asset accumulation across scenarios is a direct driver of the reserve. Whereas the DR reserve uses a pattern of earned rates as the discount rate vector, the SR uses the stream of one-year Treasury yields from each stochastic scenario times a 105% scalar to discount the asset deficiencies.

In pricing products under a VM-20 framework, companies will need to consider how to reflect the variability in VM-20 reserves and consider the pricing impact of potential reserve volatility. To illustrate these concepts, we have developed term and ULSG case studies as described in this report.

Section 6: Case Study Parameters

This section of the report describes the bases for the term and ULSG case studies. The reader should refer to Section 7 and Section 8 and to the appendices for a complete description of the products under study and for a summary of the relevant assumptions. The case studies in this Phase 1 report focus on a single pricing scenario and forecast the DR and SR for that pricing scenario. The case studies in this Phase 1 report do not address the development of pricing sensitivities and stochastic analysis that are often part of the pricing exercise.

Pricing Situations

To understand the impact of various changes in the pricing of term and ULSG products, we developed case studies that begin 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 used reserve financing to improve profits on currently issued term and ULSG products, we show profits after reflecting reserve financing in accordance with Actuarial Guideline 48 (AG48). We next show the impact of the introduction of the 2017 CSO table, both with and without reserve financing, according to AG48. Finally, we show profits after the introduction of VM-20. For both the term and ULSG case studies, we show profit measures under the five pricing situations detailed, assuming no change in the product premiums (see Figure 1).

Figure 1: Pricing Situations: Basis of Statutory and Tax Reserves

Pricing Situation	Statutory Reserve	Tax Reserves
i. **2001 CSO**	Model 830 statutory reserves (XXX, AG38) using 2001 CSO Table and no financing	Model 830 tax reserves (XXX, AG38) using 2001 CSO Table
ii. **2001 CSO AG48 Financing**	Model 830 statutory reserves (XXX, AG38) using 2001 CSO Table with AG48 financing of reserves in excess of VM-20 reserves NPR component of VM-20 reserves calculated using 2001 CSO Table with adjustment factors specified in AG48 DR and SR calculated as described for VM-20 Assumes VM-20 is effective, so treatment of reinsurance follows VM-20	Model 830 tax reserves (XXX, AG38) using 2001 CSO Table
ii. **2017 CSO**	Model 830 statutory reserves (XXX, AG38) using 2017 CSO Table and no financing	Model 830 tax reserves (XXX, AG38) using 2017 CSO Table
v. **2017 CSO AG48 Financing**	Model 830 statutory reserves (XXX, AG38) using 2017 CSO with AG48 financing of reserves in excess of VM-20 reserves NPR component of VM-20 reserves calculated using 2017 CSO Table DR and SR calculated as described for VM-20 Assumes VM-20 is effective, so treatment of reinsurance follows VM-20	Model 830 tax reserves (XXX, AG38) using 2017 CSO Table
v. **2017 CSO VM-20**	VM-20 statutory reserves using 2017 CSO Table NPR component of VM-20 statutory reserves calculated using 2017 CSO Table	NPR tax reserves calculated using 2017 CSO Table

	DR and SR, as applicable, following VM-20 requirements	

Impacts to the pricing exercise are measured by changes to the profitability of the model office results.

For the studies reflecting reserve financing, the amount of reserves financed is assumed to equal the Model 830 (XXX or AG38) statutory reserve, less the Actuarial Method amount from AG48. For this research, the Actuarial Method amount is assumed equal to the VM-20 reserve, similar to Pricing Situation 5, the VM-20 pricing sensitivity. In the pricing exercise, the net statutory liability equals the AG48 Actuarial Method amount, and the tax reserve equals the Model 830 tax reserve. There is a charge for financing equal to 75 basis points for term and 100 basis points for ULSG of the financed amount, assessed annually.

We have assumed no reserve financing under VM-20. In the pricing exercise, the statutory liability equals the VM-20 reserve and the tax reserves equal the NPR on a tax basis. Pricing assumptions are used in the financial results of the profit study, while VM-20 assumptions are used at each future valuation date to calculate the DR or SR. At each future valuation date, a determination is made whether there is any excess of the DR or SR over the aggregate NPR adjusted for any deferred premium. If there is, the statutory (not tax) excess is held on the balance sheet, together with the NPR.

Profit Measures

For each of the pricing situations, we show the following profit measures:

- Profit Margin: Present value of statutory profits as a percentage of the present value of premiums. The profit margin is presented on a pretax, after-tax and adjusted after-tax basis, where "adjusted" includes consideration for holding target capital. The discount rate used in these profit measures is the pretax net investment earned rate on the portfolio of assets backing the products. The present value of premiums used in these profit measures reflects the pretax premiums net of reinsurance.

- Surplus Strain: The statutory surplus strain for the first policy year after target capital, expressed as a percentage of first-year premium.

- IRR Adjusted After-Tax: The internal rate of return on distributable earnings. The present value of distributable earnings (statutory earnings after reflecting taxes and capital) discounted at the IRR equals the dollar amount of statutory strain.

Pricing Economic Scenario

For purposes of the case studies, we assumed the company adopted a pricing economic scenario that begins with the U.S. Treasury rates as of December 31, 2015, and grades to its long-term expectation over three years. The applicable U.S. Treasury rates for the pricing economic scenario are shown in Figure 2. Monthly rates are linearly graded between the rates shown.

Figure 2: Pricing Scenario Treasury Yields, Bond Equivalent Rates

Treasury Yields Bond Equivalent Rates					
Date	**1 Year**	**5 Year**	**10 Year**	**20 Year**	**30 Year**
12/31/2015	0.65%	1.76%	2.27%	2.67%	3.01%
12/31/2016	1.25%	2.26%	2.77%	2.97%	3.11%
12/31/2017	2.55%	2.86%	3.22%	3.32%	3.36%
12/31/2018+	3.05%	3.36%	3.72%	3.82%	3.86%

Appendix C lists the other assumptions used to develop portfolio earned rates and shows the resulting rates.

The remainder of this section describes the basis used to project the VM-20 reserves in the case studies.

Development of Treasury Rates for the DR and SR Scenarios

For purposes of projecting Treasury rates for the DR and SR calculations at future valuation dates, which we referred to as "nodes," we assumed the pricing economic scenario Treasury rates applied until the node and used the American Academy of Actuaries Economic Scenario Generator (ESG) to generate the Treasury rates for the DR and SR scenarios. The term and ULSG case studies developed different vectors of DR discount rates for each node, reflecting the investment strategy for each product, using Scenario #12 of the Stochastic Exclusion Test (SET) scenarios. We assumed the term business passed the SET and the ULSG business did not pass the SET. For the SR calculations for ULSG, we developed 200 stochastic scenarios for each of the nodes at the end of years 1, 5, 10, 20, 30 and 50. Each of the stochastic scenario sets starts from the pricing interest rate scenario at that point. The pricing scenario was entered into the Academy generator as a "projected history" to develop the appropriate mean reversion parameters.

Reserve Modeling Approach

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 valuation date in the outer loop and using the DR assumptions after the valuation date in the inner loop reserve calculation. The DR uses discount rates developed as described further in this section.

The 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 this case study, 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.

We used this approach 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 could provide a reasonable picture for how the SR will progress relative to the DR. As will be discussed later, the small amount of SR in excess of the DR helped us gain comfort that the approach did not produce materially different results than would be obtained by calculating the SR explicitly at additional nodes.

DR Discount Rates

We developed DR discount rates separately for the term and ULSG case studies. The DR discount rates were developed in a spreadsheet model, reflecting 1) for assets in-force as of a node, pricing scenario Treasury rates and spreads based on the economic conditions when the assets were purchased and VM-20 prescribed defaults, and 2) for assets purchased after the node, VM-20 Treasury rates, spreads and defaults. The spreadsheet model reflected the distribution of investments by quality and term to maturity for assets purchased in each year, and also an assumed weighting of investments by year to develop a projection of future portfolio rates net of defaults and investment expenses for each node. The vector of future portfolio rates net of defaults and investment expense at a node becomes the DR discount rates for the node. The assumptions are documented in Appendix D, which also shows the DR discount rates at sample nodes.

To illustrate the impact of the DR discount rates on the VM-20 reserves and on profitability, we include a sensitivity where the DR discount rates at each node are held constant at the rates developed as of the issue date of the policies, for a cohort of the model office.

SR Asset Modeling

For the SR, the projections reflected first principles asset modeling based on the starting asset levels at each node and the future cash flows. The asset parameters and assumptions were consistent with those used for the DR, including an annual timing for asset purchases. The key difference from the DR approach was that the pattern of investments in the SR calculation more precisely reflected the asset and liability cash flows. For the SR calculation at each node, assets were accumulated under the pricing assumptions prior to the node to obtain a proper starting asset at the node, and then prudent estimate assumptions were used to project assets under each scenario after the node.

We considered whether using a process to model assets for the SR that is different than the process to model assets for the DR would distort the results. Because of the relatively smooth progression of the prescribed DR interest rate scenario, we believed that the timing of investments for that calculation could be reasonably approximated by the spreadsheet approach to reduce model complexity without creating undue model error. With the disparity of interest rate movements in the stochastic scenario set, we favored the first principles approach with the trade-off of model complexity. We recalculated the DR at several future nodes using the modeled assets approach to validate the reasonableness of the spreadsheet approach for DR. Our conclusion was that the DR levels were not materially impacted. Further details are provided in the description of the ULSG case study.

Mortality Assumptions

The prudent estimate assumption for mortality is based on company experience with margins, grading to industry mortality with margins as outlined in VM-20. We have assumed a company with 100% credibility. Additional details can be found in the appendices. For future valuation nodes, pricing mortality is assumed prior to the node.

VM-20 does not allow reflection of mortality improvement beyond the valuation date. However, if a company normally reflects mortality improvement in its pricing mortality assumption, the company may also choose to include the impact of such improvement in the level of projected reserves by reflecting improvement experienced prior to future nodes in the pricing exercise. For the case studies, we assumed that pricing mortality improvement up until the node was reflected in the company's anticipated experience used to set prudent estimate assumptions as of each node.

To illustrate the impact of reflecting the mortality improvement up until the node on the VM-20 reserves and on profitability, we include a sensitivity where we did not reflect the pricing mortality improvement up until the node in the company's anticipated experience that was used to set prudent estimate assumptions as of each node for a cohort of the model office.

There may be other changes in mortality over the lifetime of a product that will impact VM-20 reserves that we have not reflected in the case studies, such as changes in:

- CSO Valuation Mortality Tables
- Mortality Credibility and Sufficient Data Period

For these case studies, we are not projecting changes to the 2017 CSO tables or Valuation Basic Tables (VBT), and we are not projecting changes to mortality credibility or sufficient data period from future experience that emerges over the policy lifetime. However, for a company with mortality credibility less than 100% at time of pricing, the credibility of the data will likely improve, and the sufficient data period will likely increase with time.

Reinsurance

The case studies reflect nonguaranteed yearly renewable term (YRT) reinsurance on insurance amounts in excess of assumed retention limits as described in the appendices. 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 DR and SR calculations, we treat the YRT premiums as a nonguaranteed element. We assume reinsurers will raise YRT premium rates to offset the higher mortality assumed in the reserve calculations. Specifically, we counter the impact of mortality margins and omission of mortality improvement required by VM-20 by making the same considerations in the YRT premium rates. As such, for the DR and SR calculations YRT premiums are 110% of the VM-20 mortality assumption. For these case studies, we did not assume a delay in the reinsurer's premium increase.

VM-20 requires the consideration of a number of additional aspects of the reinsurance treaty. More specifically, VM-20 requires that the direct company and reinsurer should account for counterparty company actions that could impact modeled cash flows in

the DR and SR calculations. Among these elements is the contractual right of the assuming company to increase nonguaranteed YRT rates or coinsurance allowances. Another possible company action is recapture by the ceding company or, conversely, that the reinsurer could terminate coverage if the treaty allows.

In some real-life pricing situations, the new product will be ceded into an existing reinsurance arrangement. In such cases, the pricing actuary will need to consider how the existing business in the treaty may impact the assuming company's actions when pricing and modeling DR and SR reserves for the new product. Another consideration is that a new treaty may have scheduled nonguaranteed rate increases which may incentivize recapture by the ceding company.

For the purposes of the case studies, we have assumed a new reinsurance treaty without such incentives. We concluded that at the origination of a new YRT reinsurance treaty, a plausible best estimate assumption for the ceding company would be that the assuming company has an appropriate view of the ceding company's anticipated mortality and applies a reasonable margin to cover its expenses and profits.

Given the parameters we used for the case studies, reinsurance did not have a significant impact on the case study results. The Phase 1 case studies are focused on large, top-tier companies, with high retention limits. The Phase 2 case studies will provide insight on the impact of reinsurance on other type companies and from other reinsurance arrangements.

Section 7: Term Case Studies

Product Design and Model Office

The foundation for the term model office is a top quartile (as measured by today's standards) of a 10- and 20-year level premium term plan with an insurance benefit period to attained age 95. Issue ages are 20 to 65 for the 10-year product, and 20 to 55 for the 20-year product. There are four nontobacco classes and two tobacco classes. The product is gender-distinct. Following the level premium period, the premiums increase to 250% of the 2017 CSO age nearest birthday (ANB) Ultimate mortality rates per $1,000 on the preferred table basis. We developed the level period premiums by averaging the per unit rates of select top-quartile companies. There is a $60 policy fee. Two policy sizes are represented: $350,000 and $1,200,000.

The company is assumed to cede amounts in excess of $1 million to a third-party reinsurer through YRT mortality risk reinsurance. Net reinsurance premiums for YRT reinsurance are $0 in the first policy year, and in renewal years are set equal to the direct writer's anticipated mortality experience, including mortality improvement, with a 10% profit charge included.

Anticipated experience for mortality and lapse was developed based also 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.

Commission rates and general insurance expenses are consistent with the top-quartile companies represented. For statutory reserves under Model 830 XXX, X-factors are developed to minimize or eliminate any deficiency reserve. There are no cash values that develop for this product under either the 2001 CSO or 2017 CSO valuation mortality tables. Target surplus factors representing 325% to 350% of company action level (CAL) risk-based capital (RBC) are assumed in the pricing, as well as a tax rate of 35%.

The model office assumes a distribution across the issue age range, the underwriting classes and genders. Four products are represented: Term 10 $350,000; Term 10 $1,200,000; Term 20 $350,000; and Term 20 $1,200,000. The projection horizon is equal to the level term period: 10 or 20 years.

Profitability Results

Pricing results tables are provided in Figures 3 and 4 for both the 10- and 20-year level premium term to A95 products. Figures 3 and 4 summarize the profit measures for the term model office over the five pricing situations described in Figure 1. Common investment portfolio rates are assumed in each pricing situation. The liability cash flows, including the premium, are unchanged between pricing situations, with the exception of the inclusion of financing costs under AG48. The changes in profitability are thus driven by the changes in reserve and surplus levels, the amount of investment income and the level of income taxes created by them.

Figure 3: Pricing Results 10-Year Level Premium Term to A95

	Pretax Profit Margin[1]	After-Tax Profit Margin[2]	Adjusted After-Tax Profit Margin[3]	Surplus Strain	IRR Adjusted After-Tax
Low-Band Model Office					
1) XXX Stat/Tax, 2001 CSO	15.7%	8.9%	2.8%	−128%	6.8%
2) AG48 Stat, XXX Tax, 2001 CSO	14.8%	10.3%	4.3%	−128%	17.0%
3) XXX Stat/Tax, 2017 CSO	15.7%	8.9%	2.9%	−128%	7.2%
4) AG48 Stat, XXX Tax, 2017 CSO	15.1%	9.9%	3.9%	−128%	14.2%
5) VM-20 NPR+DR Excess Stat, NPR Tax, 2017 CSO	15.7%	8.8%	2.8%	−128%	9.1%
High-Band Model Office					
1) XXX Stat/Tax, 2001 CSO	16.3%	9.1%	1.9%	−112%	6.1%
2) AG48 Stat, XXX Tax 2001 CSO	15.2%	10.8%	3.7%	−112%	21.5%
3) XXX Stat/Tax, 2017 CSO	16.2%	9.0%	1.9%	−112%	6.3%
4) AG48 Stat, XXX Tax, 2017 CSO	15.4%	10.3%	3.2%	−112%	15.8%
5) VM-20 NPR+DR Excess Stat, NPR Tax, 2017 CSO	16.2%	8.8%	1.7%	−112%	7.6%

[1] Pretax profit margin is calculated with discount at the pretax net investment earnings rate (NIER).
[2] After-tax profit margin is calculated with discount at the pretax NIER.
[3] Adjusted after-tax profit margin includes target capital effects and is calculated with discount at the pretax NIER.

Figure 4: Pricing Results 20-Year Level Premium Term to A95

	Pretax Profit Margin[1]	After-Tax Profit Margin[2]	Adjusted After-Tax Profit Margin[3]	Surplus Strain	IRR Adjusted After-Tax
Low-Band Model Office					
1) XXX Stat/Tax, 2001 CSO	18.4%	11.2%	6.5%	−180%	6.6%
2) AG48 Stat, XXX Tax, 2001 CSO	15.4%	16.0%	11.6%	−172%	25.2%
3) XXX Stat/Tax, 2017 CSO	18.4%	11.1%	6.6%	−180%	7.4%
4) AG48 Stat, XXX Tax, 2017 CSO	16.8%	13.7%	9.3%	−172%	16.5%
5) VM-20 NPR+DR Excess Stat, NPR Tax, 2017 CSO	18.4%	11.1%	6.7%	−172%	9.9%
High-Band Model Office					
1) XXX Stat/Tax, 2001 CSO	19.9%	12.0%	6.5%	−169%	6.4%
2) AG48 Stat, XXX Tax 2001 CSO	16.0%	18.4%	13.2%	−147%	37.5%
3) XXX Stat/Tax, 2017 CSO	19.9%	11.9%	6.6%	−169%	7.1%
4) AG48 Stat, AG38 Tax, 2017 CSO	17.8%	15.3%	10.1%	−147%	22.8%
5) VM-20 NPR+DR Excess Stat, NPR Tax, 2017 CSO	19.9%	11.9%	6.7%	−147%	10.4%

[1] Pretax profit margin is calculated with discount at the pretax NIER.
[2] After-tax profit margin is calculated with discount at the pretax NIER.
[3] Adjusted after-tax profit margin includes target capital effects and is calculated with discount at the pretax NIER.

In Pricing Situation 1, we evaluate the profitability of the term case study product within a statutory environment that requires Model 830 XXX reserves reflecting 2001 CSO mortality. The Model 830 reserve determination assumes an X-factor for the

minimum basis that is equal to the ratio of the experience mortality rate to the valuation mortality rate. This approach implies that the minimum reserve mortality basis is equal to the expected mortality. For most cells, this results in a minimum reserve that does not exceed the basic reserve. There are a handful of cells that do generate a deficiency reserve. This pricing situation, together with the experience assumptions assumed for a top-quartile product, produces IRRs in the 6% to 7% range. While this has become an acceptable profit level in the recent low interest period, it is lower than what a direct writer historically would hope to achieve as a new business hurdle rate.

Pricing Situation 2 is the situation that develops when competitive term direct writers recognize redundancies in XXX reserves and attempt to improve profitability or lower premiums through reserve financing. In Pricing Situation 2, the case study assumes an AG48 financing transaction is put in place, whereby the direct writer gets a reinsurance reserve credit for the difference between the statutory Model 830 XXX reserve and AG48 Actuarial Method amount, which is equal to the greater of a VM-20 DR and NPR. The cost of the financing is assumed to be 75 basis points on the financed amount. Meanwhile, on a tax basis, the tax-deductible reserve is the 2001 CSO Model 830 XXX reserve. This brings tax benefits to the pricing. The tax benefits occur when the company holds the Model 830 XXX statutory reserve, and recognizes the reinsurance reserve credit through a captive solution, while continuing to recognize the full Model 830 XXX tax reserve, thus minimizing its taxable operating gain.

Comparing the pretax profit margin to the after-tax profit margin between Pricing Situations 1 and 2, the tax benefit becomes clear. For example, Figure 5 summarizes results for the 20-year product that exhibits a profit decline of 7% to 8% when taxes are recognized for the no-financing basis of Pricing Situation 1, whereas, when taxes are recognized under the AG48 financing basis of Pricing Situation 2, the profit margin actually increases slightly. The 10-year product reacts similarly, although the tax benefit is not as pronounced.

Figure 5 shows that for Pricing Situation 1, taxes reduce profit margins by about 40%, and for the financing example of Situation 2, taxes increase the profit margins.

Figure 5: Pricing Results–Pricing Situations 1 and 2: 20-Year Products

		Pricing Situation 1[1]			Pricing Situation 2[2]		
		Pretax Margin	After-Tax Margin	Difference	Pretax Margin	After-Tax Margin	Difference
20-Year	$350K	18.4%	11.2%	−7.2%	15.4%	16.0%	0.6%
20-Year	$1.2MM	19.9%	12.0%	−7.9%	16.0%	18.4%	2.4%

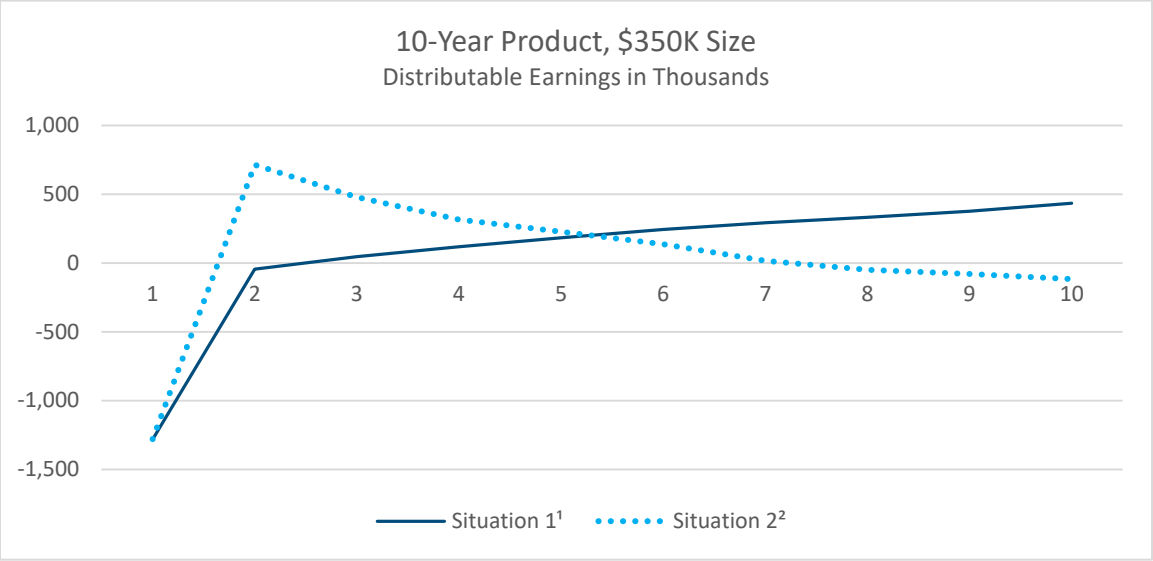
[1] Situation 1: XXX Stat/Tax, 2001 CSO.
[2] Situation 2: AG48 Stat, XXX Tax 2001 CSO.

Overall, in Pricing Situation 2, the profitability of the term products has increased materially when compared with the situation without reserve financing. For the 20-year product, the adjusted after-tax profit margins are 12% to 13%, with IRRs in the range of 25% to 38%. The 10-year product does not show a marked increase in profit margin, but does show an increase in IRRs, moving from 6% to 7% up to 17% to 22%.

The financing arrangements tend to put profit dollars from tax benefits back into the earlier years, when the increase in tax reserves exceeds the increase in statutory reserves. In later years, the situation reverses when the increase in statutory reserves exceeds the increase in tax reserves, sometimes producing negative distributable earnings. As statutory reserves under AG48 are the greater of the NPR and the DR, the pattern of distributable earnings is also dependent on the relationship of the NPR and DR by duration. In the later years of the level premium period, where the DR exceeds the NPR for the case studies shown, the increase in statutory reserves is not offset by a comparable increase in tax reserves, because the tax reserve basis is assumed to be the NPR.

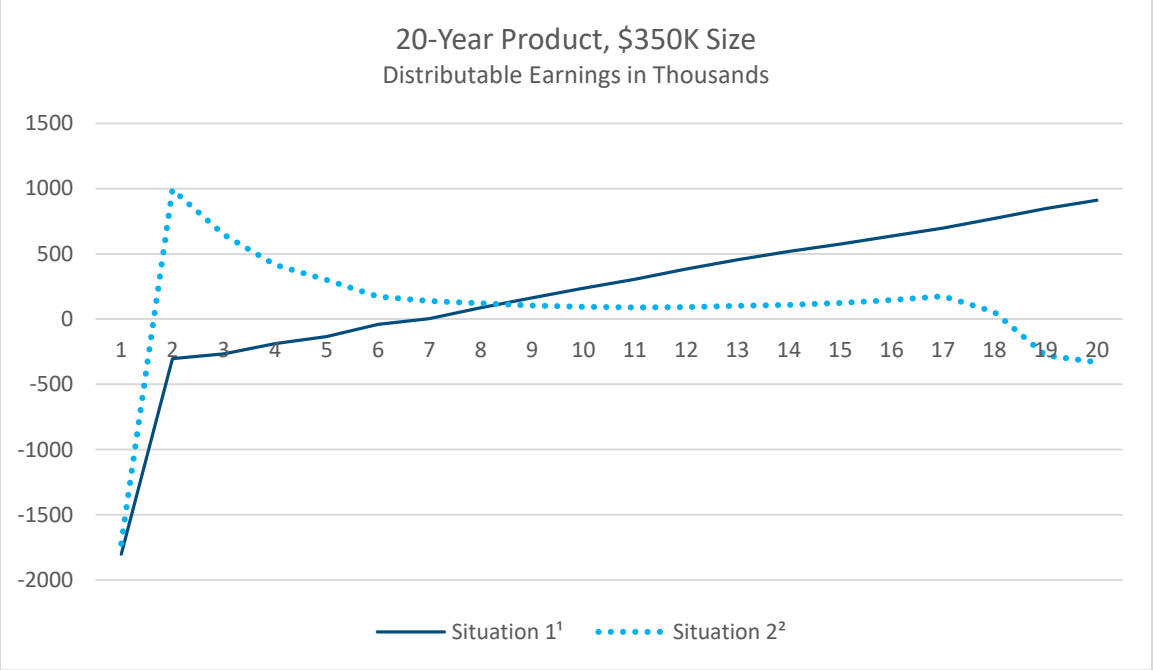
Figures 6 and 7 show the higher early year distributable earnings resulting from the financing arrangement of Situation 2 for the $350,000 size band.

Figure 6: 10-Year Product, $350,000: Distributable Earnings in Thousands



[1] Situation 1: XXX Stat/Tax, 2001 CSO.
[2] Situation 2: AG48 Stat, XXX Tax 2001 CSO.

Figure 7: 20-Year Product, $350,000: Distributable Earnings in Thousands



[1] Situation 1: XXX Stat/Tax, 2001 CSO.
[2] Situation 2: AG48 Stat, XXX Tax 2001 CSO.

Pricing Situation 3 introduces a revised no-financing situation, with valuation mortality updated to the 2017 CSO valuation mortality table on both statutory and tax bases. The profit margin metrics are very similar to Pricing Situation 1, because the pattern of reserves does not change materially (it is still a hump-backed segmented Model 830 XXX reserve pattern, with terminal reserves starting at $0 and ending at $0). The IRR metrics have increased, however, in response to the pattern of reserves being lower overall. The IRRs are 70 to 80 basis points higher than Pricing Situation 1 for the 20-year products; 20 to 40

basis points higher for the 10-year product. Statutory returns that were 6% to 7% under the 2001 CSO are now 6.3% to 7.4% under the 2017 CSO. This still does not align with historical industry targets for rate of return on new business.

Pricing Situation 4 introduces a financing solution on top of the 2017 CSO basis of Pricing Situation 3. The pretax to after-tax differences in the Pricing Situation 3 profit margins are very similar to those of Pricing Situation 1 and, as noted above, are lower than industry expectations. The financing arrangement depicted by Pricing Situation 4 helps the profitability, but does not provide as much tax benefit as under Pricing Situation 2. This is because the tax reserve, having been calculated using 2017 CSO, is a lower tax reserve than under 2001 CSO.

Figure 8 shows the impact of financing under the 2017 CSO for the 20-year products.

Figure 8: Pricing Results–Pricing Situations 3 and 4: 20-Year Products

		Pricing Situation 3[1]			Pricing Situation 4[2]		
		Pretax Profit Margin	After-Tax Profit Margin	Difference	Pretax Profit Margin	After-Tax Profit Margin	Difference
20-Year	$350K	18.4%	11.1%	−7.3%	16.8%	13.7%	−3.1%
20-Year	$1.2MM	19.9%	11.9%	−8.0%	17.8%	15.3%	−2.5%

[1] Situation 3: XXX Stat/Tax, 2017 CSO.

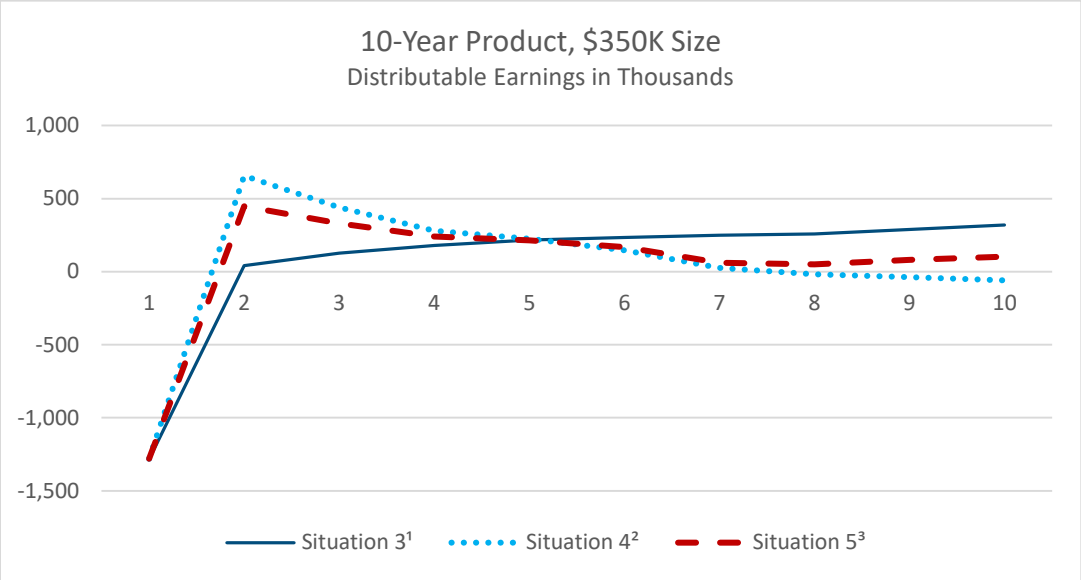
[2] Situation 4: AG48 Stat, XXX Tax, 2017 CSO.

Overall, in Pricing Situation 4, the reserve financing has worked to increase the product profitability levels over the no-financing Situation 3. For the 20-year product, the IRRs have increased from a range of 7.1% to 7.4% to a range of 17% to 23%. And for the 10-year product, the IRRs have increased from a range of 6.3% to 7.2% to a range of 14% to 16%.

Pricing Situation 5 moves to full VM-20 implementation without financing. The VM-20 statutory reserve is the same as the post-financing reserve under AG48 in Pricing Situation 4, while the tax reserve in Situation 5 is NPR on 2017 CSO rather than XXX on 2017 CSO. The profit margin metrics for Pricing Situation 5 are most similar to those of Pricing Situation 3. The IRRs for Pricing Situation 5 sit in between Pricing Situations 3 and 4. Figures 9 and 10 show the pattern of distributable earnings under a VM-20 pricing (Pricing Situation 5) when compared with that for pre-VM-20 without financing (Pricing Situation 3) as well as pre-VM-20 with financing (Pricing Situation 4). The fact that the distributable earnings are at a level between Pricing Situations 3 and 4 is consistent with the IRR for Pricing Situation 5, as it is also between IRRs for Pricing Situations 3 and 4.

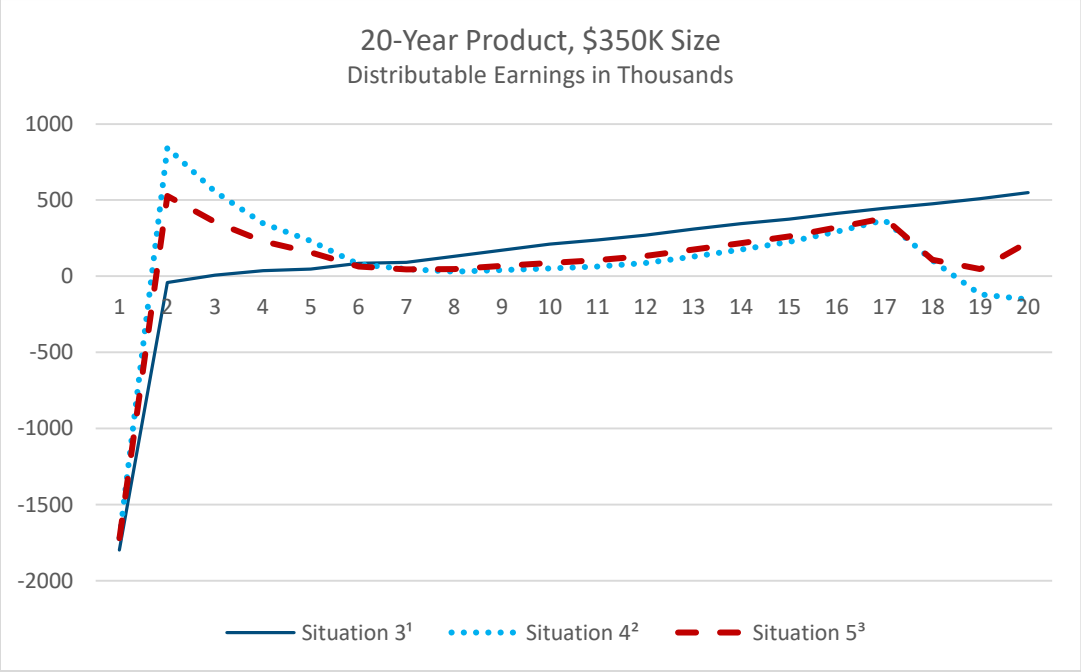
Figures 9 and 10 show that the early year distributable earnings under VM-20 fall between pre-VM-20 early year distributable earnings assuming financing and the early year distributable earnings assuming no financing. The pattern of earnings reflects the different statutory and tax bases for each pricing situations. For Pricing Situation 3, the statutory and tax bases reflect XXX reserves. For Pricing Situation 4, the statutory reserves reflect AG48 requirements, while the tax reserves reflect XXX reserves. For Pricing Situation 5, statutory reserves reflect VM-20 reserves (greater of the DR and NPR), while the tax reserves are assumed to be NPR.

Figure 9: 10-Year Product, $350,000: Distributable Earnings in Thousands



[1] Situation 3: XXX Stat/Tax, 2017 CSO.
[2] Situation 4: AG48 Stat, XXX Tax, 2017 CSO.
[3] Situation 5: VM-20 NPR+DR Excess Stat, NPR Tax, 2017 CSO.

Figure 10: 20-Year Product, $350,000: Distributable Earnings in Thousands



[1] Situation 3: XXX Stat/Tax, 2017 CSO.
[2] Situation 4: AG48 Stat, XXX Tax, 2017 CSO.
[3] Situation 5: VM-20 NPR+DR Excess Stat, NPR Tax, 2017 CSO.

In addition, we tested three sensitivities on Pricing Situation 5, the VM-20 pricing situation. The results are presented relative to Pricing Situation 5. All sensitivities were performed using the 20-year $1.2 million product.

Recall that in Pricing Situation 5 we reflected mortality improvement to future nodes in the forecast of DR. In the first sensitivity, we assume the company does not implement this assumption. In other words, we assume the mortality assumption used in the forecast of DR does not align with the pricing assumption that mortality will exhibit improvement in future years. This sensitivity provides a quantification of the impact of this assumption on the forecast DR and resulting profitability. Figure 11 demonstrates the impact of this assumption. In moving to Sensitivity 1, the pretax profit margin is unchanged. However, both after-tax profit margins show a slight reduction due to the introduction of some tax inefficiency. Where the NPR was the prevailing VM-20 component in Pricing Situation 5 (therefore maximizing tax efficiency), the DR prevails in some early and late durations in Sensitivity 1. This produces a small decline in the after-tax profit measures. The 100 basis point reduction in IRR from Pricing Situation 5 to Sensitivity 1 is indicative of the additional tax cost and the overall increase in reserve requirement.

Also recall that, in developing the DR, we used a complex process to derive what a company may view as its estimate of the DR discount rates at a future point in time. Forecast DR uses these future predictions of discount rates. The second sensitivity assumes the company does not go through this forecasting process, but rather assumes the stream of discount rates developed in the pricing exercise at time zero as the discount rates for all future nodes. Figure 11 demonstrates that, for the term product, this has very little impact because the term product is generating very little DR excess over the NPR. However, looking forward to the ULSG sensitivity section, one can see the impact of this sensitivity better, because the ULSG product does have a DR excess over NPR.

The third sensitivity quantifies the impact of a change to the liability cash flows to the DR. Pricing Situation 5 is modified by reducing the per unit gross premiums by 10%. Reducing premiums impacts the net cash flows of the product and also increases the level of the DR. This sensitivity cuts the IRR by approximately half, similar to the first sensitivity. These runs demonstrate just how finely balanced a term product must be in order for desired profitability to emerge.

Figure 11 shows the results of the VM-20 sensitivities for the 20-year level premium term product.

Figure 11: 20-Year Level Premium Term to A95 High-Band Model Office

	Pretax Profit Margin[1]	After-Tax Profit Margin[2]	Adjusted After-Tax Profit Margin[3]	Surplus Strain	IRR After-Tax
High-Band Model Office					
Pricing Situation 5[1]	19.9%	11.9%	6.7%	−147%	10.4%
Sensitivity 1: No mortality improvement to future reserve nodes in DR	19.9%	11.5%	6.3%	−147%	9.3%
Sensitivity 2: Year 1 DR discount rates in all years	19.9%	11.9%	6.7%	−147%	10.2%
Sensitivity 3: 10% premium reduction	11.0%	5.4%	−0.4%	−178%	4.7%

[1] Situation 5: VM-20 NPR+DR Excess Stat, NPR Tax, 2017 CSO.

Statutory Reserve Patterns

Figures 12 and 13 display the reserve levels from the pricing situations described above for the 10- and 20-year term products and the two face amount bands. For this case study, the XXX tax reserves are close enough to the statutory reserves that differences disappear on the chart, so tax reserves are omitted. The relative reserve levels are what is most interesting about Figures 12 and 13. Introduction of the 2017 CSO alone reduces the Model 830 XXX peak reserve by about one-third. Introduction of the VM-20 method produces a pattern that peaks one duration later than the Pricing Situations 1 and 3 reserves. In the VM-20 situation, the peak reserve is lower than the corresponding peak reserve on Model 830 XXX 2017 CSO by another 41%. In this case study, the DR produces very little excess over the NPR, except at durations 18 and 19 for the 20-year product and durations 5 to 9 for the 10-year product. This pattern is likely the result of assumptions used to set the product premiums and mortality assumptions and may not be expected for other products.

Figures 12 and 13 provide comparisons of reserve levels for the 10- and 20-year plans from XXX under the 2001 CSO, XXX under the 2017 CSO and VM-20.

Figure 12: Reserve Levels, 10-Year Plan

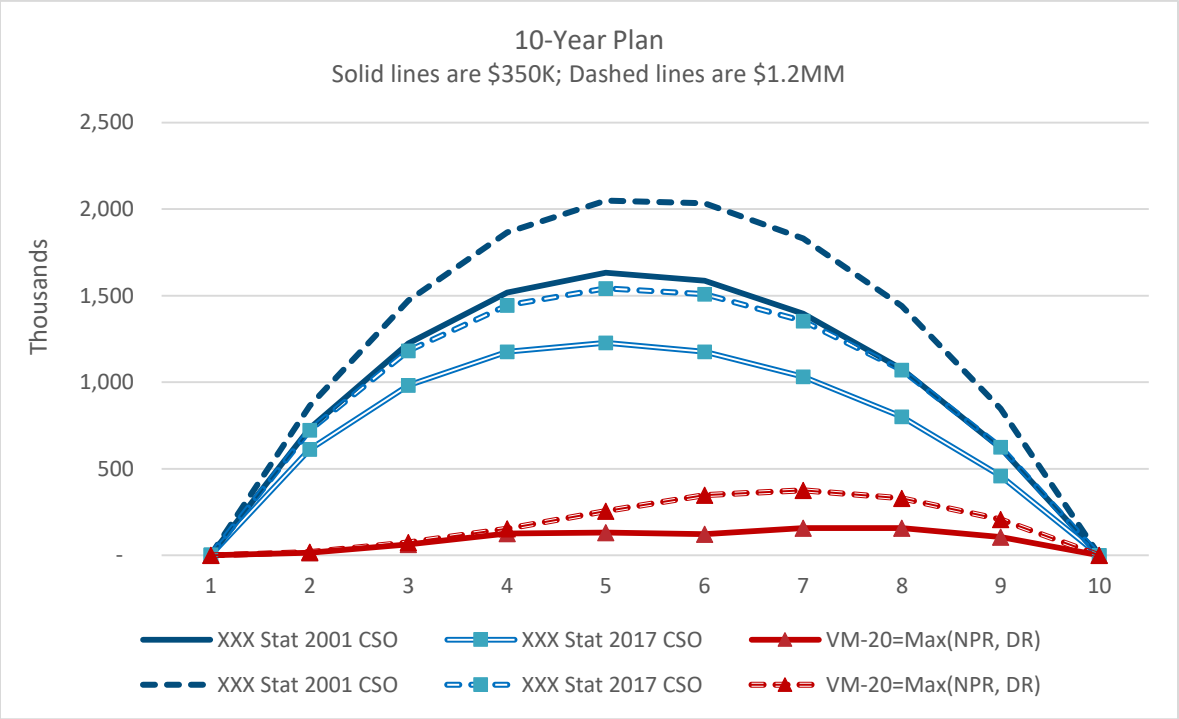


Figure 13: Reserve Levels, 20-Year Plan

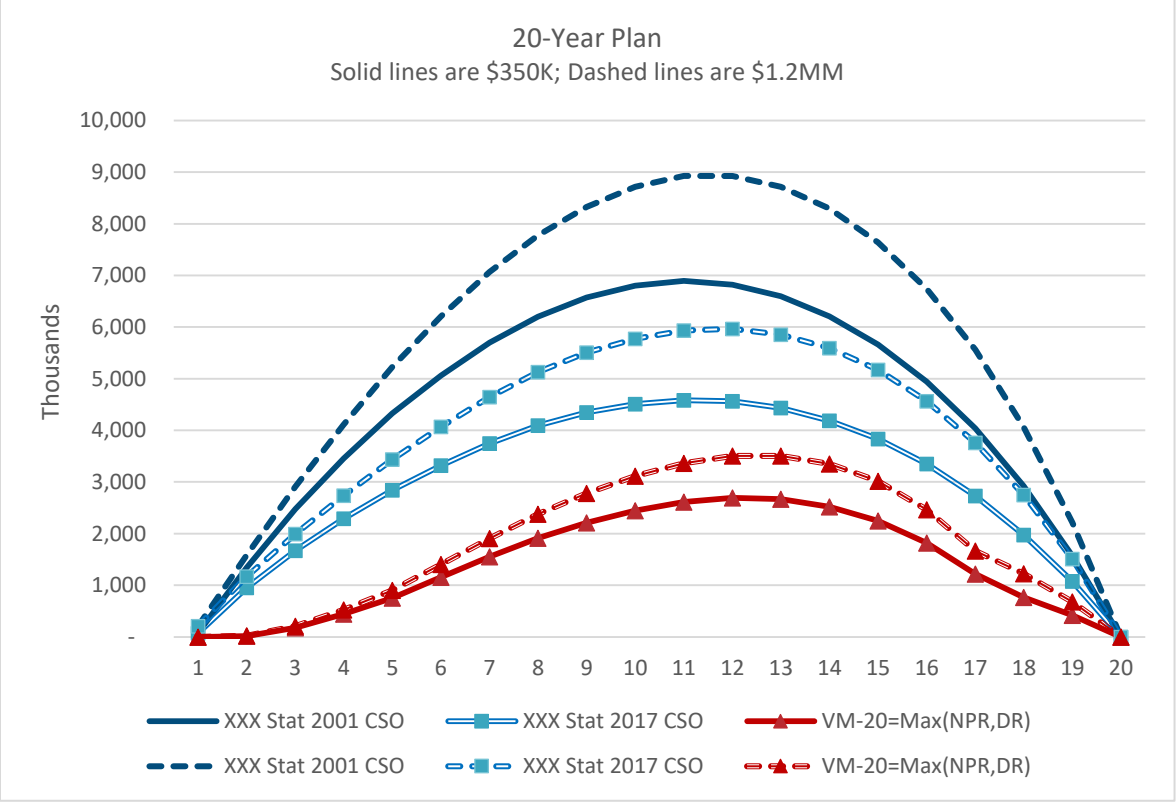
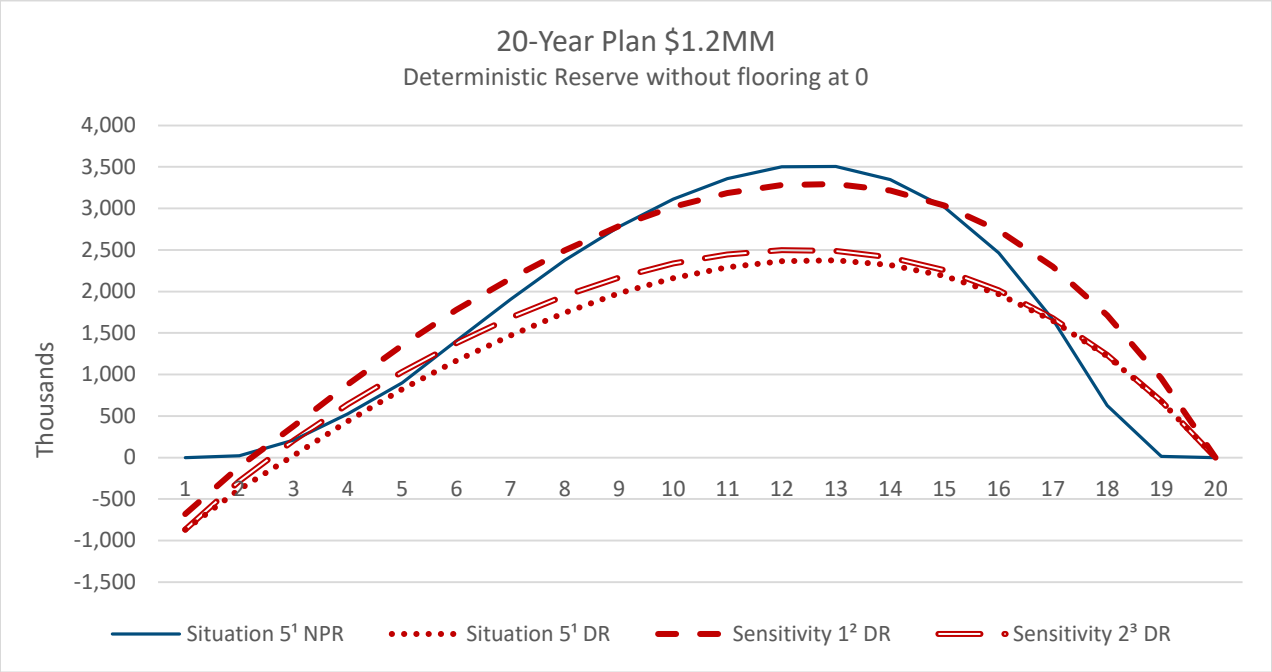


Figure 14 shows how the DR changes in the first two sensitivities described above: Sensitivity 1, remove improvement to the node, and Sensitivity 2, use initial DR discount rates for all future node calculations. For reference purposes, Figure 14 shows the NPR separate from the DR.

Figure 14: Pricing Situation 5 Sensitivities 1 and 2: 20-Year Plan, $1.2 Million



[1] Situation 5: VM-20 NPR+DR Excess Stat, NPR Tax, 2017 CSO.

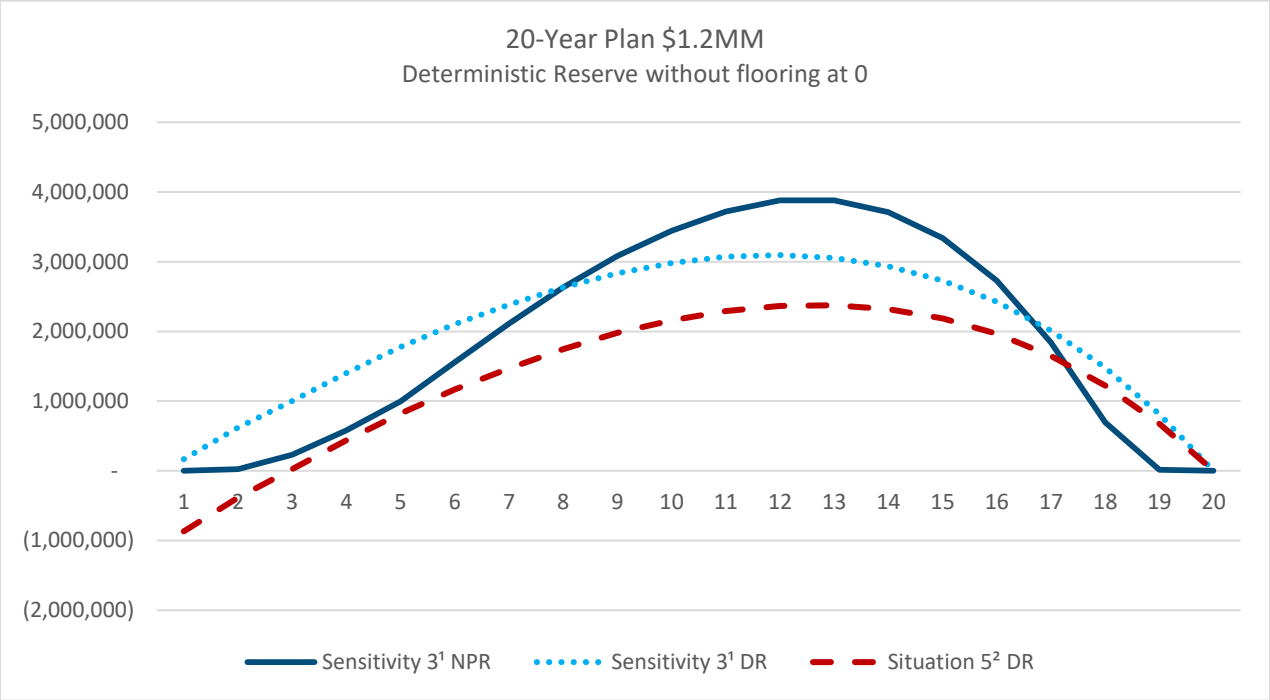
[2] Sensitivity 1: No mortality improvement to future reserve nodes.

[3] Sensitivity 2: Year 1 DR discount rates in all years.

Figure 15 shows how the DR changes in the third sensitivity, where premiums are lowered by 10%. This sensitivity also helps to illustrate how the DR can change with a change to the liability cash flows. As shown in Figure 14, in the set of assumptions for Pricing Situation 5 for the 20-year product, the NPR is greater than the base case DR at most projection periods. A 10% reduction in the per unit premium rates gives rise to a DR that is twice as large as Pricing Situation 5 in the fifth projection period, and still 40% larger than Pricing Situation 5 in the tenth projection period. The relationship between Pricing Situation 5 base case DR and NPR is a construct of the case study term product and the assumptions used for this research. This may or may not be indicative of the relationship for any given company's term product, and Sensitivity 3 in Figure 15 shows just how delicate the balance can be between these VM-20 components.

Figure 15 shows how the level of DR reserves changes due to a change in the product premiums.

Figure 15: Pricing Situation 5, Sensitivity 3: 20-Year Plan, $1.2 Million



[1] Sensitivity 3: 10% premium reduction.
[2] Situation 5: VM-20 NPR+DR Excess Stat, NPR Tax, 2017 CSO.

Observations

As we stepped through the progression of pricing situations for this case study, it became clear that the earlier emergence of earnings under the reserve financing arrangements while maintaining the Model 830 XXX tax reserves brought the profit metrics back to (and probably beyond) industry targets. On a VM-20 valuation platform (Pricing Situation 5), these term products demonstrate improved IRRs when compared with both Pricing Situations 1 and 3. For competitive term products with 100% credibility that were the basis for the case studies, companies that were not using financing transactions may see improved profitability under VM-20, but companies that previously used financing may see deteriorating profitability under VM-20. Such companies may find profitability too low and demand higher returns by continuing to seek out third-party solutions. We also noted that a company's VM-20 reserve levels are dependent upon company-specific prudent estimate assumptions and its specific term product.

Section 8: ULSG Case Studies

Product Design and Model Office

The foundation for the ULSG model office is a multitiered shadow account design that is intended to be representative of a product that is competitive at the top quartile of carriers as of early 2016. This hypothetical ULSG product offers minimal cash value accumulation potential and a lifetime secondary guarantee. The shadow account uses two sets of loads, depending on the timing of the premium payment and balance of the shadow account. This design is intended to encourage level gross premium payments while remaining compliant with AG38 8E. For this case study, we determined premiums as averages of rates for top quartile carriers, and set shadow account charges such that the level premium payments provided guaranteed coverage until age 110.

The premium levels were determined separately for policies with face amounts of $350,000 and $1,200,000. For the higher face version, per unit load charges for the shadow account were reduced compared with the low face version to meet the competitive target. Other charges remain the same between the two bands. Additional details of the product charges are available in Appendix B.

Reinsurance parameters and assumptions for experience mortality and insurance expenses were set in a manner similar to that described for the term product. Commission rates and the lapse assumption were set based on our experience with companies in the ULSG market.

The ULSG model office is constructed of policies at two sizes: $350,000 and $1,200,000 of face amount. Each size is representative of an average face amount within a band and was evaluated independently. The model office also consisted of four issue ages—35, 45, 55 and 65—both genders, and three nontobacco and two tobacco underwriting classes. The weighting of the model office characteristics was based on observations of in-force blocks and was kept the same for the low and high face versions. Additional details are available in Appendix B.

Profitability Results

Figure 16 summarizes the profit measures for the ULSG model office over the five pricing situations (analogous to those run for the term study in Figures 3 and 4). Common investment portfolio rates are assumed in each situation. The liability cash flows, including the premium, are unchanged between pricing situations, with the exception of the inclusion of financing costs under AG48. The changes in profitability are thus driven by the changes in reserve and surplus levels, the amount of investment income and the level of income taxes created by them.

Figure 16: Pricing Results ULSG with Level Premiums for Coverage to A110

	Pretax Profit Margin[1]	After-Tax Profit Margin[2]	Adjusted After-Tax Profit Margin[3]	Surplus Strain	IRR Adjusted After-Tax
Low-Band Model Office					
1) AG38 Stat/Tax, 2001 CSO	22.5%	12.6%	10.5%	−331%	7.0%
2) AG48 Stat, AG38 Tax 2001 CSO	18.9%	18.7%	17.1%	−180%	18.5%
3) AG38 Stat/Tax, 2017 CSO	21.9%	7.8%	5.5%	−610%	5.9%
4) AG48 Stat, AG38 Tax, 2017 CSO	16.7%	16.7%	15.0%	−183%	16.0%
5) VM-20 NPR+DR+SR Stat, NPR Tax, 2017 CSO	23.7%	8.6%	6.9%	−196%	7.3%
High-Band Model Office					
1) AG38 Stat/Tax, 2001 CSO	18.3%	9.0%	6.8%	−395%	6.3%
2) AG48 Stat, AG38 Tax 2001 CSO	14.9%	14.8%	13.1%	−267%	11.5%
3) AG38 Stat/Tax, 2017 CSO	17.9%	4.9%	2.6%	−633%	5.6%
4) AG48 Stat, AG38 Tax, 2017 CSO	13.2%	13.0%	11.3%	−270%	10.2%
5) VM-20 NPR+DR+SR Stat, NPR Tax, 2017 CSO	19.5%	4.4%	2.6%	−285%	5.9%

[1] Pretax profit margin is calculated with discount at the pretax NIER.
[2] After-tax profit margin is calculated with discount at the pretax NIER.
[3] Adjusted after-tax profit margin includes target capital effects and is calculated with discount at the pretax NIER.

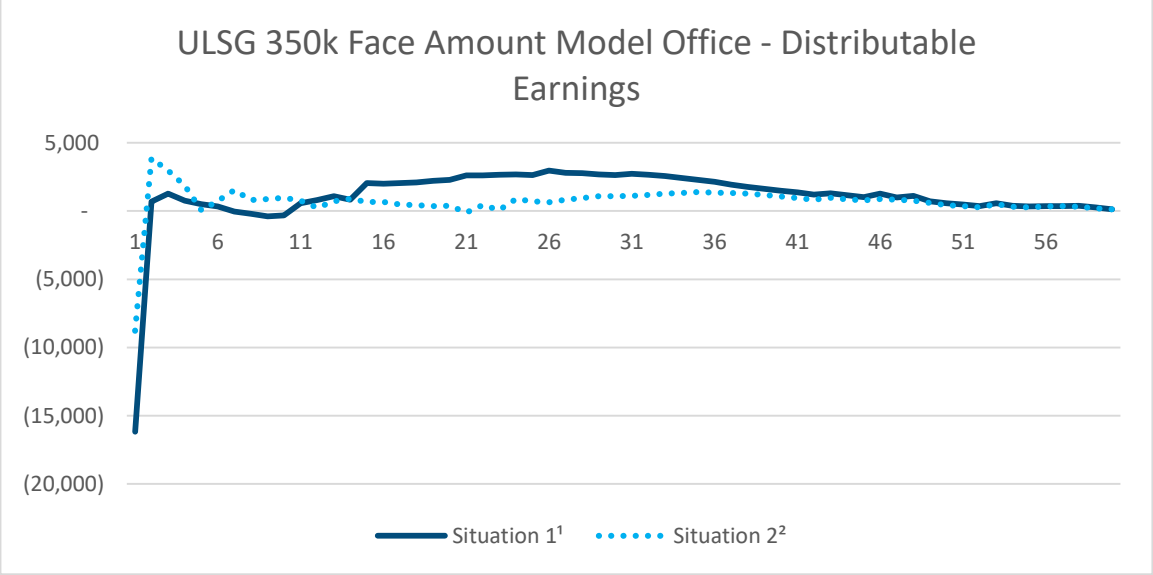
In Pricing Situation 1, we evaluate the profitability of the ULSG product under AG38 reserves using 2001 CSO mortality. There is considerable surplus strain in the first year, which holds down the IRR to a level that may be lower than a direct writer's normal new business hurdle rate. A key driver of this is that deficiency reserves are generated for many cells. For this case study, we assumed XXX X-factors, such that the minimum reserve basis mortality is equal to expected mortality. However, we have not further optimized the product to eliminate the deficiency reserve as might be done in practice, especially for a product that is not intended to be part of a financing transaction. For the first pricing situation, the adjusted after-tax (AT) profit margins of 10.5% for the low band and 6.8% for the high band are above average compared with industry data for recently issued ULSG. Profit margins are highly dependent upon the choice of discount rate. We are using the pretax net earned rate as the discount rate. This isolates the impact of the change in pretax reserve levels and immunizes the resulting changes to investment income.

In Pricing Situation 2, an AG48 financing transaction is applied. The first-year strain is greatly reduced, and the IRR increases dramatically. The product cash flows do not change, and tax reserves remain at the AG38 levels. The pretax profit margin

declines because the change in statutory reserve levels is offset by the change in investment income and the addition of a financing cost reduces the present value of profit. The after-tax profit margin increases, which is due to the tax benefit of financing.

Figure 17 shows the higher early-year distributable earnings resulting from the financing arrangement of Situation 2 for the low face amount band. The dip in earnings in year 5 under Situation 2 is related to the build-up of the SR exceeding the DR for the first time in that year.

Figure 17: Pricing Situations 1 and 2: ULSG $350,000 Face Amount Model Office, Distributable Earnings



[1] Situation 1: AG38 Stat/Tax, 2001 CSO.
[2] Situation 2: AG48 Stat, AG38 Tax 2001 CSO.

It is clear that the high face amount product was less profitable relative to the low face amount version. As noted, the product charges are nearly identical except for per unit loads in the shadow account. After further review of premium data, we believe that the market is more competitive at the higher face amount. Even though our mortality assumption anticipates better experience at the higher face amount, the premium levels necessary to remain competitive will drive lower profitability compared with what is competitive at lower face amounts.

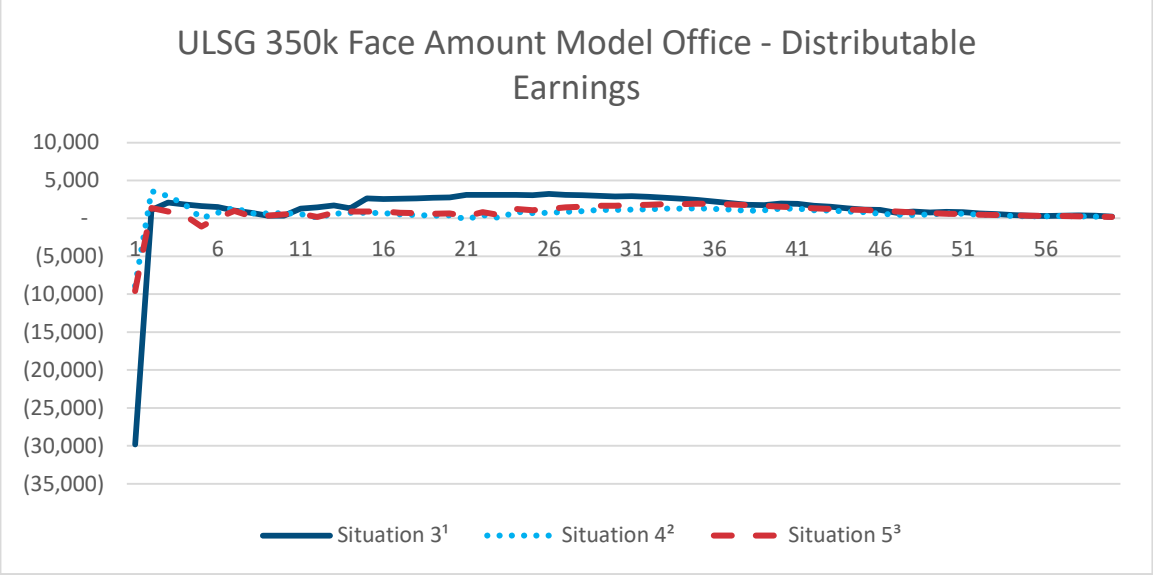
Compared with Pricing Situation 1, our results showed a modest decrease in profitability when moving to use 2017 CSO mortality in Pricing Situation 3. This occurred because of an increase in deficiency reserves. Base reserves did show a decrease that flows through results as a decrease in the tax-deductible reserve, further affecting profitability. We recalculated the X-factors based on the ratio of the experience mortality assumption to the 2017 CSO mortality table, but we did not reflect any further optimization in the case study. We believe that a company looking to price a product on the basis of 2017 CSO mortality would go through an exercise to determine a more efficient set of X-factors. We did not because we viewed this step as a stepping stone along the path to VM-20, and thus X-factor optimization was outside the focus of this report. In Pricing Situation 4, applying the AG48 financing transaction to the 2017 CSO basis resulted in a similar impact as with 2001 CSO.

Pricing Situation 5 shows the effect of the full VM-20 implementation as a decrease in after-tax IRR, an increase in pretax profit margin, and a decrease in after-tax profit margin compared with the AG48 financing results. Compared with AG38 results without financing, the VM-20 implementation caused an increase in after-tax IRR and pretax profit margin. The after-tax profit margin changed only slightly, increasing for the low-band model office and decreasing for the high-band version. This indicates a relatively neutral after-tax profit margin impact (compared to the no-financing situation) depending on the specifics of the policy. The VM-20 reserve is the same as the post-financing reserve under AG48 in Pricing Situation 4, so the first-year strain continues to be reduced relative to AG38, which helps to improve the IRR. The removal of the financing costs required to hold the VM-20 reserve improved profitability relative to AG48 on a pretax basis. However, in some durations after-tax profitability was hurt

relative to the prior regimes by the change from an AG38 tax reserve to the use of a lower NPR as the deductible tax reserve basis under VM-20.

Figure 18 illustrates the impact on distributable earnings from Pricing Situations 3 to 4 and then to 5, with the reduction of strain, changes in tax reserve deductibility and impact of financing costs.

Figure 18: Pricing Situations 3, 4 and 5: ULSG $350,000 Face Amount Model Office, Distributable Earnings



[1] Situation 3: AG38 Stat/Tax, 2017 CSO.

[2] Situation 4: AG48 Stat, AG38 Tax, 2017 CSO.

[3] Situation 5: VM-20 NPR+DR+SR Stat, NPR Tax, 2017 CSO.

In addition to the pricing situations, we tested two sensitivities on the VM-20 reserve. The results are presented relative to Pricing Situation 5, but the reserve level impacts are also relevant to reserve levels with AG48. These tests applied only to the reserve calculation and not to the pricing assumptions for cash flows. In the first sensitivity, we assume the company does not implement the pricing mortality improvement assumption to future nodes in the reserve calculation. In other words, we assume the mortality assumption used in the forecast of DR does not align with the pricing assumption that mortality will exhibit improvement in future years. This sensitivity provides a quantification of the impact of this assumption on the forecast DR and resulting profitability. The second sensitivity assumes the company does not go through the forecasting process to determine DR discount rate streams for future nodes, but rather assumes the stream of DR discount rates developed in the pricing exercise at time zero as the discount rates for all future nodes. For both sensitivities we maintained the same ratios for determining the SR.

Figure 19 shows the profit measures for the two sensitivities compared with Pricing Situation 5. The mortality improvement sensitivity showed only a minor impact to the profit measures, which was due to an increase in reserve levels. The DR discount rate sensitivity had a more significant impact. Further details of the reserve impact are included with the charts of reserve levels in Figures 20 to 22 in the next section.

Figure 19: ULSG with Level Premiums for Coverage to A110

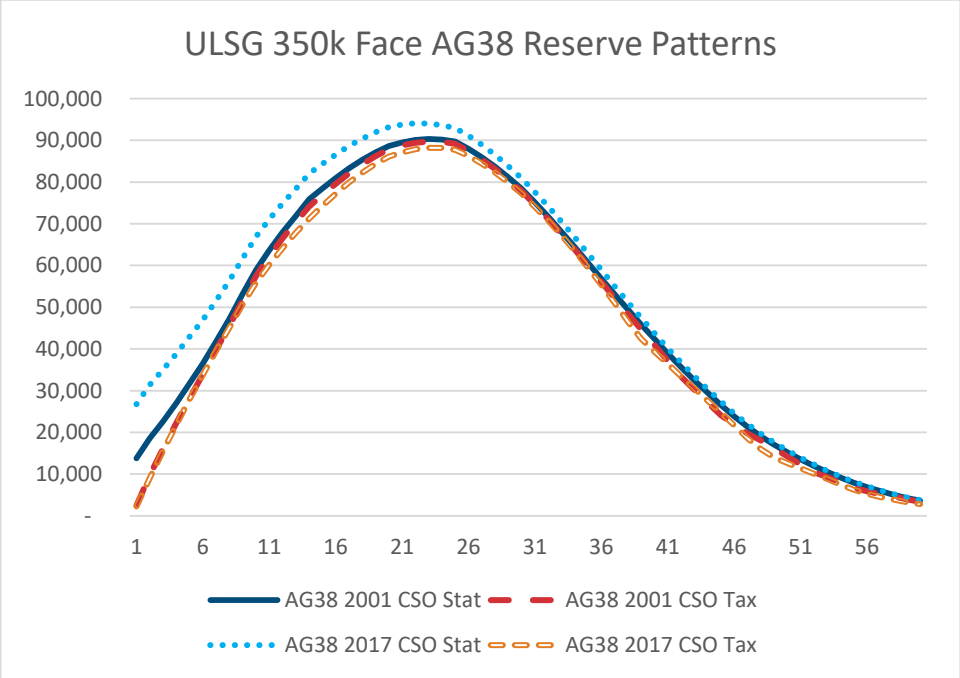
	Pretax Profit Margin[1]	After-Tax Profit Margin[2]	Adjusted After-Tax Profit Margin[3]	Surplus Strain	IRR Adjusted After-Tax
Low-Band Model Office					
Pricing Situation 5[4]	23.7%	8.6%	6.9%	−196%	7.3%
Sensitivity 1: No mortality improvement to future reserve nodes	23.6%	8.1%	6.4%	−199%	7.0%
Sensitivity 2: Year 1 DR discount rates in all years	23.2%	4.7%	2.8%	−196%	5.8%
High-Band Model Office					
Pricing Situation 5	19.5%	4.4%	2.6%	−285%	5.9%
Sensitivity 1: No mortality improvement to future reserve nodes	19.4%	3.8%	2.1%	−289%	5.8%
Sensitivity 2: Year 1 DR discount rates in all years	18.9%	0.2%	−1.8%	−285%	5.1%

[1] Pretax profit margin is calculated with discount at the pretax NIER.
[2] After-tax profit margin is calculated with discount at the pretax NIER.
[3] Adjusted after-tax profit margin includes target capital effects and is calculated with discount at the pretax NIER.
[4] Situation 5: VM-20 NPR+DR+SR Stat, NPR Tax, 2017 CSO.

Statutory Reserve Patterns

Figure 20 compares the relative reserve levels between 2001 and 2017 CSO valuation mortality tables for the ULSG model office. The pattern is roughly the same between the face amount bands, so the high-band results are not shown.

Figure 20: ULSG $350,000 Face Amount, AG38 Reserve Patterns 2001 and 2017 CSO

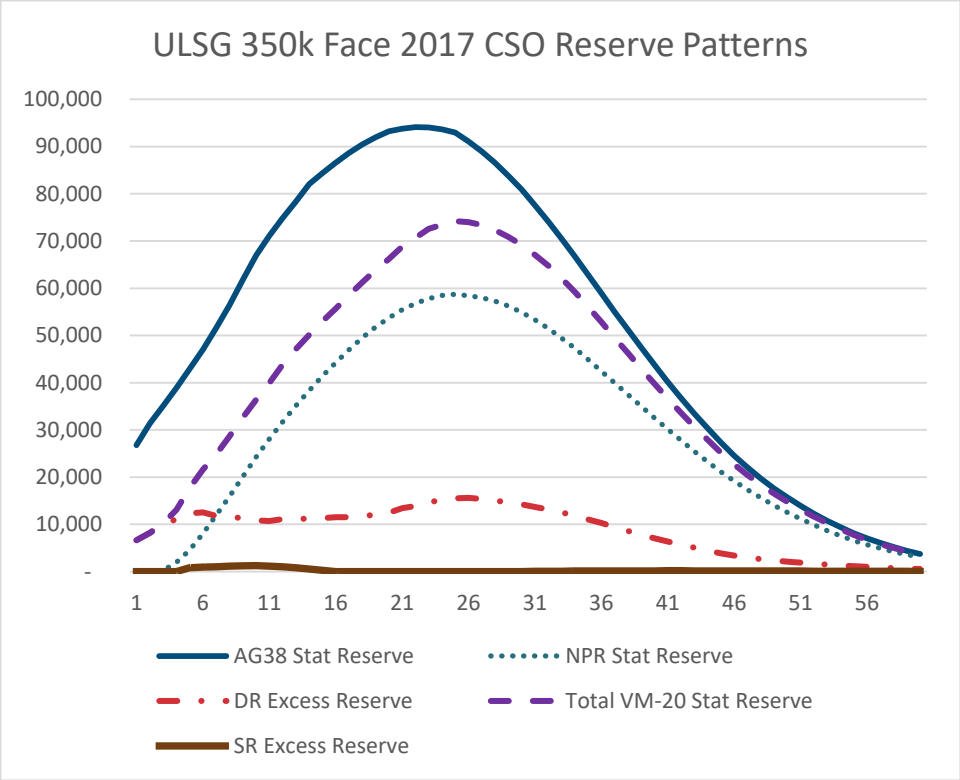


The dotted blue and solid blue lines illustrate the slight increase in the statutory reserve when moving to the 2017 CSO table because of additional deficiency reserves, as previously described. The red and yellow dashed lines represent the corresponding tax reserves, which are lower by roughly the amount of deficiency reserves. Under 2001 CSO, the tax reserve quickly converged

to the statutory reserve, but under 2017 CSO the reserve levels started with a wider statutory to tax difference and did not converge as quickly. Again, we believe that further refinement of the X-factors could remedy this outcome.

Figure 21 compares the relative statutory reserve levels under the 2017 CSO mortality table.

Figure 21: ULSG $350,000 Face Amount, 2017 CSO Reserve Patterns



The purple dashed line representing the total VM-20 statutory reserve is the greater of the NPR, DR and SR. For this ULSG case study, the SR produced only a minimal excess above the DR (indicated by the brown dashed line), peaking approximately in duration 10. Thus the total VM-20 reserve is driven primarily by the DR. The red line represents the excess of the DR over the NPR, and the sum of the NPR (light blue), DR excess (red) and SR excess (brown) lines equals the total VM-20 reserve (purple dashed). ULSG tax reserves may be close to the statutory reserves under current AG38 methods. If a version of the NPR becomes the tax-deductible reserve, Figure 21 illustrates that it could be a substantial reduction in tax reserves from current AG38 levels and lead to increased income taxes, as shown by the case study profit results for Pricing Situations 4 and 5.

We spent considerable time investigating the relationship between the DR and SR to study why the SR minimally exceeds the DR in early durations and is actually less than the DR in later durations. Our conclusion draws upon two key items, the cash value and interest sensitivity of this ULSG design. The product charges are such that the cash values and account values are relatively low in all policy durations and depleted around the 20th policy year for a strong majority of cells. Premium, death benefit and most other product cash flows, with the exception of surrender benefits, are constant across interest rate scenarios. Since cash value accumulation is low, there is little variation in surrender benefits by interest rate scenario. The period where cash values, and therefore surrender benefits, peak nearly coincides with the peak of the stochastic reserve. An increased level of stochastic reserve may have been observed if the product was assumed to be a single premium, or other short-pay premium, ULSG.

We have established that the product cash flows are materially similar across stochastic scenarios. The remaining potential impact to the SR is related to the projection of asset cash flows from the node and the discounting back to the node. Asset cash flows are projected from the node based on the asset portfolio composition at the node.

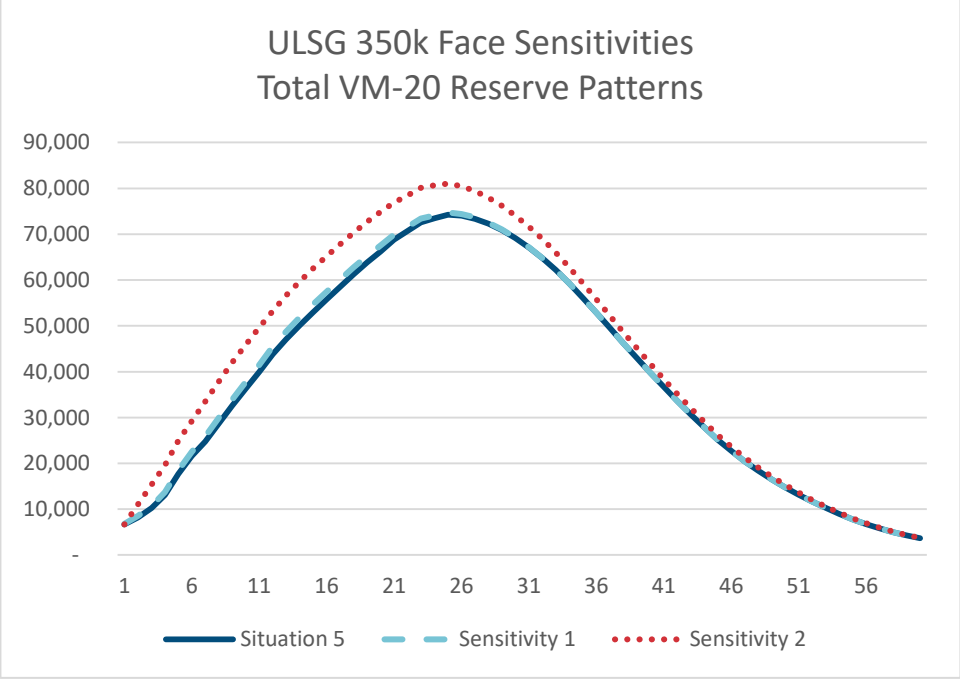
The degree to which results vary across interest rate scenarios depends on how much of the NIER projection is dependent upon the existing asset portfolio at the node. During the early durations before significant assets have built up, the projection of asset cash flows is more dependent upon the interest rate environment in which the assets are purchased, because a high percentage of the asset portfolio is new asset purchases. As a result, the reserve is more sensitive to the interest rate swings during this initial period, so the stress of stochastic scenarios generates a larger reserve. Once more significant assets have built up, starting around the duration 20 calculation, the projections of future asset accumulation show less volatility across stochastic scenarios, because the projection of asset cash flows is more heavily dependent on an existing asset portfolio. This results in relatively lower stochastic reserve requirements. We do not believe that additional points of interpolation, such as at durations 15 and 25, would produce values that differ materially from those produced from our interpolation.

Figure 22 illustrates the pattern of the total VM-20 reserves in Pricing Situation 5 relative to the two sensitivity tests. In the test for Sensitivity 1, removing mortality improvement before the node in the DR calculation, the reserve difference peaks in year 8 at about a 4% increase. We believe this reserve impact is not larger, in part, because when we reflected mortality improvement in the VM-20 and AG48 calculations we did not apply it to the industry mortality assumption, so the effect of mortality improvement in the base projection diminishes over time as the assumption grades to industry. Because of the low lapse rates, a large portion of the DR present value of cash flows is driven by the mortality level in the "tail" period when the grading occurs. This is in contrast to term product reserves, where short-term assumption effects like the mortality improvement are more significant. The mortality improvement impact is further confirmed by the convergence of the DR at duration 35, the end of the grading period. For pricing, companies could decide to assume mortality improvement on the industry table, which would change the outcome of this sensitivity.

In Sensitivity 2, the reserve increase is more substantial and builds throughout the projection to the reserve peak. The increase compared with the Pricing Situation 5 was around 25% by year 10 and a 10% increase at the reserve peak in year 10. This outcome makes sense for Sensitivity 2, because the DR discount rates are locked in the first year and do not benefit from the increase in yield curve and in-force asset portfolio yield that occurs in later years because of the pricing scenario.

Figure 22 shows how the DR changes in the first two sensitivities described above: Sensitivity 1, remove improvement to the node, and Sensitivity 2, use initial DR discount rates for all future node calculations.

Figure 22: ULSG $350,000 Face Amount Sensitivities: Total VM-20 Reserve Patterns



[1] Situation 5: VM-20 NPR+DR+SR Stat, NPR Tax, 2017 CSO.

[2] Sensitivity 1: No mortality improvement to future reserve nodes.

[3] Sensitivity 2: Year 1 DR discount rates in all years.

Observations

One of the most critical aspects of repricing under VM-20 is whether the profitability estimates will be acceptable in comparison with past reserve environments. As demonstrated in the ULSG case study above, despite comparable statutory reserve levels, the after-tax and surplus profit metrics may decrease compared with a view under AG48 financing, because of the loss of tax benefits. Companies that were not using financing transactions may be satisfied with these results under VM-20, but companies that previously used financing may demand higher premiums or continue to seek financing transactions.

In this case study, we continued using a multitiered shadow bucket design from the AG38 world. It is understood that these complex secondary guarantee designs were created at least in part in a search for reserve efficiency. The DR and SR are determined on a cash flow basis that is largely agnostic to the structure of the secondary guarantee. If, as demonstrated in the case study, the minimum reserve is either the DR or SR, rather than the NPR, these complex product mechanics may become less important. The requirements of the secondary guarantee reserve calculation in the NPR also appear to reduce or eliminate the reserve impact of some of the shadow account design structures.

We believe that companies may give consideration to simpler designs, perhaps even a return to specified premiums, in order to reduce logistical challenges ranging from key person risk, sales training and administrative system implementations. Ultimately, product designs may be able to focus more on encouraging or discouraging certain premium payment patterns, with less concern for the implications of a formulaic reserve. It is worth noting that the product design in our case study results in a relatively low NPR compared with DR and SR. Consideration may even be given to testing for product designs that generate a relatively higher NPR, but still less than the DR and SR, if NPR becomes the tax-deductible reserve.

Section 9: Observations and Other Commentary

Impact on Product Development Process

As newly introduced regulation, industry practice in regard to how companies will reflect VM-20 in the product development process is in early formation.

Dealing with Aggregate Level Reserves

Coming from a perspective where life insurance pricing has been conducted at both single cell and model office levels, the prospect of having reserve requirements that are calculated on an aggregate basis introduces new challenges to the process. The calculation of the NPR is not an issue in this regard, as the NPR portion of the reserve requirement is completed on a seriatim basis and can be applied to a pricing cell. Even the DR, while technically an aggregate reserve requirement, can be calculated at the pricing cell level, as the present value of pricing cell cash flows discounted at the DR discount rates. However, DR and SR contributions to the VM-20 reserve are the excess, if any, of the aggregate DR or SR over the sum of the NPR for all policies. It is likely that the excess of the DR or SR over the NPR will arise unequally from various issue ages, bands or risk classes for a given product. Decisions on how to allocate excesses may impact profitability.

Taking a term product as a first example, it is likely that only NPR and DR calculations will be necessary. For some pricing modeling systems, this will permit a single run to produce projections of all future cash flow and reserve amounts. Analysis of an existing product (pretending it is being newly priced) should provide insight into the relative relationships of the NPR and the DR. One method for gaining this understanding could be to calculate a DR-like reserve on a seriatim basis and compare it with the NPR. This exercise should provide some insight into which pricing cells are likely to generate a positive contribution to DR excess over the NPR, and provide a starting point for considering how to allocate any excess from the DR back to individual pricing cells. Decisions concerning the allocation may impact the competitiveness of premiums for pricing cells. In any case, completing sample calculations on an existing product should create a sort of “pricing road map” for how to proceed with a new design and how to price at a cell level.

Additionally, for companies considering aggregation beyond a product cohort but still within the Section 2.A product grouping, more rigor may be required to understand how layers of a new product might fold into the reserve calculations of similar (but different) businesses. At a minimum, the DR, and SR for products requiring an SR, will require some means of calculating the aggregate reserve and allocating it back to cell-level results. Over time, a company will get a sense for the DR/SR impact and might have proxies from past pricing processes to employ. For first time VM-20 pricing, however, companies may find themselves stepping a bit gingerly.

For a ULSG product, the new paradigm is a bit more challenging, given the likely need for the SR. Handling of the NPR and DR could follow what is outlined for the term product above (meaning model new products after gaining understanding of a current product under VM-20). Some pricing systems may require a multistep projection process for determining the future SR and/or an approximation mechanism for SR effects that have been calibrated at a few future points in separate projections. For instance, it could be reasonable to choose five future valuation points at which estimations of the SR in relation to the NPR/DR have been completed. This relationship could be used throughout the pricing process, perhaps with occasional pauses to recalibrate the estimates if significant product features or risk parameters have changed. As cumbersome as this process sounds, companies will get a feel for how to include SR effects, making the process less of a hurdle as comfort is gained.

As with the DR, understanding which cells contribute significantly to a stochastic reserve will be a challenging but necessary step to appropriately allocate reserves at the cell level. It remains to be seen if this cell-level allocation will be attempted for the SR, or if all cells will get a pro rata increase to cell-level pricing reserves to account for SR impacts. From a theoretical standpoint, it stands to reason that some cells will generate more SR than others (and should support the SR more at the cell level). As a simplification, companies may get comfortable with the distribution risk of spreading the SR across all cells.

Reinsurance

It should be noted that inclusion of reinsurance into the pricing process may be interesting. Presumably, reinsurers will analyze existing books of business (as direct companies will examine existing products) to understand how to price under VM-20. It is possible (and likely), however, that reinsurer pricing under VM-20 will take on an increased level of robustness, adding potential time to the pricing process where reinsurance is desired.

The timing of including reinsurance in pricing will also likely change under VM-20. Because reinsurance is embedded in the VM-20 reserve calculations, companies will either need to have quotes in hand earlier in the pricing process, or they will need to be comfortable pricing from an existing treaty. In today's environment, pricing is sometimes completed on a direct basis with a post-reinsurance view as a sort of addendum (or sensitivity). Under VM-20, companies would likely want to fold reinsurance impact into the base pricing, at least for cells where reinsurance is significant.

Underwriting Changes

We note that the market appears to be turning toward underwriting schemes that leverage data rather than well-understood fluids testing and medical markers. Medical markers have always been the gold standard when it comes to life insurance underwriting protocols. The data-driven frontier for life insurance underwriting has little precedence at this point, and insurers will need to recognize the lack of credibility and increased uncertainty in the VM-20 mortality assumption, at least initially until credible experience develops. This may change the complexion of the DR reserve from that presented in this case study.

We note there is a joint Society of Actuaries and American Academy of Actuaries group working to better define the characteristics of accelerated underwriting in order to ensure that the mortality data captured as a result of VM-51 requirements appropriately identify the emerging experience of this underwriting schematic.

Impact on Product Premiums

General industry expectation of the impact of VM-20 is that it will allow for lower-priced premiums on some protection-oriented products. This expectation is born from the ability to use company-specific assumptions as well as an industry-presumed lessened need for reserve financing (because VM-20 reserves should be equal to or very similar to AG48 Actuarial Amounts).

In reality, however, assumptions (and the margins included in them) will vary by company. Smaller companies will lack the credibility of larger companies and may have larger margins and/or earlier grades to industry. In Phase 2 of this research, the impact of smaller-company margins will be folded into a sensitivity to illustrate this phenomenon.

For larger companies, level term premiums may decrease, as nonfinanced reserve levels should decrease. Nonfinanced reserves under VM-20 may not be as low as economic reserves under financing, however, so it is possible some companies may experience little ability to lower term premiums. It is also possible that tax benefits from traditional financing (pre- or post-AG48) may lead to less favorable results under VM-20 than under previous traditional financing arrangements.

ULSG will likely be an accentuated version of term in regard to the effect of company-specific assumptions. Combining the effect of mortality/lapse margins with the product design risk (i.e., how quickly account value is depleted) should create substantial variability in company-specific VM-20 impact on product pricing (and resulting premium levels). VM-20 should have the effect of

aligning reserve levels with product design risk, assuming models of the underlying product adequately reflect those risks. Fundamentally, ULSG product risk boils down to whether the product charges (and premiums paid from which charges are deducted) are sufficient to cover the long term expected death benefits. However, ULSG as a product type can encompass a wide variety of product designs. The impact to premiums will depend largely on how product design changes, as discussed further in the next section.

Impact on Product Design

The product design effects of VM-20 are a little nebulous at this early stage. For base product design of term insurance, level term premiums will still be followed by some sort of Annual Renewable Term (ART) scale, although the importance of having very high guaranteed ultimate rates to achieve the desired segmentation under XXX may subside somewhat. We expect the product design will evolve around encouraging favorable product cash flows and managing risks, rather than a design focused on formulaic reserve requirements. We note that for the term case studies, we set the post–level term premiums at 250% of 2017 CSO Preferred Class Ultimate mortality and did not design an optimal level of premiums to maximize profit or manage risk.

For base ULSG, product designs can be expected to be widely reevaluated. With the removal of AG38 mechanics from the equation, it is possible that shadow funds will see less emphasis in the market than in the recent past, when increasingly complex shadow account designs were developed with an eye toward AG38 and XXX reserve efficiency.

Additionally, it is possible the new paradigm allows for (or even encourages?) designs with somewhat higher account value accumulations than some of the low-account value ULSG products of recent iterations. On one hand, very low account value designs may be able to pass the SET because, absent material surrender benefits, the liability cash flows can become almost insensitive to the investment income margin that is tested by the SR. On the other hand, higher account value designs could be impacted less by the VM-20 prescribed lapse margin. VM-20 requires a lapse margin by which company lapse rates grade to the Canadian term-to-100 lapse rate on policies with low surrender value after the period of credible lapse experience. Since ULSG products are typically lapse supported, the margin serves to increase the DR and SR calculations. By including material account value on the product, there could potentially be a twofold impact to lower VM-20 reserves. First, it increases the incentive to the policyholder to surrender, potentially leading to justifiably higher lapse rates. Second, it could defer or eliminate the prescribed grading for minimally funding policies.

As noted previously ULSG as a product type can encompass a wide variety of product designs, and ULSG risk boils down to whether the product charges are sufficient to cover the long term expected death benefits. For this research, we have focused on a low premium, protection-oriented product. However, often a secondary guarantee comes in the form of a rider added to a more typical accumulation UL or, increasingly in more recent years, Indexed UL policy.

Under the formulaic AG38 paradigm, the final statutory reserve for an accumulation product would have been the greatest of the reserves independently calculated under any applicable regulation or guideline (e.g., CRVM, AG38, AG36). In the case of many accumulation product designs with a ULSG rider, the AG38 reserve would be the greatest.

While the AG38 reserve would be a function of the value of the underlying guaranteed premium, the AG38 calculation would be independent of other product features. In the case of the subject product design of this report, there are few additional product features to consider. In the case of an accumulation focused product, it makes more sense to address the product risks as a whole. VM-20 takes a more holistic approach to measuring such product risks.

For the sake of argument, consider an accumulation UL product that has a secondary guarantee rider with the same lifetime guarantee premium as a low-cash-value, low-premium focus design. Now consider that the accumulation policyholder could pay a premium twice as high as the low-premium policyholder, since his or her primary goal is to accumulate. Under AG38 the accumulation policyholder would have a *higher* reserve, since the guarantee is funded at a higher level. Intuitively, the expectation would be that the accumulation policyholder carries less secondary guarantee risk, since he or she is expected to pay more premium and therefore less likely for the secondary guarantee to be necessary. Under VM-20, this interaction will be captured, rather than using the greatest of multiple independent calculations. This should allow product actuaries more liberty to provide valuable features to the customer, with less worry regarding undue reserve strain. (It is noted that an accumulation product is more likely to be affected by the SR, but that is again a sign that VM-20 reflects actual product risks.)

A number of additional questions for the ULSG product actuaries and companies to consider include:

- For low account value designs, will the line between 30-year term and shorter term ULSG become blurred? Will term and ULSG markets for long-term, low-cost coverage begin to overlap?

- Could a well-timed incentive to surrender (like a return of premium option) before assumptions grade to industry assumptions improve DR and SR reserves?

- What is the term of secondary guarantee period that is short enough to include on an accumulation product without generating "extra" reserves relative to the product without it?

- Will companies offer an increased level of cash value on ULSG in order to justify higher lapse rate assumptions? What will regulators think about this?

Aside from base product design, it will be interesting to see how other benefits and riders are affected by VM-20. Does waiver of premium (WP) or other ancillary benefits change substantially under VM-20? Anecdotally, WP and other often-offered riders are seldom repriced (or included in the pricing process). Does this change under VM-20? Modeling efforts under VM-20 for base products are perceived to include substantial effort; modeling efforts under VM-20 when riders are included (when perhaps not even modeled previously) would accentuate the issues.

VM-20 Implementation Strategy

Assuming tax reserves follow the statutory basis and assuming tax reserves under VM-20 are set at the level of NPR, the case studies suggest that companies that finance statutory reserves may have incentive to delay implementation of VM-20 until required by 2020.

Impact on Pricing Systems

Through this pricing exercise we have identified several areas where legacy pricing systems and approaches may need to evolve. State-of-the-art systems already have inner and outer loop logic to enable forecasting a DR and/or SR into the future. Here are possible ways pricing systems may evolve to facilitate product pricing under VM-20:

- The ability to project future deterministic scenarios launched from the point of a company's assumed baseline Treasury curve would facilitate the ability of a company to reflect its own best estimate of future risk-free interest rates and the deterministic scenarios that result from it.

- From each node's unique DR scenario, the functionality to determine the company's earned rates at each node based on that scenario and assuming the company's reinvestment strategy.

- Each of the first two bullet points can also be repeated for forecasts of the SR scenarios and the earnings rates thereon. Stochastic projections introduce a layer of complexity that may elevate run times. Systems could potentially accommodate simplifying this by providing options for the user to preselect the nodes at which the SR should be derived.

Allocating aggregate results back to the model cell will be important in managing distribution risk and avoiding soft spots in the pricing and design of insurance products.

Section 10: What's Coming in Phase 2 Report

Phase 2 of our research will expand upon the case studies shown in Phase 1 and include illustrative pricing examples for the following situations:

- Small company with limited data with an illustration of the impact of coinsurance
- Guaranteed YRT premium reinsurance

- Level term product where post–level term profits are assumed
- 30-year level term product
- Simplified issue term product
- Short pay ULSG product

The Phase 2 report will provide additional commentary on other issues, including:

- Changes in Product Development Process, such as
    i. Product Handoff
    ii. Implementation
    iii. Valuation System support of the product
    iv. Use of pricing models, if valuation system not ready
    v. Product Filing
    vi. Time Needed to Complete
- Setting assumptions where limited credibility is available, for mortality, lapses and other policyholder behavior assumptions or when entering new markets such as accelerated underwriting
- Challenges in implementing best practices stochastic pricing under VM-20
- Benefits of aggregating different product groups
- Level of industry preparedness for pricing under VM-20
- Impact on other product lines
- Pricing sensitivity tests
- Are there ways to simplify the pricing process?
- Will the issues around allocating back aggregate reserves to pricing cell-level results change the way companies view cell-level competitiveness and/or distribution risk?
- How might reinsurance affect VM-20 pricing?

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Appendix A: Phase 1 Case Studies: Term Product

Product Definition, Pricing Metrics and Basis for Experience Assumptions

Product Definition	10- and 20-year level premium to A95 product with four nontobacco classes (e.g., "MN1" is male best nontobacco) and two tobacco classes.
Framework of Pricing Metrics	Pricing performed over level premium term period.
Product Parameters	Gross premiums reflective of top-quartile direct writer. Tail premiums set equal to 250% of 2017 CSO Preferred Structure Ultimate rates. Policy sizes of $1.2MM and $350,000.
Experience Assumptions	Experience mortality set at averages of rates for representative companies. Mortality improvement assumed to follow SOA improvement factors for AG38 year-end 2015 calculations. Lapse reflects general industry data from LIMRA studies for level premium term products. Expense assumptions include premium tax consistent with industry averages. Commission structure consistent with top-quartile writers.
Third-Party Reinsurance	Retention limit applied. First dollar quota share arrangement, with YRT reinsurance premiums reflecting reinsurer margin of 10% on assumed mortality.
Asset Earnings Rate	Assume portfolio rates reflective of base case pricing scenario where the asset portfolio develops from new asset purchases.
Target Surplus	Factor-based and representing 325% to 350% of NAIC RBC (reserves will reflect applicable reserve basis).
Statutory Reserves; Tax Reserves	Varies depending on Pricing Situation defined in Section 6. Further details follow.
Cash Values	No nonforfeiture values, no return of premium (ROP), no riders.
Model Office Definition	Definition including class/gender/issue age/size derived from representative company data.
Financing Costs	75 basis points of amounts financed for Reserve Financing Post-AG48 (2001 CSO or 2017 CSO)

Product Specifications

Policy size	$1.2MM, $350,000 (high-band, low-band)
Policy Fee	$60
Premium Mode	Annual
Insurance Period	Attained age 95
Commission Rate	(Yr 1) 105% of premium, (Yr 2+) 0% of premium
Acquisition Costs	$0.2 per unit and $250 per policy
Maintenance Expense	$45 per policy with 2% inflation all years, 1.5% of premium

Premiums per Unit

Sampling of Rates		
Cell	**10-Year Product, $1.2MM**	**20-Year Product, $1.2MM**
35MN1	$0.23	$0.43
35MN2	$0.33	$0.59
35MN3	$0.45	$0.73
35MN4	$0.58	$0.96
35MS1	$1.21	$1.97
35MS2	$1.62	$2.63

Pricing Assumptions: Lapse Rates

10-Year Product, High-Band ($1.2MM Size)								
	Duration							
Issue Age	1	2	3	4	5	6	7	8–10
20	9%	10%	9%	8%	8%	7%	7%	6%
25	9%	10%	9%	8%	8%	7%	7%	6%
30	7%	8%	7%	6%	5%	5%	4%	4%
35	7%	8%	7%	6%	5%	5%	4%	4%
40	6%	7%	6%	5%	4%	3%	3%	3%
45	6%	7%	6%	5%	4%	3%	3%	3%
50	5%	6%	5%	5%	4%	4%	3%	3%
55	5%	6%	5%	5%	4%	4%	3%	3%
60	5%	6%	6%	6%	6%	5%	4%	4%
65	5%	6%	6%	6%	6%	5%	4%	4%

20-Year Product, High-Band ($1.2MM Size)									
	Duration								
Issue Age	1	2	3	4	5	6	7	8-14	15–20
20	7%	8%	6%	6%	5%	5%	4%	4%	3%
25	7%	8%	6%	6%	5%	5%	4%	4%	3%
30	4%	4%	4%	3%	3%	2%	2%	2%	2%
35	4%	4%	4%	3%	3%	2%	2%	2%	2%
40	4%	4%	3%	2%	2%	2%	2%	2%	2%
45	4%	4%	3%	2%	2%	2%	2%	2%	2%
50	5%	5%	4%	3%	3%	2%	2%	2%	2%
55	5%	5%	4%	3%	3%	2%	2%	2%	2%
60	7%	6%	5%	4%	3%	2%	2%	2%	2%
65	7%	6%	5%	4%	3%	2%	2%	2%	2%

10-Year Product, Low-Band ($350K Size)								
	Duration							
Issue Age	1	2	3	4	5	6	7	8–10
20	11%	12%	11%	10%	10%	9%	9%	8%
25	11%	12%	11%	10%	10%	9%	9%	8%
30	9%	10%	9%	8%	7%	7%	6%	6%
35	9%	10%	9%	8%	7%	7%	6%	6%
40	8%	9%	8%	7%	6%	5%	5%	5%
45	8%	9%	8%	7%	6%	5%	5%	5%
50	7%	8%	7%	7%	6%	6%	5%	5%
55	7%	8%	7%	7%	6%	6%	5%	5%
60	7%	8%	8%	8%	8%	7%	6%	6%
65	7%	8%	8%	8%	8%	7%	6%	6%

20-Year Product, Low-Band ($350K Size)								
	Duration							
Issue Age	1	2	3	4	5	6	7	8[1]
20	9%	10%	8%	8%	7%	7%	6%	6%
25	9%	10%	8%	8%	7%	7%	6%	6%
30	6%	6%	6%	5%	5%	4%	4%	4%
35	6%	6%	6%	5%	5%	4%	4%	4%
40	6%	6%	5%	4%	4%	3%	3%	3%
45	6%	6%	5%	4%	4%	3%	3%	3%
50	6%	6%	5%	4%	4%	3%	3%	3%
55	6%	6%	5%	4%	4%	3%	3%	3%
60	8%	7%	6%	5%	4%	3%	3%	3%
65	8%	7%	6%	5%	4%	3%	3%	3%

[1] Variations beyond $t = 8$ for ages 20, 25 and 30 reduce lapse rate to 0.03.

Pricing Assumptions: Mortality Rates

Expected Basis	2008 VBT ANB Sex and Smoker Distinct Table

Actual-to-Expected Factor

Average of Factors First Five Policy Years, All Issue Ages		
Cell	$1.2MM Band	$350,000 Band
MN1	0.53	0.57
MN2	0.65	0.65
MN3	0.84	0.84
MN4	1.05	1.05
MS1	0.61	0.72
MS2	0.83	0.83
FN1	0.52	0.51
FN2	0.64	0.65
FN3	0.82	0.83
FN4	1.03	1.08
FS1	0.55	0.69
FS2	0.78	0.78

VM-20 Reserves

<table>
<tr><td>NPR Reserves</td><td>VM-20 NPR together with NPR assumptions of interest, lapse and select and ultimate 2001 or 2017 CSO mortality table. Tax reserves assumed equal to NPR.</td></tr>
<tr><td>Deterministic Reserve</td><td>Prudent estimates of mortality, lapse, expense, reinsurance and projected NIER under DR scenario; 100% credibility and 15-year sufficient data period are assumed, consistent with top-quartile level premium term writers.</td></tr>
<tr><td>Stochastic Reserve</td><td>The product is assumed to avoid the SR by way of the exclusion test.</td></tr>
<tr><td>Lapse Margin</td><td>
<table>
<tr><th>Duration</th><th>Term 10</th><th>Term 20</th></tr>
<tr><td>1</td><td>+5%</td><td>+5%</td></tr>
<tr><td>2</td><td>+5%</td><td>+5%</td></tr>
<tr><td>3</td><td>+5%</td><td>+5%</td></tr>
<tr><td>4</td><td>−10%</td><td>+5%</td></tr>
<tr><td>5</td><td>−10%</td><td>+5%</td></tr>
<tr><td>6+</td><td>−10%</td><td>−10%</td></tr>
</table>
</td></tr>
<tr><td>Expense Margin</td><td>5% on maintenance expenses.</td></tr>
<tr><td>Mortality Margin</td><td>From Limited Fluctuation table when 2015 VBT is the industry basic table; assuming 99% credibility, no mortality improvement beyond node.</td></tr>
<tr><td>Reins Premium</td><td>Increased to reflect the VM-20 mortality margin. Some call this a “margin,” others may think of it as reconciling the economics of the reinsurance with the VM-20 valuation.</td></tr>
<tr><td>Target Surplus</td><td>Maintain target surplus formula</td></tr>
</table>

Appendix B: Phase 1 Case Studies: ULSG

Product Definitions, Pricing Metrics and Basis for Experience Assumptions

Product Definition	Universal life product with secondary guarantees up to lifetime, with three nontobacco classes (e.g., "MN1" is male best nontobacco) and two tobacco classes.
Framework of Pricing Metrics	Pricing performed over life of contact.
Product Parameters	Premiums reflective of top-quartile direct writer will serve as gross premiums. Product is designed so that these premiums will maintain the secondary guarantee at least through attained age 110. Product is designed to offer minimal opportunity for cash value accumulation at current crediting rates levels. Policy sizes of $1.2MM and $350,000.
Experience Assumptions	Experience mortality set at averages of rates for representative companies. Mortality improvement assumed to follow SOA improvement factors for AG38 year-end 2015 calculations. Lapse reflects general industry data from experience with pricing ULSG products. Expense assumptions including premium tax consistent with industry averages. Commission structure consistent with top-quartile writers.
Third-Party Reinsurance	Retention limit applied. First dollar quota share arrangement with YRT reinsurance premiums reflecting reinsurer margin of 10% on assumed mortality.
Asset Earnings Rate	Assume portfolio rates reflective of base case pricing scenario, where the asset portfolio develops from new asset purchases.
Target Surplus	Factor-based and representing 325% to 350% of NAIC RBC (reserves will reflect applicable reserve basis).
Statutory Reserves; Tax Reserves	Varies depending on Pricing Situation defined in Section 6. Further details follow.
Cash Values	Developed from account value less surrender charges.
Model Office Definition	Definition including class/gender/issue age/size derived from representative company data.
Financing Costs	100 basis points of amounts financed for Reserve Financing Post-AG48 (2001 CSO or 2017 CSO).

Product Specifications

<table>
<tr><td>Policy Size</td><td>$1.2MM, $350,000 (high-band, low-band)</td></tr>
<tr><td>Premium Mode</td><td>Annual</td></tr>
<tr><td>Insurance Period</td><td>Attained age 121</td></tr>
<tr><td>Base Account Charges</td><td>• $96 annual policy fee
• 8% premium load
• Per unit loads varying by age, gender, risk class and duration
• Cost of insurance charges varying by age, gender, risk class and duration
• 2% guaranteed interest crediting rate
• 2% target spread for setting interest crediting rate</td></tr>
<tr><td>Shadow Account Charges</td><td>• $108 annual policy fee
• Premium loads varying by above and below shadow account target premium, and varying by issue age, risk, gender, risk class and duration
• Per unit loads varying by age, gender, risk class and duration
• Cost of insurance charges varying by age, gender, risk class and duration
• 7.5% interest crediting rate
• Two-bucket design, first bucket captures first-year premiums only</td></tr>
<tr><td>Commission Rate</td><td>• Up to target: Year 1, 120%; Years 2–10, 3%; Years 11+, 2%
• Above target: Years 1–10, 3%; Years 11+, 2%
• Targets set at approximate level of lifetime premium</td></tr>
<tr><td>Acquisition Costs</td><td>$0.55 per unit and $200 per policy</td></tr>
<tr><td>Maintenance Expense</td><td>$50 per policy with 2% annual inflation, 2% of premium</td></tr>
<tr><td>Gross Premiums</td><td>
<table>
<tr><th colspan="3">Sample gross premiums for ULSG model office</th></tr>
<tr><th>Cell</th><th>Low-Band</th><th>High-Band</th></tr>
<tr><td>55 MN3</td><td>$5,486</td><td>$17,782</td></tr>
<tr><td>55 MN1</td><td>$4,135</td><td>$13,584</td></tr>
<tr><td>55 FN3</td><td>$4,415</td><td>$14,896</td></tr>
<tr><td>55 FN1</td><td>$3,515</td><td>$11,618</td></tr>
<tr><td>65 MN3</td><td>$9,376</td><td>$31,961</td></tr>
<tr><td>65 MN1</td><td>$7,154</td><td>$23,901</td></tr>
<tr><td>65 FN3</td><td>$7,749</td><td>$26,279</td></tr>
<tr><td>65 FN1</td><td>$5,937</td><td>$19,793</td></tr>
</table>
</td></tr>
</table>

Pricing Assumptions: Lapse Rates

Year	Rate[1]
1	3.0%
2	3.0%
3	2.5%
4	2.5%
5	2.0%
6	2.0%
7	2.0%
8	2.0%
9	2.0%
10+	3.5%

[1] Lapses occur before annual premium due dates.

Dynamic Lapse Adjustment		
Account Value	Secondary Guarantee Status	Adjustment
Positive	Paid Up	50%
Negative	Paid Up	0%
Negative	Not Paid Up	50%

Pricing Assumptions: Mortality Rates

Expected Basis	2008 VBT ANB Sex and Smoker Distinct Table
Actual-to-expected factors	Same as those used for term product, varying by issue age, gender, risk class and band.

VM-20 Reserves

NPR Reserves	VM-20 NPR together with NPR assumptions of interest, lapse and select and ultimate 2001 or 2017 CSO mortality table. Tax reserves assumed equal to NPR.
Deterministic Reserve	Prudent estimates of mortality, lapse, expense, reinsurance and projected NIER under deterministic scenario; 100% credibility and 10-year sufficient data period is assumed, consistent with top-quartile ULSG writers.
Stochastic Reserve	The product is assumed to fail the stochastic exclusion test under VM-20 and by de facto requirements of AG48.
Lapse Margin	10% in all years. After year 10 through year 15, for policies with minimal cash value (which we define as below $10 per unit in-force), the lapse assumption grades to the Lapse Experience table for Term-to-100 policies available in the October 2007 report published by the Canadian Institute of Actuaries.
Expense Margin	5% on maintenance expenses.
Mortality Margin	From Limited Fluctuation table when 2015 VBT is the industry basic table; assuming 99% credibility, no mortality improvement beyond node.
Reins Premium	Increased to reflect the VM-20 mortality margin. Some call this a “margin,” others may think of it as reconciling the economics of the reinsurance with the VM-20 valuation.
Target Surplus	Maintain target surplus formula.

Appendix C: Asset Modeling and Assumptions: Portfolio Earned Rates under Pricing Scenario

The applicable U.S. Treasury rates for the pricing economic scenario are shown in the following table. Monthly rates are linearly graded between the rates shown:

Treasury Yields Bond Equivalent Rates					
Date	1 Year	5 Year	10 Year	20 Year	30 Year
12/31/2015	0.65%	1.76%	2.27%	2.67%	3.01%
12/31/2016	1.25%	2.26%	2.77%	2.97%	3.11%
12/31/2017	2.55%	2.86%	3.22%	3.32%	3.36%
12/31/2018+	3.05%	3.36%	3.72%	3.82%	3.86%

The assumed investment strategy, spreads, default rates and investment expense for the term portfolio are shown in the following table:

Term Pricing: Investment Mix and Assumptions						
Percentage Allocation	S&P Quality	Public/Private	Maturity	Spread	Defaults	Investment Expenses
20%	A	Public	10	125	10	15
10%	BBB	Public	10	200	30	15
10%	A	Private	10	160	10	15
10%	BBB	Private	10	230	30	15
40%	A	Public	20	140	10	15
10%	BBB	Public	20	215	30	15
WTG AVG			15	161.5	16	15

Cash flows are invested in a mix of public and private investment-grade bonds, with equal weighting of 10- and 20-year maturities. Cash flows available for investment are assumed to be level for the 20-year projection period.

Under the assumed pricing scenario, the portfolio earned rate net of defaults and investment expenses for the term product is as follows:

Term: Pricing Scenario NIERs			
Year	NIER	Year	NIER
2016	4.18%	2026	4.99%
2017	4.38%	2027	5.01%
2018	4.61%	2028	5.02%
2019	4.73%	2029	5.02%
2020	4.80%	2030	5.02%
2021	4.84%	2031	5.02%
2022	4.88%	2032	5.03%
2023	4.90%	2033	5.03%
2024	4.92%	2034	5.03%
2025	4.94%	2035	5.03%

The assumed investment strategy, spreads, default rates and investment expense for the ULSG portfolio are shown in the following table:

ULSG Pricing: Investment Mix and Assumptions						
Percentage Allocation	S&P Quality	Public/Private	Maturity	Spread	Defaults	Investment Expenses
20%	A	Public	10	125	10	15
20%	BBB	Public	10	200	30	15
10%	A	Private	10	160	10	15
17%	BBB	Public	30	205	30	15
17%	A	Public	30	140	10	15
13%	A	Private	30	175	10	15
3%	BBB	Private	30	235	30	15
WTG AVG			20	169.7	18	15

Cash flows are invested in a mix of public and private investment-grade bonds, with equal weighting of 10- and 30-year maturities to achieve an ultimate portfolio allocation of 25% and 75% in 10- and 30-year maturities, respectively. Cash flows available for investment are assumed to be level for the entire projection period.

Under the assumed pricing scenario, the portfolio earned rate net of defaults and investment expenses for the ULSG portfolio is as follows:

ULSG: Pricing Scenario NIERs					
Year	NIER	Year	NIER	Year	NIER
2016	4.31%	2026	5.08%	2036	5.17%
2017	4.48%	2027	5.11%	2037	5.17%
2018	4.71%	2028	5.12%	2038	5.18%
2019	4.82%	2029	5.13%	2039	5.18%
2020	4.89%	2030	5.14%	2040	5.18%
2021	4.93%	2031	5.14%	2041	5.19%
2022	4.96%	2032	5.15%	2042	5.19%
2023	4.99%	2033	5.15%	2043	5.19%
2024	5.01%	2034	5.16%	2044	5.20%
2025	5.02%	2035	5.16%	2045	5.20%

Appendix D: Asset Modeling and Assumptions: DR Discount Rates

The first step in the process to develop DR discount rates at each valuation node is to develop the DR Scenario at each node. The DR Scenario is defined as Scenario #12 of the Stochastic Exclusion Test scenarios from the American Academy of Actuaries scenario generator. Using the pricing economic scenario, we updated the Academy scenario generator with the pricing scenario assumption to each node, and ran the generator to capture the DR Scenario.

For example, to develop the DR Scenario Treasury rates as of year-end 2019, we updated the Academy scenario generator with Treasury rates from the pricing scenario through December 31, 2019, and generated a projected DR Scenario as of December 31, 2019. The Academy generator starts with the assumed yield curve as of December 31, 2019, and applies the mean reversion parameters calculated using the historical data through December 31, 2015, and the pricing scenario data for 2016 through 2019. A similar process was used to generate DR Scenarios for all other nodes in the projection period.

The following table shows 10-year Treasury rates from the DR Scenarios at several nodes:

Years from Node	12/31/2015 Node	12/31/2025 Node	12/31/2035 Node	12/31/2045 Node
1	2.31%	3.62%	3.60%	3.58%
2	2.31%	3.54%	3.51%	3.48%
3	2.31%	3.47%	3.42%	3.38%
4	2.32%	3.40%	3.34%	3.28%
5	2.33%	3.33%	3.26%	3.19%
6	2.35%	3.27%	3.19%	3.11%
7	2.36%	3.21%	3.12%	3.03%
8	2.38%	3.16%	3.06%	2.96%
9	2.39%	3.11%	3.01%	2.90%
10	2.40%	3.07%	2.96%	2.85%
11	2.42%	3.03%	2.92%	2.80%
12	2.43%	2.99%	2.88%	2.76%
13	2.44%	2.96%	2.84%	2.72%
14	2.45%	2.93%	2.81%	2.68%
15	2.46%	2.91%	2.78%	2.65%
16	2.47%	2.89%	2.76%	2.63%
17	2.48%	2.87%	2.74%	2.60%
18	2.49%	2.85%	2.72%	2.58%
19	2.49%	2.83%	2.70%	2.56%
20	2.50%	2.82%	2.68%	2.54%
21	2.58%	2.89%	2.75%	2.61%
22	2.66%	2.97%	2.82%	2.67%
23	2.74%	3.04%	2.89%	2.73%

24	2.81%	3.11%	2.95%	2.79%
25	2.89%	3.18%	3.01%	2.85%
26	2.95%	3.24%	3.07%	2.90%
27	3.02%	3.31%	3.13%	2.95%
28	3.08%	3.36%	3.18%	3.00%
29	3.14%	3.42%	3.23%	3.04%
30	3.19%	3.47%	3.28%	3.09%

Once the DR Scenario is generated for a particular node, the DR discount rates are developed through the following process:

1. In-force assets as of a particular node are generated using the reinvestment mix and assumptions described in Appendix C above. These assets represent the assets that would be in-force as of a particular valuation date.
2. Default charges and investment expenses for the in-force assets at each valuation node are projected using the following VM-20 default rates:

Term: VM-20 Assumptions for In-Force Assets					
Percentage Allocation	S&P Quality	Public/Private	Maturity	Defaults	Investment Expenses
20%	A	Public	10	21	16
10%	BBB	Public	10	56	16
10%	A	Private	10	21	16
10%	BBB	Private	10	56	16
40%	A	Public	20	21	16
10%	BBB	Public	20	56	16
WTG AVG			15	31.5	16

ULSG: VM-20 Assumptions for In-Force Assets					
Percentage Allocation	S&P Quality	Public/Private	Maturity	Defaults	Investment Expenses
20%	A	Public	10	21	16
20%	BBB	Public	10	56	16
10%	A	Private	10	21	16
17%	BBB	Public	30	56	16
17%	A	Public	30	21	16
13%	A	Private	30	21	16
3%	BBB	Private	30	56	16
WTG AVG			20	35.1	16

3. Project reinvestments after the node using VM-20 assumptions, as listed:

Term VM- 20 Investment Mix and Assumptions						
Percentage Allocation	S&P Quality	Public/Private	Maturity	Spread	Defaults	Investment Expenses
25%	AA	Public	10	115	3	16
25%	AA	Public	20	128	3	16
25%	A	Private	10	140	21	16
25%	A	Private	20	150	21	16
WTG AVG			15	133.4	12.3	16

ULSG VM- 20 Investment Mix and Assumptions						
Percentage Allocation	S&P Quality	Public/Private	Maturity	Spread	Defaults	Investment Expenses
25%	AA	Public	10	115	3	16
25%	AA	Public	30	141	3	16
25%	A	Public	10	140	21	16
25%	A	Public	30	161	21	16
WTG AVG			25	139.3	12.3	16

4. Develop NIERs for the DR Scenario, combining the earnings on assets purchased before the node using the assumptions defined in steps 1 and 2, with the earnings on assets purchased after the node using the assumptions defined in step 3. Cash flows available for investment are assumed to be level for the pricing projection period.

The following table shows the resulting DR discount rates at several nodes:

Term DR Discount Rates				
Years from Node	12/31/2015 Node	12/31/2020 Node	12/31/2025 Node	12/31/2030 Node
1	3.51%	4.65%	4.81%	4.85%
2	3.50%	4.65%	4.81%	4.83%
3	3.49%	4.64%	4.79%	4.81%
4	3.49%	4.62%	4.77%	4.79%
5	3.49%	4.60%	4.74%	4.76%
6	3.49%	4.61%	4.71%	4.75%
7	3.49%	4.59%	4.68%	4.73%
8	3.49%	4.54%	4.65%	4.68%

9	3.50%	4.50%	4.61%	4.63%
10	3.50%	4.45%	4.58%	4.58%
11	3.52%	4.42%	4.57%	4.53%
12	3.53%	4.39%	4.54%	4.49%
13	3.55%	4.36%	4.50%	4.44%
14	3.56%	4.33%	4.47%	4.40%
15	3.57%	4.31%	4.43%	4.35%
16	3.58%	4.29%	4.39%	4.31%
17	3.59%	4.27%	4.35%	4.27%
18	3.60%	4.22%	4.32%	4.22%
19	3.61%	4.18%	4.28%	4.18%
20	3.62%	4.14%	4.25%	4.14%

ULSG DR Discount Rates				
Years from Node	12/31/2015 Node	12/31/2025 Node	12/31/2035 Node	12/31/2045 Node
1	3.62%	4.89%	4.98%	5.03%
2	3.61%	4.90%	4.97%	5.03%
3	3.60%	4.89%	4.95%	5.01%
4	3.59%	4.87%	4.94%	4.99%
5	3.59%	4.85%	4.92%	4.96%
6	3.59%	4.82%	4.89%	4.93%
7	3.59%	4.80%	4.87%	4.90%
8	3.59%	4.77%	4.84%	4.86%
9	3.59%	4.74%	4.81%	4.82%
10	3.60%	4.71%	4.78%	4.77%
11	3.62%	4.68%	4.76%	4.73%
12	3.63%	4.66%	4.74%	4.69%
13	3.65%	4.64%	4.71%	4.66%
14	3.67%	4.62%	4.67%	4.62%
15	3.68%	4.60%	4.64%	4.58%
16	3.70%	4.58%	4.61%	4.54%
17	3.71%	4.57%	4.57%	4.51%
18	3.72%	4.55%	4.54%	4.47%

19	3.73%	4.54%	4.51%	4.44%
20	3.74%	4.53%	4.48%	4.40%
21	3.76%	4.53%	4.45%	4.37%
22	3.78%	4.52%	4.43%	4.34%
23	3.80%	4.51%	4.41%	4.32%
24	3.82%	4.50%	4.40%	4.30%
25	3.85%	4.49%	4.39%	4.28%
26	3.87%	4.49%	4.38%	4.27%
27	3.90%	4.49%	4.37%	4.26%
28	3.93%	4.49%	4.37%	4.25%
29	3.97%	4.50%	4.38%	4.25%
30	4.00%	4.51%	4.38%	4.25%

Appendix E: Asset Modeling and Assumptions: SR

The projections for calculating the SR at the present and future nodes utilize a simple asset modeling strategy analogous to that described in Appendix D with two key modifications. The intent of the strategy is to reflect the impact of the changing interest rate scenarios in the projection of asset cash flows that would occur in a more robust financial reporting calculation, while maintaining a simple model.

The first modification was weighting the net spreads of the asset portfolio to create only two assets: bonds with 10- and 30-year maturities. The net spreads used for each bond are shown in the following table. Two sets of net spreads are used as described in Appendix D. The first is for assets purchased before the SR calculation node, using the best estimate spreads with adjustment for the investment expense and defaults that will apply to in-force assets after the SR calculation node. After the calculation node, assets are purchased at the net spreads resulting from parameters prescribed by VM-20:

ULSG VM- 20 SR Investment Mix before Node					
Percentage Allocation	**Maturity**	**Spread**	**Defaults**	**Investment Expenses**	**Net Spread**
50%	10	162.0	35.1	16.0	110.9
50%	30	177.3	35.1	16.0	126.3

ULSG VM- 20 SR Investment Mix after Node					
Percentage Allocation	**Maturity**	**Spread**	**Defaults**	**Investment Expenses**	**Net Spread**
50%	10	127.5	12.3	16.0	99.1
50%	30	151.1	12.3	16.0	122.8

The second modification relative to the DR discount rate approach is the explicit investment and disinvestment in the assets described above per the pattern of model cash flows. Assets are purchased when there is a cash flow surplus and sold on a pro rata basis when there is a cash flow deficit. Thus the allocation of asset purchase dates would differ from the Appendix D approach and lead to somewhat different net investment returns for the same scenario. An asset portfolio is built up before each future projection node based on the best estimate pricing cash flows to simulate the hypothetical portfolio that an insurer may hold at that valuation date.