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What's a Moderately Adverse Interest Rate Scenario, Anyway?

By Mark Alberts

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475 N. Martingale Road, Suite 600
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Phone: 847.706.3500 Fax: 847.706.3599
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Chairperson's Corner

By Bob Leach

This might sound weird, but I'll just say it—now is an exciting time to be an actuary in the world of financial reporting. All of the major reporting bases are on the move, improving approaches to the valuation and reporting of obligations created by life, annuity and health insurance policies. The National Association of Insurance Commissioners is leveraging actuarial knowledge and the power of computers to establish principle-based reserves via modeling techniques outlined in the Valuation Manual. Through its Targeted Improvements initiative, the Financial Accounting Standards Board will make GAAP financial statements easier to understand by simplifying the measurement of deferred acquisition costs and valuing guarantees in a more consistent manner. The International Accounting Standards Board has issued IFRS 17, with the goal of valuing insurance obligations on a more consistent basis across jurisdictions, thereby improving the comparability of IFRS financial statements among insurance organizations and countries.

Amid this sea of change, the financial reporting actuary can potentially become the "go to" person—a knowledge source who can lead by educating actuaries in pricing, product development and risk management, as well as accounting, investment, marketing, tax and other professionals—on the nature of these changes. Opportunity abounds for those who take the time to learn about the new approaches. For those who don't, beware of the risks!

It is my good fortune to serve our profession at this pivotal moment as chair of the Society of Actuaries (SOA) Financial Reporting Section. First and foremost, I'd like to recognize those who have laid a solid foundation for the section. Jim Hawke's sage approach provided thoughtful leadership as chair of the section and overseer of its research efforts during the past year. Len Mangini preceded Jim as chair, and during the past year he exhibited boundless energy in creating education opportunities for our section. Jason Kehrberg provided the spark that produced a successful series of GAAP seminars, while also acting as the section's secretary. As a friend of the council, Kerry Krantz served the section faithfully as webmaster during the past several years. We thank Jim, Len, Jason and Kerry and wish them the very best of luck as they leave the section council (but hopefully not the section!) in search of new adventures.

Last summer's SOA elections yielded three new council members who will serve the section for the next three years. We enthusiastically welcome Lance Berthiaume, Enzinma Miller and Dave Armstrong to the section council.

Our section is among the largest in the SOA, yet its growth rate lags behind the overall rate of SOA membership growth. To close this gap, we intend to focus on adding value for section members while promoting the broader interests of the actuarial profession. Key areas of focus during the next year include:

- Offering professional development opportunities in 2018 through sessions at the Life & Annuity Symposium in Baltimore, the Valuation Actuary Symposium (VAS) in Washington, D.C., and the 2018 SOA Annual Meeting & Exhibit in Nashville. Of note, our section is now the primary sponsor of the VAS.
- Continuing to provide specialized professional development, including GAAP and Economic Balance Sheet seminars.
- Creating virtual professional development through webcasts—these count as "organized" CPD!
- Energizing research on topics such as earnings emergence under various reporting bases and PBA attribution analysis.
- *The Financial Reporter* newsletter will continue to be the section's primary vehicle for providing members with updates on new developments across the financial reporting spectrum.
- Our section's website (*https://www.soa.org/sections/financial-reporting/financial-reporting-landing/*) provides a wide range of resources, including access to recent issues of *The*

Financial Reporter, information about upcoming events, research, podcasts and other resources.

- The regulatory web resource (*https://www.soa.org/resources/regulatory-resource/default/*) provides access to a curated list of links to source documents that drive financial reporting requirements.
- The section has started an e-news initiative to keep members informed of breaking news and provide access to in-depth information that may be too extensive for *The Financial Reporter*.

The above doesn't happen without a lot of good work behind the scenes to coordinate efforts with other sections and recruit volunteers to do research, make presentations and write articles for publication. If you'd like to get involved in any of this, please get in touch!

Finally, we offer a special word of thanks to Don Walker, who retired after several years as chair of the VAS. The SOA made the difficult decision to cancel the 2017 VAS in San Antonio in the face of Hurricane Harvey. Don's leadership brought the VAS back to life as an addendum to the 2017 SOA Annual Meeting & Exhibit in Boston. Enjoy your retirement, Don!

On behalf of the section council, we wish everyone a happy and peaceful holiday season, and success in 2018! ■

Bob Leach, FSA, MAAA, is a vice president at Fidelity Investments Life Insurance Company. He can be reached at *robert.leach@fmr.com.*

What's a Moderately Adverse Interest Rate Scenario, Anyway?

By Mark Alberts

Here's a conversation starter for your next Society of Actuaries (SOA) meeting reception. How often has a 3 percent pop-up[1] in interest rates occurred? How about a 3 percent pop-down? The U.S. valuation and cash flow testing actuaries among us certainly recognize the 3 percent pop-up and pop-down as scenarios #4 and #7 of the New York 7 scenario set (NY7), the most common measure of moderately adverse interest rate conditions for U.S. life companies' cash flow testing. Not surprisingly, as shown in Table 1, the answer is different for short rates and long rates, and also for a pop-up and a pop-down.

Table 1
Interest Rate Pop-Up/Pop-Down Occurrence

Tenor	Data Period	Trading Days	# of Pop-Downs > 2.75%	# of Pop-Ups> 2.75%
90-day	1962-current	~12,000	185	119
20-30-year	1954-current	~15,600	13	0

For short rates, 3 percent pops are rare, with approximately 1 percent frequency for both the pop-up and pop-down. For long rates, excepting a three-week period in mid-1982, they are unheard of.

What does this factoid tell us about moderately adverse conditions for asset adequacy analysis? On its own, perhaps not much. But at a time when asset adequacy margins are squeezed by the ongoing low interest rate environment, appointed actuaries increasingly question the relevance of the NY7, and median stochastic scenario paths increasingly resemble a best-case rather than a best-estimate, this question has become an important one. The appointed actuary must opine on whether the assets backing reserves are adequate under moderately adverse conditions, but has little in the actuarial literature to help him or her evaluate what interest rate conditions are moderately adverse.

Recognizing this gap, the Financial Reporting Section and Smaller Insurance Company Section of the Society of Actuaries have released a new research report, *Modern Deterministic Scenarios for Interest Rates*[2], which attempts to develop a framework for evaluating moderately adverse conditions for interest rates and, further, develops a new set of interest rate scenarios intended to capture moderately adverse conditions for a range of initial interest rate conditions. The methodology and results contribute to the actuarial literature in several ways. First, the report's empirical conditional tail expectation (CTE) analysis methodology provides a way to measure moderately adverse conditions for interest rates that is fundamentally consistent with the CTE70 stochastic standard used in VM-20 and VM-21. Second, we constructed interest rate series for the analysis that go back as far as 1729, which actuaries can use for their own analysis. Finally, the project output includes an Excel tool that can easily be used by practicing actuaries to calculate the deterministic scenario set. In addition to the interest rate research, the report also includes analysis of investment spreads, inflation rates and equity returns to assist the actuary in modeling these elements in a deterministic context.

OVERVIEW OF THE MDS SCENARIO SET

Why deterministic scenarios? The research focused on deterministic scenarios for several reasons. Deterministic scenario sets, specifically the NY7, remain the primary (and in many cases, the only) scenario sets used by appointed actuaries to evaluate asset adequacy. Many companies lack the time or resources for extensive stochastic modeling. Deterministic scenario results are easier to analyze and explain than stochastic results. Some actuaries are also concerned that they lack a reasonable basis for evaluating the range of scenarios produced by their stochastic generators.

The ultimate output of the research was a set of 16 modern deterministic scenarios (MDS). These scenarios are easily calculated using Excel files included as appendices to the report. Scenarios MDS1 through MDS14 are based on the empirical analysis and are calculated using the Excel workbook posted as Appendix J. Scenarios MDS15 and MDS16 are not based on the empirical

Table 2
Descriptions of Scenarios

Scenario Number	Scenario Name	Scenario Description
Reversion Scenarios:		
MDS1	Reversion—High	Grade linearly to an 85HCTE (right tail) reversion target over a 15 year period.
MDS2	Reversion—Low	Grade linearly to an 85LCTE (left tail) reversion target over a 15 year period.
MDS3	Delayed Reversion—High	Long and Short Rates level for 5 years, then grade linearly to CTEH85 reversion target over a 10 year period.
MDS4	Delayed Reversion—Low	Long and Short Rates level for 5 years, then grade linearly to CTEL85 reversion target over a 10 year period.
MDS5	Pop-up with Reversion—High	Initial pop-up, then grade linearly to CTEH85 reversion target by year 15.
MDS6	Pop-down with Reversion—Low	Initial pop-down, then grade linearly to CTEL85 reversion target by year 15.
MDS7	Delayed pop-up with Reversion—High	Long and short rates level for 5 years followed by pop-up, then grade linearly to CTEH85 reversion target by year 15.
MDS8	Delayed pop-down with Reversion—Low	Long and short rates level for 5 years followed by pop-down, then grade linearly to CTEL85 reversion target by year 15.
Rate Change Scenarios		
MDS9	Rate Change CTE—High	Change from initial rate based on CTEH85 (right tail) historical change statistics for the applicable interest rate group.
MDS10	Rate Change CTE—Low	Change from initial rate based on CTEL85 (left tail) historical change statistics for the applicable interest rate group.
MDS11	Rate Change CTE—High with pop-up	Change from initial rate based on CTEH85 (right tail) historical change statistics for the applicable interest rate group, with initial pop-up based on CTEH85 transitional changes.
MDS12	Rate Change CTE—Low with pop-down	Change from initial rate based on CTEL85 (left tail) historical change statistics for the applicable interest rate group, with initial pop-down based on CTEL85 transitional changes.
Interest Rate Cycle Scenarios		
MDS13	Cyclical, 20 year cycle	20 year cycles of interest rates—5 years declining, 10 years flat, 5 years increasing.
MDS14	Cyclical, 40 year cycle	40 year cycles of interest rates—10 years declining, 20 years flat, 10 years increasing.
AIRG Scenarios (See Appendix K; not included in the Scenario Calculator workbook)		
MDS15	AIRG—High	Rates based on 1,000 scenarios from Academy interest rate generator, 85HCTE of cumulative average rates, annualized.
MDS16	AIRG—Low	Rates based on 1,000 scenarios from Academy interest rate generator, 85LCTE of cumulative average rates, annualized.

analysis, but rather are a distillation of a stochastic set generated from the Academy Interest Rate Generator (AIRG) and are calculated using the Excel workbook posted as Appendix K.

Table 2 lists the scenarios with their descriptions. There is not room in this article to describe the scenarios in detail, but some key elements are:

- The scenarios project a long rate and a short rate and use a regression model to complete the yield curve.
- Short and long rates can be projected independently or using one of three yield curve steepness parameters. There are no parallel shifts.
- There are eight high rate and eight low rate scenarios, with each high rate scenario having a low rate counterpart, but these are not symmetric around the starting rate. Low rate and high rate are not synonymous with increasing and decreasing, depending on initial conditions.
- There is no level scenario. We believe it is always appropriate to run a level scenario as a baseline, but that it is not generally a useful measure of moderately adverse conditions.
- Scenarios MDS1 through MDS8 are denoted reversion target scenarios, and revert to either a high- or low-rate target over 15 years using four different reversion patterns—MDS1 and MDS2 revert linearly, while the others incorporate pop-ups/downs and/or delays in the start of reversion. The ultimate target rates are independent of the initial rate and are shown in Table 3.

Table 3
Ultimate Target Rates

Tenor	Low Reversion Target	High Reversion Target
Short rate (90-day)	0.50%	6.25%
Long rate (20/30-yr avg.)	2.60%	7.50%

- Scenarios MDS9 through MDS12 are denoted rate change scenarios and project specified changes in interest rates from the initial rate level—either moderately high or moderately low changes—over 30 years. The projected changes are asymmetric and are dependent on the initial level of interest rates. Scenarios MDS11 and MDS12 incorporate an initial pop-up or pop-down, while MDS9 and MDS10 do not.
- Scenarios MDS13 and MDS14 are cyclical scenarios that assume 20- or 40-year interest rate cycles, respectively. These scenarios are most relevant for longer projection periods and are the only scenarios that require subjective input by the user.
- Scenarios MDS15 and MDS16, computed in a different Excel workbook than the others, use a similar CTE methodology as scenarios MDS9 through MDS12, but applied to a set of 1000 stochastic scenarios generated from the AIRG. These scenarios require the user to run the AIRG and input the scenarios into the Excel workbook. Other stochastic generators could be used as well, but the input is set to accept the AIRG output format.

AUG. 31, 2017, SCENARIOS AND COMPARISON TO THE NY7

Reading the research report will tell you everything you might ever want to know about the development of the scenarios, and more, but what is the upshot? How do the scenarios look today, and how do they compare to the NY7? The report presents the scenarios compared to the NY7 as of Dec. 31, 2015. For this article, we have updated the comparisons to Aug. 31, 2017, for scenarios MDS1 through MDS12, those most comparable to the NY7, but not for scenarios MDS13 through MDS16. To get a sense of the scenarios in other environments, Appendix J to the report can easily be updated to show scenarios for any date going back to 1982.

First, we will review the high/increasing interest rate scenarios. Figures 1 and 2 show, for long interest rates, the MDS high rate scenarios compared to New York scenarios #2 and #4. For long rates, the MDS scenarios reach ultimate rates as high as or higher than the comparable NY7 scenarios, but much more gradually.

Figures 3 and 4 show the same scenario comparisons, but for short rates rather than long rates. The short rates move up much more quickly than the long rates, and also move up more quickly and to higher levels than the comparable NY7 scenarios.

Figure 1
MDS Long Rate–Reversion Target Scenarios–High vs. NY2 and NY4

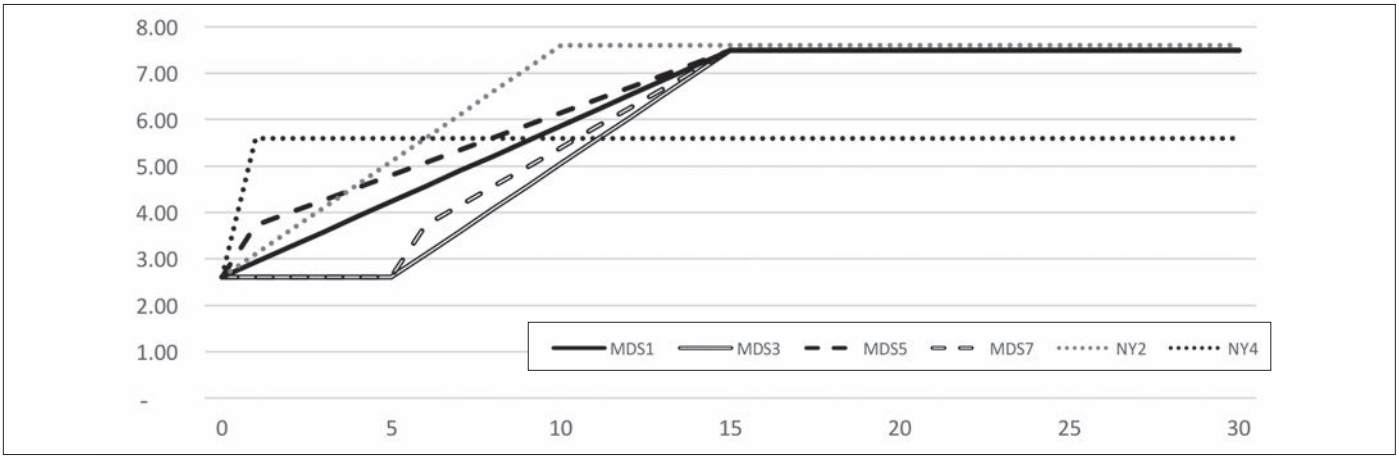


Figure 2
MDS Long Rate–Rate Change CTE Scenarios–High vs. NY2 and NY4

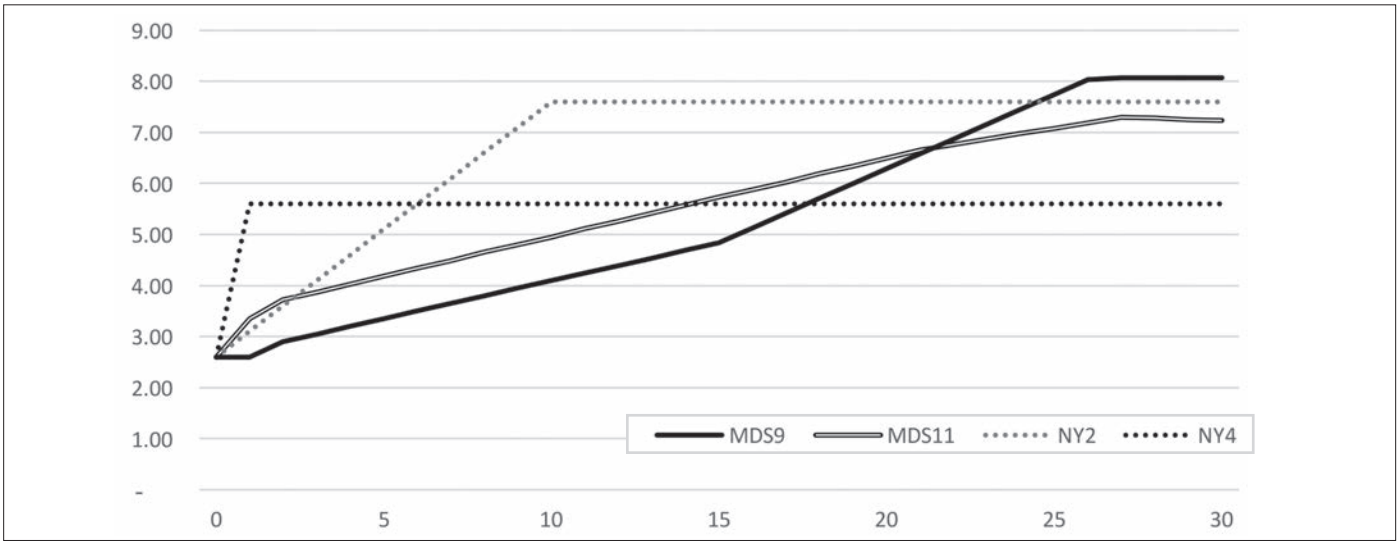


Figure 3
MDS Short Rate–Reversion Target Scenarios–High vs. NY2 and NY4

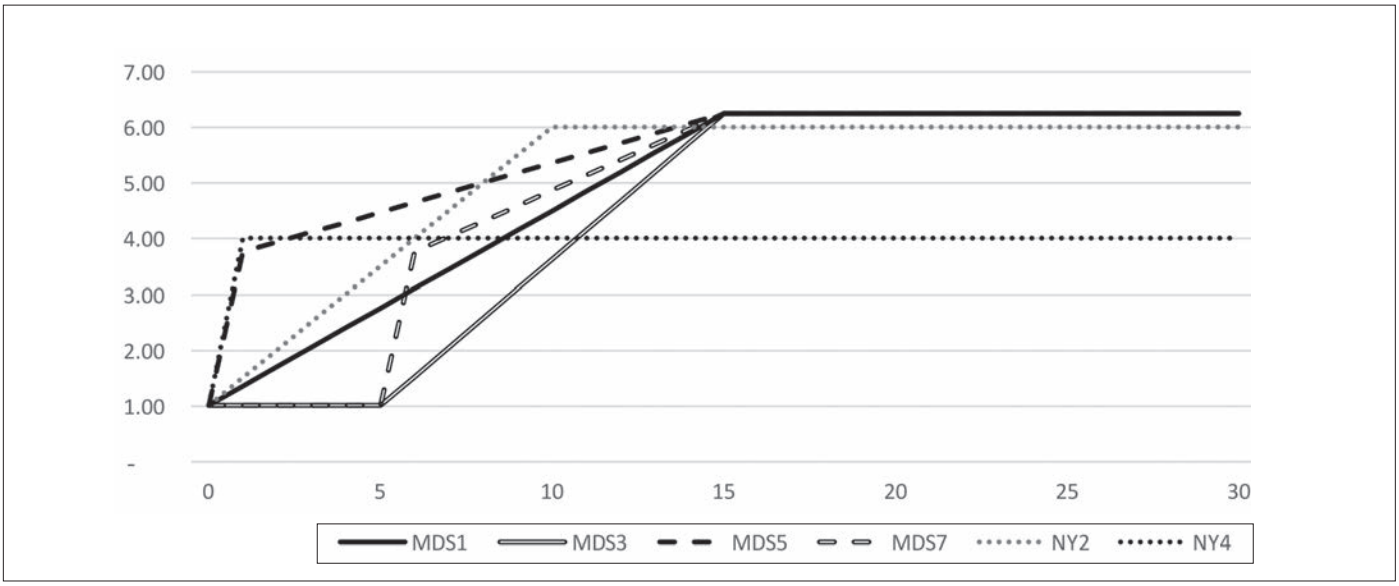


Figure 4
MDS Short Rate–Rate Change CTE Scenarios–High vs. NY2 and NY4

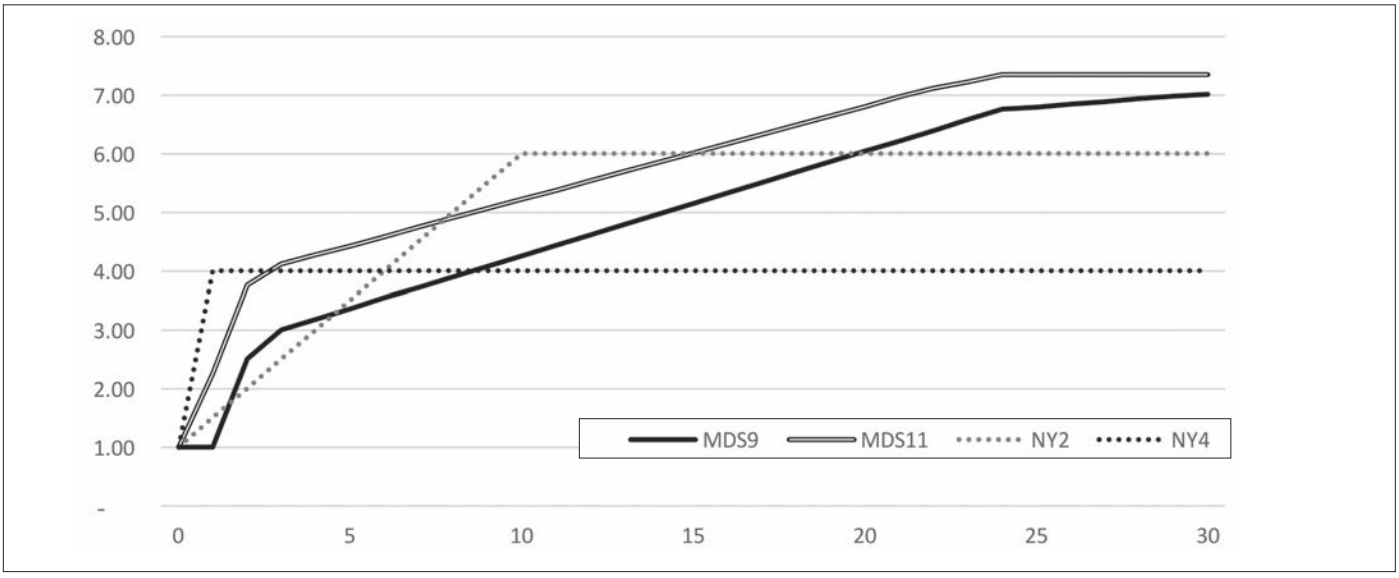


Figure 5
MDS Long Rate–Reversion Target Scenarios–Low vs. NY5 and NY7

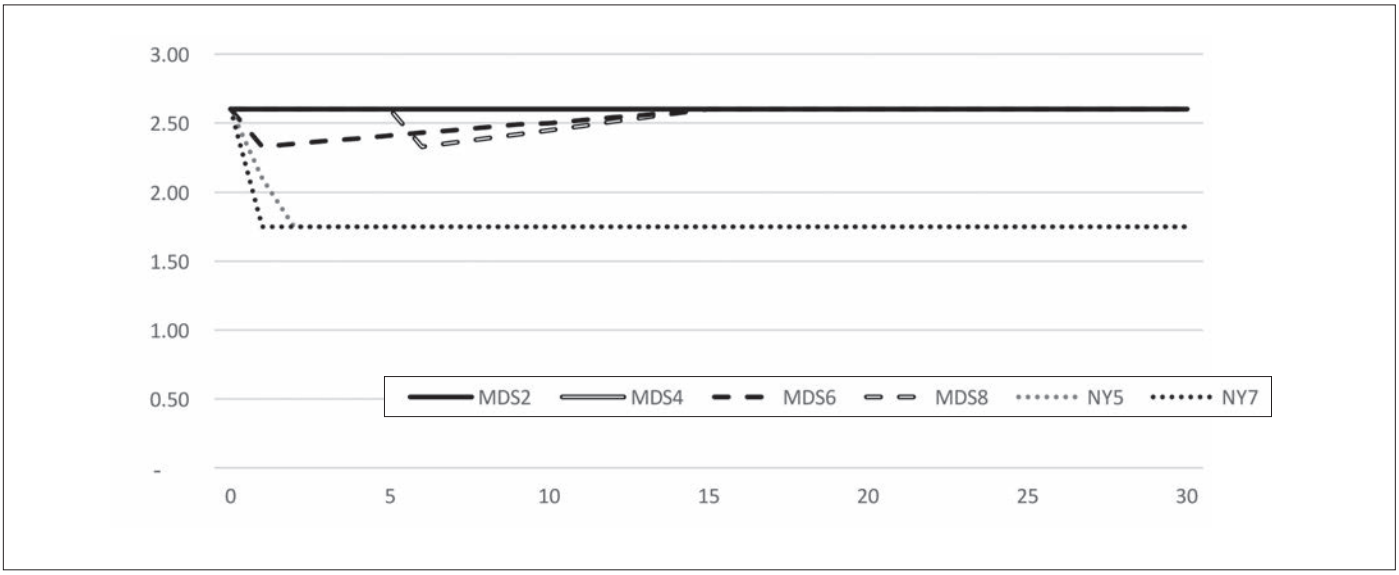
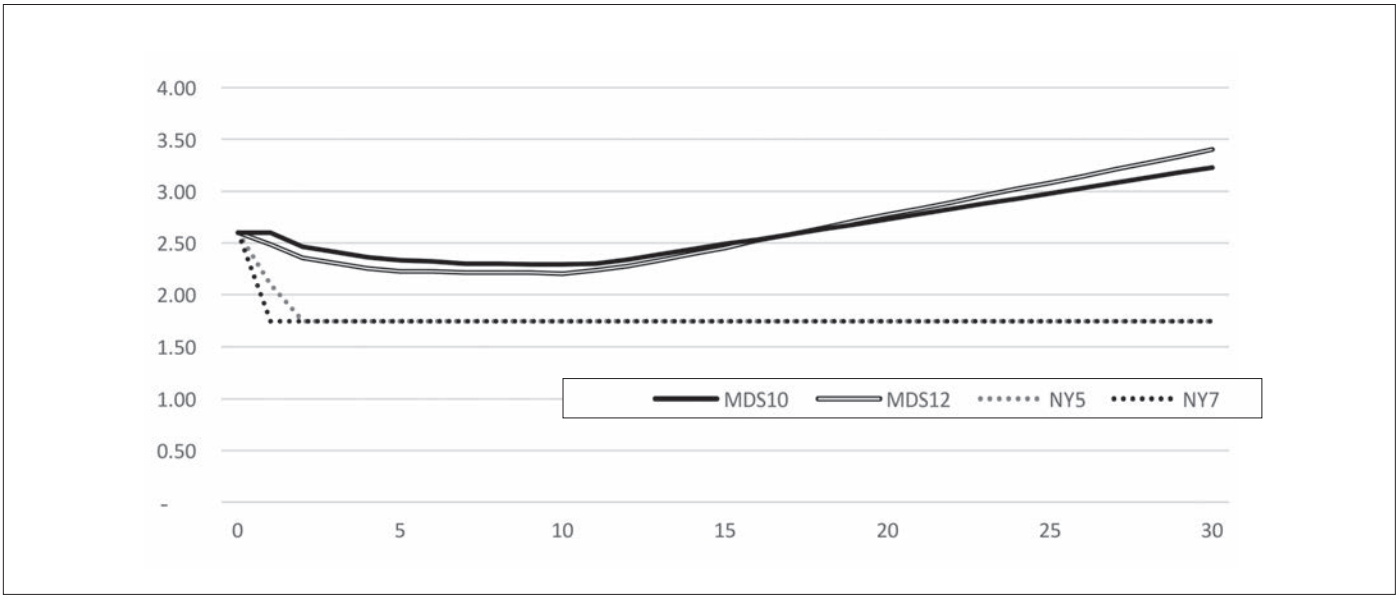


Figure 6
MDS Long Rate–Rate Change CTE Scenarios–Low vs. NY5 and NY7



Now, we will review the low/decreasing interest rate scenarios. Figures 5 and 6 show, for long interest rates, the MDS low rate scenarios compared to NY5 and NY7. The MDS scenarios, consistent with the view that the NY7 decreasing scenarios are beyond moderately adverse in today's conditions, do not decrease as far or as long as the comparable NY7 scenarios. However, these scenarios do reflect decreases in rates from the starting rates that may be significant for some lines of business, and for a substantial period of time. In addition, since the starting rate is very near the reversion target, scenarios MDS2 and MDS4 are indistinguishable, much like NY5 and NY7 after year two.

Figure 7
MDS Short Rate–Reversion Target Scenarios–Low vs. NY5 and NY7

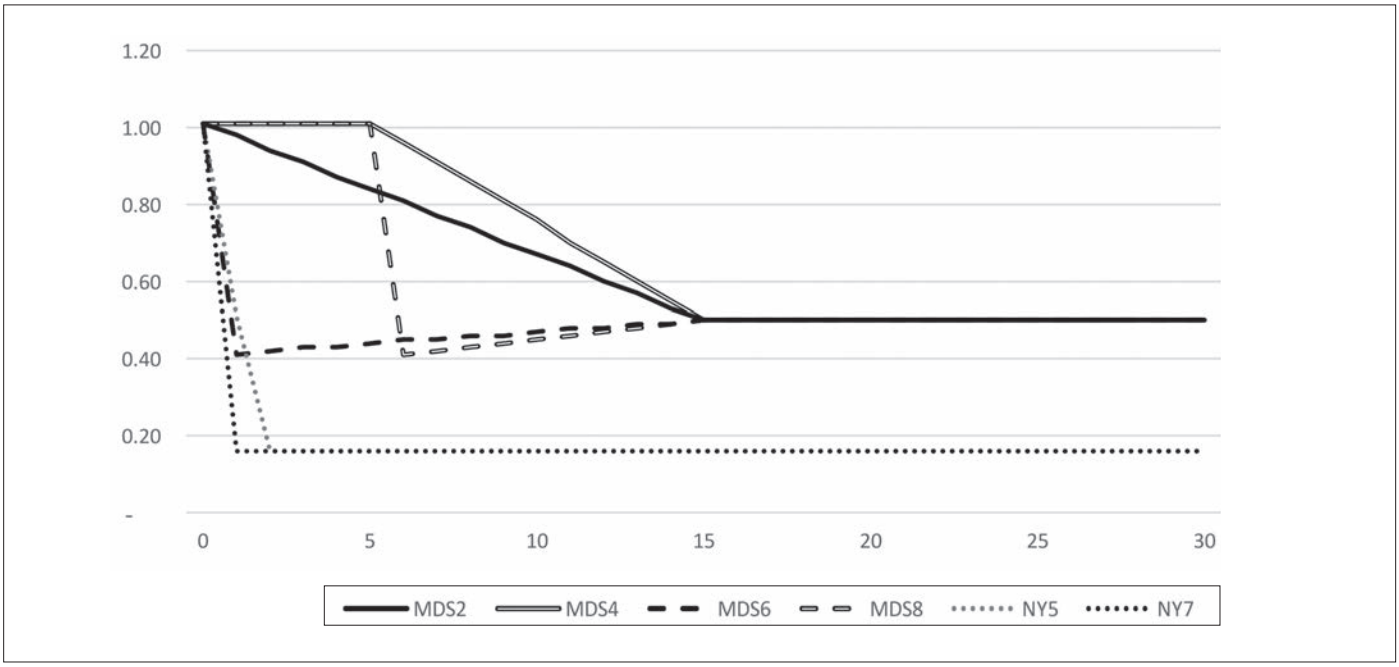
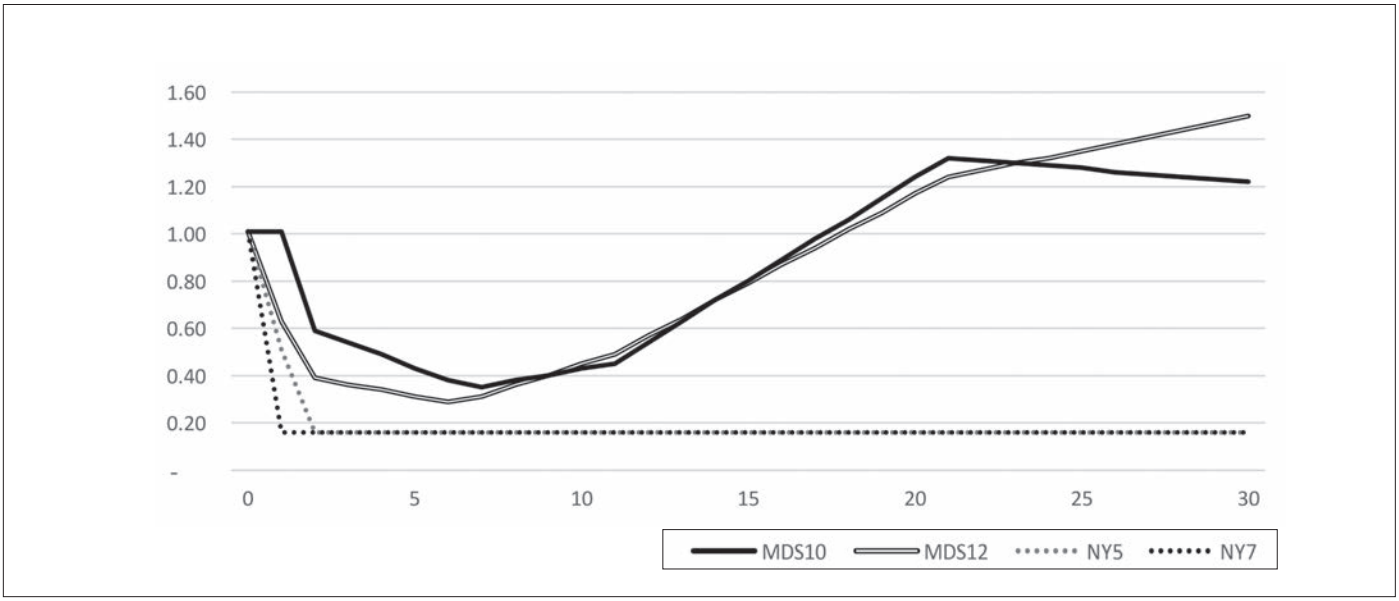


Figure 8
MDS Short Rate–Rate Change CTE Scenarios–Low vs. NY5 and NY7



Figures 7 and 8 show the same scenario comparisons, but for short rates rather than long rates. Similar to the high rate scenarios, the MDS scenarios more closely resemble the NY7 scenarios for short rates than for long rates. Both the reversion scenarios and the rate change scenarios show initial declines comparable to the NY5 and NY7, although the rate change scenarios begin climbing in years five through seven and ultimately end up above the starting point.

OVERVIEW OF THE MDS INTEREST RATE SERIES

I will not describe here the empirical data analysis and the techniques we used to convert the data analysis into scenario calculation algorithms, but refer the interested reader to the report for details of this work. However, a description of the historical interest rate series used as the basis of our analysis is worth a few paragraphs in this article. Much of the prior actuarial literature analyzing interest rates goes back to 1953, the earliest year for which the Federal Reserve maintains detailed treasury rate data. The path of interest rates since then might be likened to a photograph of Mount McKinley—dramatic, but not very helpful for thinking about future interest rate paths, and offering too few annual data points for meaningful analysis. We would need more data, both to increase the number of data points for analysis and to avoid overweighting the extreme high rate period of the 1970s and 1980s.

Unable to find any series of existing interest rate data that met our needs, we constructed our own. Ultimately, we constructed a series of long interest rates going back to 1729 and a series of short interest rates going back to 1825, dubbing them the MDS Interest Rate Series. For recent periods where robust data is maintained by the Federal Reserve, we used the 90-day Treasury for the short rate and the average of 20- and 30-year Treasuries for the long rate. For earlier periods, we selected interest rates from other sources that we believed best represented market interest rates. Most notably, for periods prior to 1920, we selected interest rate data from the United Kingdom, which held the position of economic power now occupied by the United States.

Our decisions to base our analysis on interest rates going back to the 1700s and to use U.K. interest rates as a basis for assessing current and future U.S. interest rates may foster some debate, and we welcome that debate. We believe it was important to use the data sources most relevant to the analysis and as much relevant data as was available. We believe we accomplished that goal.

CONCLUSION

"The work of science is to substitute facts for appearances and demonstrations for impressions." This quote, attributed to Ruskin, is well known to members as the motto of the SOA. Deterministic modeling of interest rates, particularly in the context of moderately adverse conditions, has been sorely lacking in facts and demonstrations. Just in time for 2017 cash flow testing, the SOA offers this new research to advance the state of actuarial practice and to provide appointed actuaries with a new framework for considering moderately adverse interest rate conditions.

In the context of empirical evidence, there are some significant shortcomings to the NY7 scenarios as measures of moderately adverse conditions. Among these: 1) parallel yield curve shifts either understate variability at the short end of the yield curve or overstate variability at the long end, or both; 2) historical data show that the incidence and magnitude of actual rate increases and decreases are asymmetric and are tied to the initial rate level; 3) actual rate changes, particularly for the long end of the curve, are almost never as rapid as the NY7 changes; and 4) over longer modeling horizons, the NY7 maximum increases/decreases may understate the actual range of interest rates.

The MDS scenarios address these shortcomings and are easily computed using the Excel tools accompanying the research report. In the current environment, some actuaries may consider the MDS low rate scenarios to be more moderate than the NY7 decreasing rate scenarios. However, other actuaries who believe that even the level scenario is currently beyond moderately adverse may be dismayed that the MDS scenarios do include decreases from current rate levels.

The appointed actuary is responsible for defining moderately adverse conditions and cannot blindly rely on this, or any other, scenario set. Therefore, perhaps even more important than the scenarios themselves, our research provides actuaries with an empirical data set and an analysis framework that they can use to inform their own view of moderately adverse interest rate conditions. Some elements of the empirical data set or the analysis may prove controversial and will no doubt serve as fodder for future debate. This is debate that we need to have!

Finally, any user of the report must keep in mind that reserves are intended to cover moderately adverse conditions, and capital to cover extreme conditions, and that the context of the report is moderately adverse testing of reserves. While the research could be extended to cover stress testing and extreme conditions, those conditions are not covered by the report and one should take extreme care in trying to apply these analyses or results in a risk management or capital adequacy context. ■

Mark Alberts, FSA, MAAA, is president and consulting actuary with Alberts Actuarial Consulting. He can be reached at *mark@albertsactuary.com*.

ENDNOTES

1 Measured as the average rate over the next 12 months less the rate on the start date.

2 *https://www.soa.org/research-reports/2017/2017-modern-deterministic-scenarios/*

Accounting Change for Variable Annuities With Implications on Hedging

By Bruce Rosner and Robert Frasca

Actuaries who spend time working with variable annuities know that financial reporting for these products can be complex and sometimes frustratingly disconnected from their perceived economic values. This can lead to management decisions driven as much by accounting considerations as by the expected economic impact on the insurance company, sometimes hindering companies from hedging risks they might otherwise look to address. But change is on the way. The standard setters for U.S. statutory, US GAAP, and IFRS reporting are all taking steps to revise the accounting for variable annuities and the policyholder guarantees embedded within them. Though they vary by accounting basis, these changes are generally in the direction of reflecting current market conditions and include moving toward measures of current economic value.

At the same time, there has been a slight shift recently in companies' hedging preferences, away from a full economic hedge and toward protecting solvency capital. One potential outcome of the upcoming accounting changes is a shift back toward hedging of the economic exposures to guaranteed benefits.

US GAAP

Currently, there is a diversity in practice in how companies account for variable annuities under US GAAP. Companies uniformly record a base contract liability equal to the account value, but there is a split in the treatment of variable annuity riders. Guaranteed minimum death benefits, income benefits, and lifetime withdrawal benefits are often classified as insurance benefit features and consequently follow ASC 944-40-30 guidance (previously, and commonly, known as SOP 03-1). Guaranteed minimum accumulation benefits and non-lifetime withdrawal benefits are often classified as embedded derivatives and are recorded at fair value following ASC 815/820 (FAS 133/157) rules. Interpretations of classification may vary by company as well, with companies assigning different classifications to seemingly identical benefits.

Companies often observe accounting mismatches when hedging guarantees fall under SOP 03-1 because the movements in the fair values of hedging instruments through profit and loss are not identically offset by the movement in the liabilities. Such mismatches can occur even when the liabilities are recorded at fair value due to elements in the definition of liability fair values, including the provisions for nonperformance risk and risk margins. In some cases, the perceived accounting anomalies discourage companies from hedging.

Targeted improvements proposed by the FASB, if adopted in their current state, will significantly alter this situation. The proposed guidance creates a new class of benefit features called "market risk benefits." These benefits, which are guarantees made with reference to contracts backed by separate accounts, include all common guarantee riders currently found in variable annuities whether currently classified as SOP 03-1 insurance liabilities or embedded derivatives. The proposal would have all such guarantees recorded at fair value with changes recorded through profit and loss, except for changes in the provision for nonperformance risk, which would be recorded through

other comprehensive income. This proposal has its supporters and critics, with many people feeling that fair value is not an appropriate measurement basis for a long-term guarantee triggered only by an insured event (as is the case with a guaranteed minimum death benefit, for example). However, if adopted, this change will likely eliminate the diversity in practice currently observed across companies. It may also encourage more hedging of various guarantees by eliminating, or at least reducing, the mismatch in the measurement of hedge instruments and the liabilities being hedged.

IFRS

IFRS is the accounting basis required for public company financial reporting for Canada, most of Europe, and many other countries around the world. Most variable annuity contracts are classified as insurance contracts under IFRS, a consequence of guaranteed annuity purchase rates or other features that lead to insurance (mortality or longevity) risk within the contract.

Currently, insurance contract accounting is defined in IFRS 4. IFRS 4 has been authoritative since 2004 and was introduced as a stopgap measure to tide IFRS accounting over until such time as a permanent approach to insurance accounting could be developed. Essentially, IFRS 4 reverts insurance accounting back to the approach that had been applied prior to a company's adoption of IFRS as its accounting basis. For variable annuities written in the U.S., this frequently means US GAAP.

All of this is about to change. In May 2017, the IASB issued a new standard, IFRS 17, to replace IFRS 4 and to cover insurance accounting. Effective for annual periods commencing on or after Jan. 1, 2021, the standard fundamentally changes the accounting for all contracts classified as insurance, including variable annuities. The IFRS 17 standard for insurance contracts now provides a full framework for companies to follow. The standard is based on a foundation of insurance contract liability measurement that comprises two pieces: (1) "fulfilment cash flows," which represent the present value of the expected cash flows needed for the insurance company to fulfill its obligations under the insurance contract, plus a risk adjustment; and (2) a "contractual service margin" reflecting unearned profits the entity expects to earn as it fulfills its obligations under the contract in the future.

The standard also defines a special class of "insurance contracts with direct participation features," for which the insurance company is expected to pay the policyholder an amount equal to fair value of the underlying assets, less a variable fee that the company may deduct for providing services. The amount payable may also be increased due to the presence of various

contractual guarantees. The criteria for being classified as such a contract are defined more fully in the standard and, while it is by no means assured, many people believe that variable annuities will be considered insurance contracts with direct participation features and will follow a variation of accounting within IFRS 17 commonly known as the "variable fee" approach. Components of the contract classified as embedded derivatives, including certain guarantee features, will be treated separately and recorded at fair value.

The variable fee approach contains several distinguishing features. First, because of the direct linkage between underlying asset returns and the fulfilment cash flows, discount rates will likely equal projected growth rates on the underlying assets. This, in the absence of any contractual guarantees, yields a contractual service margin at issue equal to the present value of contract fees less expenses.

Second, the contractual service margin is adjusted to absorb any change in the fulfilment cash flows related to future services resulting from changes in the fair value of the underlying assets. Amounts representing return of the account value to the policyholder are excluded. This means that changes in the present value of future asset-based fees arising because of market movements are generally not reflected in the current earnings because they are directly offset through the contractual service

margin (provided the contractual service margin is positive). Similar treatment is applied to changes in cash flows on guaranteed benefit features.

Third, an entity may elect to **not** recognize changes in fulfilment cash flows in the contractual service margin for cash flows that are hedged, but rather have such changes flow directly to profit and loss in the period in which the changes take place. The election is subject to certain constraints related to the structure of the hedging program, but it appears that most dynamic hedge programs covering variable annuity guarantees would qualify for this treatment, and macro hedge programs could potentially qualify as well.

By providing the option to align liability movements with hedge values through profit and loss, IFRS 17 largely accommodates a company's decision process around whether to hedge. If a company chooses to hedge its exposure to guaranteed benefit cash flows, it can opt to have changes in cash flows reflected immediately in profit and loss, presumably matching the treatment of cash flows arising from hedging instruments. Hedge ineffectiveness will flow through profit and loss in each period as a natural consequence of the accounting treatment. There may be other sources of volatility, including the risk adjustment and the illiquidity premium in liability discount rates, that have no counterpart in the value of hedge instruments. Nonetheless, IFRS 17 would appear to enable a fairly broad recognition of hedge activity, potentially encouraging companies to hedge in cases where they might not have considered doing so under IFRS 4.

U.S. STATUTORY

While US GAAP and IFRS accounting may influence companies' hedging decisions, U.S. statutory accounting and risk-based capital (RBC) requirements are often more significant motivating factors for companies operating in the United States.

The NAIC introduced Actuarial Guideline 43 (AG 43) in 2009, which applied to the vast majority of variable annuities, both in force and new business. AG 43 requires two methods of valuation, and the final reserve is equal to the greater of the two:

1. **Standard Scenario Amount:** A single scenario following prescribed assumptions. The scenario itself is designed with a drop and recovery. The projection includes hedge cash flows for existing derivatives, but those derivatives are assumed to be liquidated after one year.

2. **CTE Amount:** A CTE 70 measure using real-world valuation principles. Hedge cash flows are also reflected, including projected dynamic hedge behavior, modified by measures of hedge effectiveness.

C3 Phase II, which is the principle-based capital requirement introduced at year-end 2005, defines a similar standard for NAIC RBC for variable annuity guarantees.

Both AG 43 and C3 Phase II have provisions that affect reserves and capital requirements through the reflection of hedge activity within the reserve/capital calculations. Most notably, they both allow for some reflection of current hedge positions as well as future hedge activity when the company follows a clearly defined hedging strategy. These provisions are by no means complete, however. The reflection of hedge activity is limited by an effectiveness factor in the CTE Amount and by the requirement that hedges are all assumed to be liquidated within one year in the Standard Scenario Amount. Moreover, because the statutory reserve calculations incorporate real-world measurement concepts, they do not align with the market consistent valuation inherent in the fair values of hedge instruments.

AG43 and C3 Phase II currently generate reserve/capital requirements with varying degrees of sensitivity to market risks. For example, when the Standard Scenario Amount dominates, the reserve is not sensitive to changes in market interest rates. This discourages companies from hedging interest rates, as hedging has the potential to erode statutory capital when market interest rates increase. The NAIC and industry have recently proposed a number of changes to the methodology and are currently analyzing the implications.

Our attention is drawn to one specific proposal—to allow special treatment for any derivative that includes an interest rate hedge component—which is contained in the NAIC exposure draft "Issue Paper XX—Special Accounting Treatment for Limited Derivatives."[1] Subject to a number of qualifications, any mismatches between the fair value of the interest rate hedges and the change in the AG 43 reserve could be amortized over a number of years, up to the duration of the liability. This potentially allows companies to enter into full economic hedges with substantially reduced concern that a mismatch

> Changes are generally in the direction of reflecting current market conditions ...

between the timing of asset and liability movements will affect statutory capital.

THOUGHTS ON HEDGING

The changes across the accounting bases share one common theme—standard setters are increasingly aware of how integral hedging and risk management practices are to the management of variable annuity business and are adopting changes that enable financial reporting to reflect more closely the economics of the business when hedging is employed.

- US GAAP is poised to recognize all guarantees under variable annuities at fair value, providing a consistent measurement basis (fair value) and removing inconsistencies that may have impeded companies from more fully hedging market-based guarantees in the past.
- IFRS 17 enables consistency of treatment by offering the option to either align liability movements with hedge values through profit and loss or use the contractual service margin to absorb economic impacts on the liability.
- The proposed changes to AG 43 should dampen the balance sheet sensitivity to market movements when hedging is present, particularly with respect to interest rate risk. AG 43 reserves tend to have a relatively low sensitivity to interest rate risk, and companies will now have the option to fully hedge without concern that surplus may be affected by market movement.

The suite of risk management levers available for variable annuities includes product design, benefit pricing, in-force management, reinsurance and hedging. While we might like to think that all risk management activities are driven solely by economic considerations, the reality is that accounting impacts have significant sway in forming risk management policies. Until now, hedging has played a more limited role than it might otherwise due to concerns about the way the economic benefits of hedging fail to manifest themselves reliably in the financial reporting bases. The proposals before the NAIC would appear to lessen volatility, thereby increasing predictability of capital funding requirements when guarantees are hedged. IFRS 17 and the tentative decisions on US GAAP changes lead in this direction as well, with earnings volatility and fluctuations in equity lessening under the influence of well-designed hedge programs. This will likely encourage companies to hedge guarantees more fully than they perhaps have done in the past. Participants in the variable annuity markets would be well advised to continue to follow these proposed changes through to adoption and to assess their impacts on risk management practices as they manage their businesses in these changing times. ■

The views expressed are those of the authors and not necessarily those of Ernst & Young LLP or other members of the EY organization.

Bruce Rosner, FSA, MAAA, is a senior manager at Ernst & Young LLP. He can be reached at *bruce.rosner@ey.com.*

Robert Frasca, FSA, MAAA, is an executive director at Ernst & Young LLP. He can be reached at *rob.frasca@ey.com.*

ENDNOTE

1 *www.insurance.naic.org/documents cmte_e_app_sapwg_exposure_2016_03_ip.docx*

Understanding VM-20 Results—Research Summary

By Karen Rudolph

This article summarizes aspects of a recently completed research report titled, *Understanding VM-20 Results*, sponsored by the Society of Actuaries (SOA) Committee on Life Insurance Research, the Financial Reporting Section, the Smaller Insurance Company Section, and the Product Development Section. The Milliman research team included Seng-Siang Goh, William Hines, Mike Nam, Karen Rudolph, William Sayre, Tung Tran and David Wang. For a full appreciation of the concepts presented in this summary, see the complete report on the SOA's Life and Annuities Research webpage.[1] The author would like to thank Mike Nam for his review of this article.

SUGGESTED VM-20 ATTRIBUTION ANALYSIS

Once a company has implemented principle-based reserves (PBR) for life insurance products, actuaries and management will benefit from tools to better understand the implications of period-to-period changes in VM-20 reserves. In this article, "period" can mean a month, quarter or year (i.e., typical statutory reporting cycles). The research effort is focused on providing a suggested systematic method for analyzing the movement from the beginning of period reserve (Time 0) to the end of period reserve (Time 1). A reserve movement or reserve change (terms that are used interchangeably in this article) is a quantifiable difference between a reserve at Time 0 and the reserve amount at Time 1. In other words, the Time 1 reserve less the Time 0 reserve quantifies the reserve movement and the attribution analysis works to break up that difference into amounts that were expected and amounts that developed through volatility.

Many reporting regimes in place today utilize attribution analysis (or reserve movement analysis) as a way to sort the many contributing factors in the calculation into broad categories. But more importantly, the reason for this analysis is to better distinguish the changes that took place during the interim period that were expected versus those that were not expected. The latter type of change is referred to as "reserve volatility." It is this volatility that can be quantified using a systematic attribution analysis approach. An attribution analysis uses successive valuation steps to quantify the components of change in reserve. This can provide the company with a deeper understanding of the sensitivity of the balance sheet to changes in experience, show the company where the greatest risks lie for each product group, aid the actuary in communicating statutory reporting results to senior management, and help in estimating reserves between reporting cycles. As part of the research effort, the research team surveyed five reporting regimes currently used by insurance companies to provide a launch pad for a suggested VM-20 attribution analysis.

As a first step in the process of suggesting an appropriate VM-20 attribution analysis, we needed to understand the sources of change in the VM-20 reserving regime. In other words, what are the key drivers for a change in VM-20 reserves from one period to the next? Taking guidance from attribution methods already in place within other reporting regimes, we find four broad categories of change: economic, non-economic, demographic and risk mitigation. Within each of the broad categories are a variety of drivers. The order in which these categories are assessed matters as well. Again, using the sign posts from other reporting regimes, the research report presents a suggested order of attribution for VM-20 analysis, as follows.

DEMOGRAPHIC CHANGES

This broad category includes anything that changes the characteristics of the group of in-force policies subject to the VM-20 valuation. What happens to an in-force population from period to period? In answering this question, the following breakout items occur most frequently in other regimes and are fundamental to the underlying concept of advancing a valuation date to the next reporting period. Therefore, they are included as part of the suggested attribution analysis for VM-20 reserves.

Time passage: The policies in force at Time 0 are now one period closer to their maturity date, the insured life is one period older, and each policy exhibits behavior indicative of policies more mature by one period. We characterize this as "time passage." Quantifying this component is relatively easy—advance the valuation date in the model used for the prior valuation period and rerun. Any model conflict errors that need resolving should be considered as part of this attribution step. Time passage is an expected change to the reserve amount.

Account value changes: If the policies in scope are of the type that carry a policy account value, the prior step of time passage advances the account value of each policy based on the anticipated economic environment from the perspective of Time 0. In contrast, this step quantifies reserve volatility by replacing anticipated credited rates with actual credited rates between the two reporting dates.

Terminations: This step has two components—an expected component and an unexpected component. The expected component is defined by quantifying what the model expected the terminations to be based on assumptions for mortality and lapse resident in the model. The unexpected component is defined by quantifying the terminations the company actually experienced during the period.

New business: For any product block that has policies being sold in the market, there is the expected level of sales and the actual level of sales. These do not always align, producing an amount of reserve volatility. The expected layer is quantified by looking back to the Time 0 model and extracting the forecast of the reserve at Time 1 generated solely by anticipated new business. This is what the model thought the Time 1 reserve would be for the new business block the company expected to be issued between Time 0 and Time 1. The volatility layer is measured by updating the Time 1 policy inventory file for the actual policies issued during the period.

NON-ECONOMIC CHANGES

In some reporting regimes, this category can include up to four key drivers: experience assumptions, methodology changes, prevailing reserve and non-guaranteed element changes. The research team found that of these four, the experience assumptions item occurs most frequently in all regimes for which a cash flow model is used to produce reserves. And because VM-20 has three reserve components, with any of these prevailing on a given valuation date, the prevailing reserve item is also included in the suggested reserve attribution for VM-20.

Assumption changes: Above, under "Terminations," the attribution quantifies the expected terminations and the unexpected terminations, which together net out to produce reserve volatility. Specifically, this reserve volatility is due to unexpected changes that occur between Time 0 and Time 1. But what about changes introduced when the company's experience indicates the need for a modification to baseline assumptions? Such an assumption update will introduce volatility to the current period modeled reserve via changes to future projected cash flows past Time 1, since the update is not something the company would have anticipated back at Time 0. The step is performed by updating the assumption, processing a valuation and comparing the Time 1 reserve to the reserve amount that was apparent just prior to the assumption change. This amount serves as a reserve volatility component.

Prevailing reserve changes: In VM-20 valuations, the financial measurement of minimum reserve is (potentially) determined by comparing more than one calculated component. Should the prevailing reserve component stay the same over the period, this step contributes $0 to the attribution analysis. When the component that drives the minimum reserve switches from one period

Management pays attention to volatility analysis when volatility runs high.

to the next, this introduces volatility into the reserve movement. The Prevailing Reserve step is most easily quantified by tracking all attribution steps for each component in the calculation of the PBR for the product group. For example, if a term insurance product group includes the net premium reserve (NPR) and deterministic reserve (DR) in the principle-based valuation, but not the stochastic reserve (SR), then all the steps up to this point would track both NPR and DR. Table 1 shows one example of how the reserve change in this step may be bifurcated into: (i) volatility from the prevailing reserve type switching, and (ii) changes due to other attribution categories. It is at step 2 that the prevailing reserve switches from NPR to DR. The total change in PBR quantified in this step is three (15–12). Had the prevailing reserve not switched, the change would have been quantified as one for the step (13–12, from the NPR column). Therefore, the change from other attribution categories is assigned this amount of one, with the volatility from switch in prevailing reserve type over the period assigned the balance of two.

Table 1
Reserve Change Bifurcation

Attribution Category Step	NPR	DR	PBR	Volatility From Prevailing Reserve Type	Reserve Change From All Other Attribution Categories
Opening	**10**	8	**10**		
Step 1	**12**	10	**12**	0	2
Step 2	13	**15**	**15**	2	1
Step 3	14	**16**	**16**	0	1
End			**16**		

ECONOMIC CHANGES

A VM-20 valuation includes modeling assets, and as a result, there is an abundance of economic elements that impact the resulting reserves each reporting period.

Starting yield curve: There is both an "anticipated" and a "volatility" component to this element. The first step is the asset equivalent of "time passage" described under demographic changes and, on the grid, is aptly labeled "rolling down the Time 0 Treasury curve." Similar to the liability side, this first step

recognizes that the assets are one period closer to their maturity dates, or first call dates, or other features impacting asset cash flows. To implement this concept in the model, the yield curve from Time 0 is shifted one year in this step, assuming the yield curve modeled at Time 1 thus far is identical to that at Time 0. For example, the one-year forward rates from the Time 0 five-year Treasury curve would be used as the four-year spot rates as of Time 1. Running a valuation under this premise and differencing the reserve with the reserve from the step immediately prior quantifies the anticipated reserve change due to change in reference yield curve.

The second step to this attribution element is the reserve volatility component. The starting yield curve in the model is updated to be consistent with the curve on the valuation date. The difference with the reserve that emerges with the step just above is the reserve volatility component for the change in starting yield curve.

Changes in asset spread and default charge assumptions: In the Valuation Manual, asset spread tables and default charge tables are updated periodically. As these assumptions are updated in the actuarial model, a valuation run will provide the reserve amount, which, when differenced with the reserve amount from the immediately preceding step, will quantify the reserve volatility introduced by these changes.

Change in investment strategy: A company's investment strategy is constantly evolving and reacting to current conditions. This introduces volatility to reserves when the prevailing reserve is one determined using a cash flow model. As the revised investment strategy assumption is implemented in the actuarial model, a valuation run will provide the reserve amount, which, when differenced with the reserve amount from the immediately preceding step, will quantify the reserve volatility introduced by a company's changes to its investment strategy.

RISK MITIGATION, MANAGEMENT ACTIONS, OTHER

This last category attempts to capture examples of the kind of elements that can have a material impact on the financial measure being calculated, but are not expected to occur in the normal course of business, period after period. A company will have its own unique items falling into the risk mitigation category. In the research report, we use the examples of reinsurance retention limit changes and hedge programs to serve as examples of changes to risk mitigation programs that potentially introduce volatility to the reserve change analysis.

Reinsurance retention limit change and hedge program change: For both the reinsurance and the hedge program changes, the revised program is implemented in the actuarial model for the current valuation date. A valuation run will provide the reserve amount, which, when differenced with the reserve amount from the immediately preceding step, will quantify the reserve volatility introduced by a company's changes to any risk mitigation programs.

ANECDOTAL EVIDENCE OF THE BENEFIT OF ATTRIBUTION ANALYSIS

Once the full complement of attribution steps has been processed, the final reserve calculation should represent the company's Time 1 VM-20 reserve. The attribution analysis facilitates a better understanding of the characteristics of the movement of the VM-20 reserve from Time 0 to Time 1. In the course of the research, the team had the opportunity to discuss the practical use of the attribution tool through interviews with valuation actuaries. These actuaries report financial results under various accounting regimes, and they confirm their use of the roll-forward analysis, or reserve attribution steps, as the tool of choice when investigating period-to-period changes. Communication with senior management and the board of directors is facilitated by this type of analysis, and in particular, management seems to take an increased interest when volatility in reserves runs high. A common item on the wish list of these interviewees is more time and resources to enable sensitivity runs and more comprehensive analysis of their models. Attribution processes already in place for other reporting regimes will likely be the springboard in developing VM-20 attribution analysis. Companies may also seek to refine their attribution processes while reported VM-20 reserves are still relatively small in size over the early days of reporting.

The full research report provides an overview of other reporting regimes, as well as a how-to guide and case studies as examples of performing an attribution analysis specific to VM-20 valuations. The case studies include projection model results of a term insurance block and a universal life with secondary guarantee block. Each case study tracks the VM-20 reserve components of NPR, DR and SR (for ULSG) through the steps summarized above. ■

The views expressed in this article are solely those of the author and do not necessarily reflect the views of Milliman or the Society of Actuaries, nor are they intended as methods of regulatory or tax compliance.

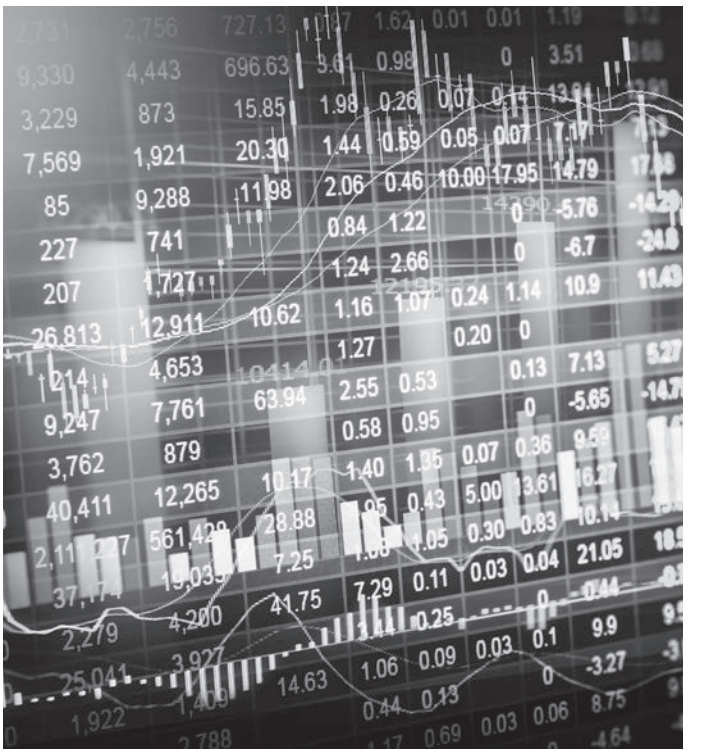
Karen Rudolph, FSA, MAAA, is a principal & consulting actuary at Milliman. She can be reached at *karen.rudolph@milliman.com.*

ENDNOTE

1 *https://www.soa.org/research-reports/2017/2017-understand-vm-20-results/*

A VM-20 Mortality and Credibility Factor Observation

By Tim Cardinal



Many questions have been asked regarding VM-20[1] and reserves over the past decade. Will our company's reserves be lower or higher, and by how much? The answer "it depends" isn't as clean or easy as a "yes/no and by a lot." Mortality is an obvious driver to answering the yes/no/how much question. A second series of related questions is: what is our mortality assumption? What is our credibility factor? How much do reserves change with a higher credibility factor? This article presents graphical results[2] to answer the last question.

The VM-20 mortality assumption splits the policy period into three periods: Period 1—based on company tables plus margin; Period 2—grades linearly from company to industry; and Period 3—based on an industry table plus industry margin. Margins for the company tables are determined via one of two permissible credibility methods to determine a credibility factor—Bühlmann and Limited Fluctuation. For both methods the factor is used as a table lookup to determine a vector of margins; the column is based on the credibility factor and the margins in rows vary by attained age. These margins are applied to company tables. Another dimension to credibility is how long—the sufficient data period—which VM-20 defines as the last duration in which there were more than 50 claims. The sufficient data period along with the credibility factor is used to determine the length, start and end of each of the three periods. The details of the mortality assumption process are beyond the intent and scope of this article.

Figures 1–3 present deterministic reserve results for a 10/20 year term cohort using Bühlmann credibility factors for 11 of the VM-20 margin table's 24 columns—corresponding to the columns 33–37%, 48–52%, 58–62%, 68–72%, 78–82%, 83–87%, 90–91%, 92–93%, 94–95%, 96–97%, and 98%. The margin decreases as one moves across the table from left to right. To avoid the possible confusion that the 11 results are consecutive columns (they are not) I use the word "trial" as a label rather than "column." The margins at ages 0–45 for these 11 trials are shown in Table 1.

The 10/20 year term cohort consists of one year of issues—40 percent 10 Year, 60 percent 20 Year—using LIMRA sales mix data. Reserves are on a direct basis.

Deterministic reserves depend on a myriad of other assumptions and modeling methods. Without knowledge of all assumptions, one cannot and should not read too much into the values. However, in this article, we are interested in change. Changing an assumption would simply shift all the results by nearly the same amount. In the figures, the trials alternate between dark/light and use different dash-dot patterns. Since VM-20 requires a comparison of the deterministic reserve (DR) plus the due and deferred premium asset (DPA) to the net premium reserve (NPR), the analysis considers DR + DPA. As expected, DR + DPA decreases across all policy years as the credibility factor increases, meaning a column further right in the VM-20 table is used resulting in lower margins for the company table.

Table 1
11 Margin Trials

33–37%	48–52%	58–62%	68–72%	78–82%	83–87%	90–91%	92–93%	94–95%	96–97%	98%
18.6%	16.3%	14.6%	12.7%	10.3%	8.9%	7.3%	6.5%	5.7%	4.6%	3.3%

Figure 1
Projected DR + DPA by Policy Year

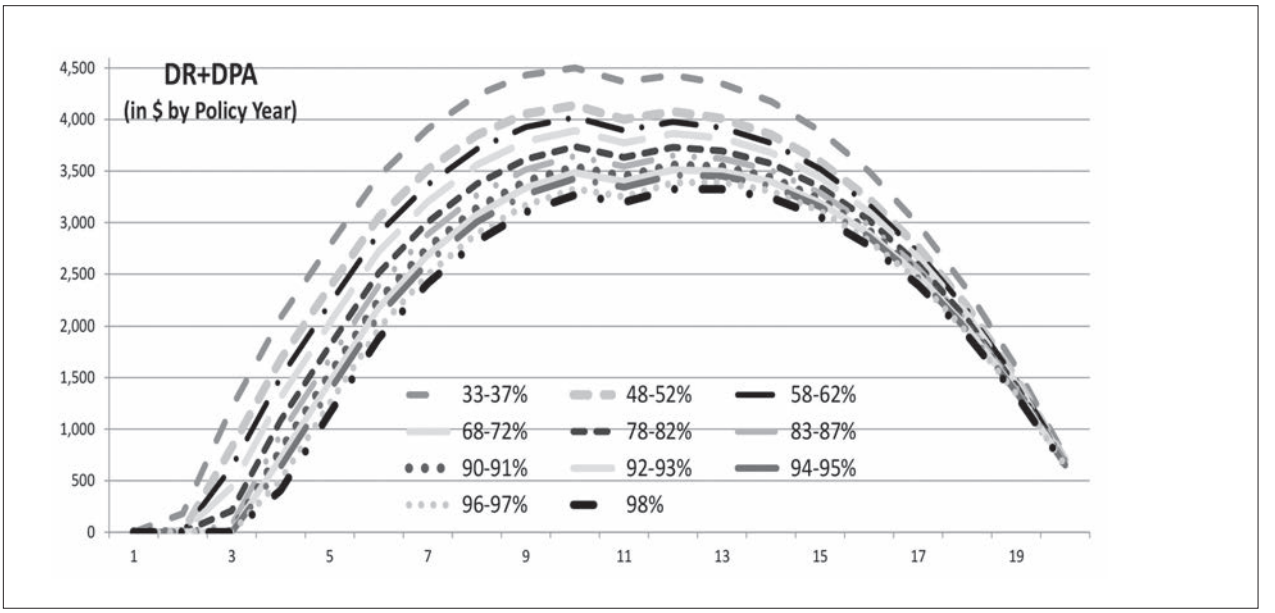


Figure 2
The Ratio of Individual Trials to the Middle Trial

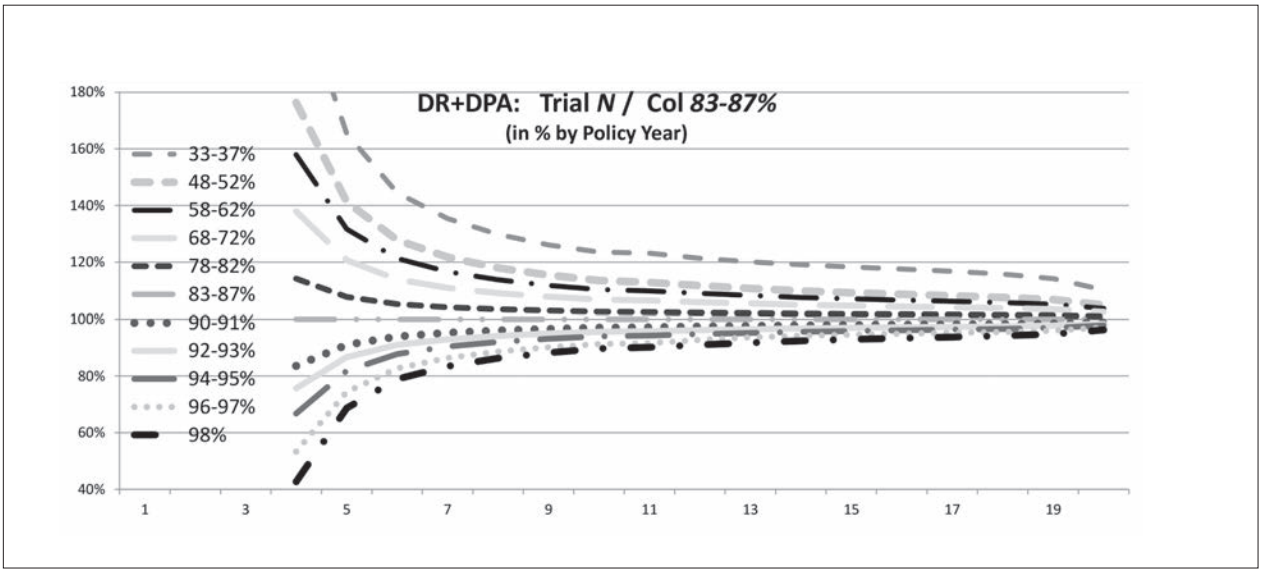


Figure 3
The Ratio of Individual Trial's DR + DPA to Prior Trial

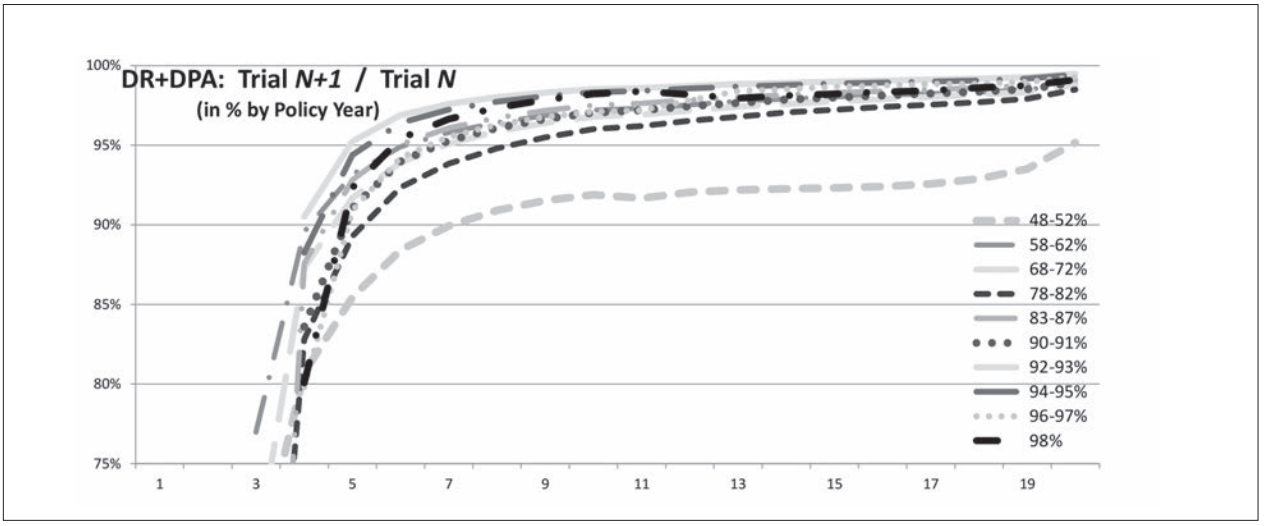


Figure 2 uses the middle trial—the 83–87% column—as a central point of comparison. The percentage differences in DR + DPA are not immaterial between consecutive trials and are significant between many trials (and hence many VM-20 table columns). Values for policy years 1–3 are not shown because DR + DPA is zero or small, resulting in undefined and/or very large ratios.

Figure 3 compares the percentage change from one trial to the next. In policy years three to five, the change is greater than 10 percent between each trial.

COMMENTS

Without turning this article into a monograph and a proliferation of graphs, results using the Limited Fluctuation method are similar as are blocks with slightly different assumptions. Blocks with a higher percentage of 10-year term have larger changes than blocks with more 20-year term. UL and ULSG VM-20 deterministic and stochastic reserves show similar patterns but tend to have smaller percentage impacts.

Do not read too much into the precision of the values or ratios in Figures 1–3—the general observation is that, yes, as suspected, mortality credibility factors do materially impact deterministic reserves. VM-20 permits companies to exercise actuarial judgment in determining the assumption and the relevant data. For example, VM-20 permits internal and external sources of data such as reinsurers, LIMRA and MIB. Widening the quantity and quality of underlying data leads to higher credibility. The data needs to share similar characteristics, but VM-20 defines neither "similar" nor "characteristics." Companies and actuaries alike will be looking for solutions to the challenges in developing and setting mortality assumptions. One of the challenges materially impacting deterministic reserves is credibility. ■

Widening the quantity and quality of underlying data leads to higher credibility.

Tim Cardinal, FSA, CERA, MAAA, MBA, is a principal at Actuarial Compass LLC in Cincinnati. He can be reached at *tcardinal@actuarialcompass.com.*

ENDNOTES

1 National Association of Insurance Commissioners. Valuation Manual. April 2016. Accessed online: *http://www.naic.org/documents/cmte_a_latf_related_val_adopted_160829_with_changes.pdf.*

2 The PBR Consortium—Actuarial Compass LLC, AADicke LLC, and Mangini Actuarial and Risk Advisory LLC. Voyager m2Lab PBA Training. 2015 revised 2016.

Considerations for Indexed Universal Life Under PBR

By Olivia Yang, Erzhe Zhang and Nick Dunn

Indexed universal life (IUL) is a form of universal life (UL) insurance that credits interest based on changes to a benchmark index. IUL policies have the potential to credit higher returns over traditional general account UL policies through participation in market growth while maintaining safety for the policyholder with guaranteed minimum rates.

Actuarial Guideline 49 (AG 49) was enacted in December 2015 and establishes for policy illustrations a benchmark crediting rate and a ceiling for index values. There were concerns that AG 49 would reduce the appeal of IUL. Despite this, 2016 was a record-setting year for IUL, nearly reaching $2 billion[1] in sales, and the market continues to grow in 2017.

With the adoption of Valuation Manual 20 (VM-20) in 2016, principle-based reserves (PBR) became effective on Jan. 1, 2017, with an optional three-year phase-in period. This article highlights key considerations as companies begin to reserve for their IUL products under PBR.

The American Academy of Actuaries (the Academy) Life Principle-Based Approach Practice Note Work Group released a practice note[2] on May 18, 2017, to assist actuaries with the PBR implementation. In this practice note, it explicitly states that indexed life and indexed universal life policies are subject to VM-20.

NET PREMIUM RESERVE

The net premium reserve (NPR) for IUL is similar to that for other UL products. For an IUL policy with a secondary guarantee, the NPR is the maximum of three components:

- NPR—Main Guarantee (Section 3.B.5)
- NPR—Secondary Guarantee (Section 3.B.6)
- Cash Surrender Value

With minimal guidance on the IUL specific application of VM-20, companies are taking different approaches for the minimum credited rate. Options include using fixed account minimum guaranteed rates as well as using indexed rates determined by the implied guarantee rate method (IGRM) found in Actuarial Guideline 36.

DETERMINISTIC RESERVE

The prescribed economic scenario for deterministic reserve (DR) may produce unintuitive results for IUL products. The Academy Life Reserves Work Group is conducting a survey of IUL writers to better determine the fitness of the DR calculation to IUL products.

The prescribed scenario (Section 7.G.1.c) is as follows:

> The Scenario 12 interest rate yield curves and total investment returns are based on approximately a one standard deviation shock to the economic conditions as of the projection start date, where the shock is spread uniformly over the first 20 years of the projection.

The prescribed equity return results in low account value growth. The suppressed account value lowers profitability by lowering interest spread earned on account value (interest earned minus interest credited). For IUL designs with secondary guarantees, policies are more likely to be in-the-money. Based on analysis to date, the resulting DR is significantly higher than the SR, which is believed to be an unintended result.

In Table 1, a profit measure is presented for each scenario.[3] The profit measure is calculated in each month as one annualized basis point of the account value at the end of the month. These monthly profits over 20 and 40 years respectively are then discounted to the policy issue date at 5 percent per annum. The comparison of the two columns demonstrates the increased crediting rate seen after policy year 20.

Table 1
Profit Measure

Percentile of SR scenarios	PV @ Issue of Profit Measure	
	Through PY20	Through PY40
Min	$103.82	$222.52
10th	103.88	222.69
20th	103.91	222.76
30th	103.93	222.82
40th	103.97	222.88
50th	103.98	222.90
60th	104.00	222.96
70th	104.03	223.12
80th	104.06	223.25
90th	104.07	223.27
100th	104.11	223.44
Max	104.17	223.53
DR Scenario	103.33	222.73

The DR scenario is outperformed by every single SR scenario over the 20-year period, and lags behind the 20th percentile of the SR scenarios over the 40-year period, indicating the strongly suppressed account value growth seen in the DR scenario.

In light of this, many companies are taking a "wait and see" approach, and it is not uncommon for pricing and forecasting models to adjust DR in anticipation of an update to the VM-20 for IUL.

STOCHASTIC RESERVE

Section 6 of VM-20 describes the stochastic exclusion test (SET), which can be used to identify groups of policies that do not have material interest rate or asset return volatility risk. Companies may elect to use this test to exclude groups of policies from the calculation of the stochastic reserve (SR). According to Section 6.A.1.b of VM-20, products with a clearly defined hedging strategy cannot be excluded from the SR requirement, which inherently excludes IUL products from the SET.

Companies are allowed to use simplifications, approximations or modeling efficiency techniques to calculate their SR. For example, fewer than 10,000 scenarios may be used if the company can demonstrate that this does not understate the reserve by a material amount. If used, these considerations must be fully documented in the PBR report described in VM-31.

ASSUMPTIONS

Premium Funding

Premium funding assumptions are a significant driver of reserves under PBR. Consistency in assumptions and methodology between pricing and valuation is required to prevent artificial reserve variances from occurring. In addition, a mechanism should be considered to adjust modeled premium to prevent over/under funding, as earned rates, option budgets, caps and indexed credit rates will vary by PBR scenario.

Moreover, PBR requires certain sensitivity tests to be performed. Section 9.A.7 of VM-20 specifies requirements for performing sensitivity tests "to understand the materiality of prudent estimate assumptions on the modeled reserve." Section 9.D.4.b of VM-20 requires "for policies that give policyholders flexibility in the timing and amount of premium payments" that the following four sensitivities are run at a minimum:

- Minimum premium scenario,
- no further premium payment scenario,
- pre-payment of premiums—single premium scenario, and
- re-payment of premiums—level premium scenario.

The above scenarios can be used to examine the sensitivity of the reserve to the premium payment pattern assumption. The impact on the PBR reserve may be particularly adverse for IUL products depending on the pattern of investment, COI and expense margins. The premium payment prudent estimate assumption should be formed in light of these sensitivity test results. VM-31 also requires these results to be disclosed in the PBR report.

Non-Guaranteed Elements

Non-guaranteed elements (NGE), as defined in Section 1.C.12 of VM-20, refer to charges or credits to a policyholder's account value, benefit, premium or consideration that are both established and which may be adjusted at the discretion of an insurance company.

Under PBR, the DR and SR are calculated using projected cash flows under prudent estimate assumptions reflecting a "moderately adverse" view of future experience. The projected NGE should follow the company's strategy, consider past practices and be consistent with the assumptions and emerging experience used in each scenario (VM-20, Section 7.C.2).

Like all other assumptions, VM-20 requires that the NGEs include a margin. Therefore, companies may choose not to fully reflect the projected experience in the model as doing so could eliminate the margin built into the prudent estimate assumption. For example, companies may assume that current cost of insurance (COI) rates are adjusted based on changes in the projected mortality. However, to account for efficiency, reaction time, implementation costs and secondary effects not explicitly modeled, only a portion (e.g., 50 percent) of the extra mortality will be recouped through increased COI rates.

Indexed Crediting

Under PBR, the DR and SR require projecting assets and liabilities under different economic scenarios which are generated "on the fly" at future valuation dates. The caps need to be solved for along the scenario path and compared to the index growth rates to determine the credited rates.

Companies may utilize the portfolio rate arising from the asset liability projections, solve for the option budget and indexed caps dynamically and credit the modeled index account accordingly.

Practices regarding the setting of PBR margins for indexed products are emerging. As a result, companies should build flexibility into their models to allow for testing the impact of various alternative scenarios.

CONCLUSION

PBR implementation for IUL can be more complicated relative to implementation for general account UL. The additional computation requirements for the DR and SR, treatment of hedge costs, and policyholder behavior modeling are primary considerations for companies when evaluating the impact of PBR on IUL products. ■

The views expressed in the article are those of the authors and not representative of Oliver Wyman's.

Olivia Yang, FSA, CERA, MAAA, is a consulting actuary with Oliver Wyman in Philadelphia. She can be reached at *olivia.yang@oliverwyman.com*.

Erzhe Zhang, FSA, MAAA, is a consulting actuary with Oliver Wyman in Chicago. He can be reached at *erzhe.zhang@oliverwyman.com*.

Nick Dunn is an actuarial analyst with Oliver Wyman in Chicago. He can be reached at *nick.dunn@oliverwyman.com*.

ENDNOTES

1 Wink's Sales & Market Report, 78th edition, *http://www.thinkadvisor.com/2017/03/03/indexed-universal-life-insurance-sales-hit-new-hig.*

2 *https://www.actuary.org/index.php?q=content/work-group-releases-practice-note-life-principle-based-reserves-under-vm-20.*

3 Assume a policy with $1,000,000 face amount is issued to a 30-year-old non-smoking male. $10,000 is contributed annually. COI rates are based on 2008 VBT Ultimate. Expenses and premium loads are not considered for simplicity. Interest rate credited is floored and capped at an annualized rate of 1 percent and 5 percent, respectively. All rates are applied monthly.

PBR Reporting Requirements

By Connie Newby and Aisling Metcalfe

Principle-based reserving (PBR) is now in effect for most states. There is a three-year transition period, beginning Jan. 1, 2017, and many insurers, for a variety of reasons—including uncertainty around the tax treatment—are choosing to wait and not implement PBR immediately. This article concentrates on reporting requirements under PBR, including what will be required for companies that do not implement PBR for year-end 2017.

NEW REQUIREMENTS

All companies, whether or not they are implementing PBR, will need to comply with the changes to the asset adequacy opinion and memorandum in VM-30.

Companies implementing PBR for year-end 2017 will need to complete the PBR section of the VM-20 Reserves Supplement, produce a VM-31 PBR Actuarial Report and comply with VM-G Corporate Governance.

Companies not implementing PBR in 2017 will need to complete the sections of the VM-20 Reserves Supplement for non-PBR reserves. However, the VM-31 report and VM-G requirement will only be required once PBR is implemented; i.e., if the company chooses not to adopt PBR until 2020, the VM-31 report will not be needed until 2020.

Companies with variable annuities have reserves subject to VM-21 and will need to produce a PBR Actuarial Report even if they do not adopt VM-20 for life reserves in 2017. However, the VM-31 reporting requirements for variable annuities are the same as the VM-21 reporting requirements (VM-31 simply refers to VM-21 for variable annuities), and VM-21 mirrors AG 43, so this does not introduce an additional reporting requirement.

VM-G applies once PBR is adopted. However, it also applies to products issued prior to PBR adoption which are subject to AG 43, so companies that do not adopt PBR for life products (VM-20) but do have variable annuities subject to AG 43 or VM-21 will need to comply with the VM-G requirements.

VM-50 (Experience Reporting) is not yet operational and does not apply for year-end 2017. Therefore, we will not discuss it here.

Annual Statement and VM-20 Reserves Supplement

There are changes to the annual statement which are applicable for companies implementing PBR. These include:

- A new line in the analysis of increase in reserves exhibit for "change in excess of VM-20 deterministic/stochastic reserve over net premium reserve";
- the new valuation methods will be added to Exhibit 5 and Separate Account Exhibit 3;
- the five-year historical data exhibit will include a line for excess VM-20 deterministic/stochastic reserves over net premium reserve; and
- supplemental exhibits and schedules interrogatories will include the question, "Will the VM-20 reserves supplement be filed with the state of domicile and the NAIC by April 1?"

For Exhibit 5 and Separate Account Exhibit 3, in addition to methods such as NLP and CRVM, the following methods will be available:

- VM-20 NPR—net premium reserve component of VM-20 reserve, and
- VM-20 DET/STO—deterministic/stochastic reserve component of VM-20 reserve (excess over net premium).

There is one new exhibit: the VM-20 reserves supplement (VM-20 blank). This is a three-part document and the relevant sections must be filled out by all companies, whether or not PBR is being adopted.

Part 1 of the VM-20 reserves supplement is for those reserves currently valued under VM-20. Required information includes:

- Gross and net reserves by life product line;
- ceded life reserves in aggregate;
- write-in amounts; and
- prior year reported reserves versus current year reported reserves and deferred premium asset.

The current year amounts are separated into Sections A, B and C as follows:

- Section A includes those products for which stochastic reserves are required. Required fields are net premium reserves, deterministic reserves, stochastic reserves, number of policies and face amount.
- Section B is for products where deterministic reserves are required, but not stochastic. Required fields are net premium reserves, deterministic reserves, number of policies and face amount.
- Section C is for products where only net premium reserves are required, so required fields are simply net premium reserves, number of policies and face amount.

Part 2 of the VM-20 reserves supplement covers reserves for policies which are not yet based on VM-20, as a result of the three-year transition period. Required fields are prior year gross and net reserves by product, and current year gross and net reserves by product, along with number of policies and face amount.

Part 3 is a questionnaire for the PBR life exemption. The insurer must indicate whether the exemption is the result of the NAIC-adopted Valuation Manual, or a state statute or regulation which differs from the NAIC-adopted Valuation Manual.

VM-31 PBR ACTUARIAL REPORT

The VM-31 PBR actuarial report is required annually if a company computes deterministic or stochastic reserves as defined in VM-20. It must be submitted to the state insurance commissioner upon request. Additionally, the VM-31 overview must be submitted to the commissioner by April 1st of the year following the year to which the PBR actuarial report applies.

Companies that pass the exclusion test must develop a PBR actuarial report that addresses the requirements of Section 3.D.10 (deterministic and stochastic exclusion tests) and 3.D.12.c (certifications), if applicable.

The PBR actuarial report is more detailed than the asset adequacy memorandum. The required report contents are detailed in the Valuation Manual. Additional disclosures are required, including documentation of the rationale behind the assumptions (not just the assumptions themselves), the impact of individual and aggregate margins on deterministic reserves, the impact of aggregation on stochastic reserves, quantification of assumption margins and sensitivities, and details of reinsurance treaties.

Preparation of the report, especially for the first time, is likely to be challenging and time-consuming, especially at a time of year when resources are already stretched. Companies should plan carefully, consider the timing of the different reports (including the Actuarial Opinion and Memorandum) and collect as much information as possible ahead of time.

VM-G CORPORATE GOVERNANCE

VM-G provides guidance on the responsibilities of the board of directors, senior management and the appointed actuary and/or other qualified actuaries as they relate to PBR.

Under VM-G, the board must establish a process whereby it receives and reviews reports including certification by senior management of the effectiveness of internal controls with respect to PBR. Board meeting minutes must document this

Preparation of the report, especially for the first time, is likely to be challenging and time-consuming, especially at a time of year when resources are already stretched.

review as well as actions undertaken by the board relating to PBR.

Senior management must report to the board, at least annually, on:

- Infrastructure senior management has established to support PBR;
- critical risk elements of the valuation;
- summary results of the PBR valuation;
- level of knowledge and experience of senior management personnel responsible for PBR; and
- reports related to governance of PBR, including the certification of the effectiveness of internal controls.

Insurers implementing PBR at year-end 2017 will need to comply with VM-G and should ensure that appropriate governance structures and procedures are in place.

Companies not implementing PBR at year-end 2017 have some more time to set up governance processes. They should start by analyzing the gaps between their current state and what will be required under VM-G.

VM-30 NEW ACTUARIAL OPINION AND MEMORANDUM REQUIREMENTS

VM-30 has no transition period and changes to the asset adequacy opinion and memorandum go into effect at year-end 2017, regardless of whether or not PBR is being implemented. The main differences between VM-30 and the previous actuarial opinion and memorandum regulation are:

- Subtle changes in prescribed language;
- a stricter adherence to prescribed language, in the form of a table of "key indicators" where deviations from prescribed language are catalogued;
- a relevant comments section, to explain items such as material changes in assumptions or methods, or reasons for a qualified opinion; and
- a new column in the asset adequacy tested amounts table, for principle-based reserves.

Appointed actuaries should review VM-30 in advance of preparing the asset adequacy opinion and memorandum to ensure that the report adheres to the prescribed language, and that all data needed for the report will be available. ■

Connie Newby, FSA, MAAA, is a manager at KPMG. She can be reached at *cnewby@kpmg.com.*

Aisling Metcalfe, FSA, FIA, MAAA, is a manager at KPMG. She can be reached at *AMetcalfe@kpmg.com.*

GAAP Targeted Improvements: Unlocking 2.0

By Steve Malerich

In August, FASB affirmed its earlier decisions to require that the benefit reserve[1] for traditional contracts be calculated using current assumptions without provision for adverse deviation and to review and update the assumptions at the same time each year using a retrospective "catch-up" method of accounting for changes.

Under the retrospective method, the net premium ratio represents the actuary's current estimate of the proportion of lifetime revenue that is needed to fund lifetime benefits. To achieve that objective, it is necessary to replace expected experience with actual experience as it emerges.[2]

RETROSPECTIVE DISTORTIONS

In an earlier article ("Retrospective Noise," *The Financial Reporter*, September 2017) I illustrated the noise that can result from the retrospective method when experience is consistently better or worse than assumed. I suggested that we might reduce the frequency and severity of noise if we can find a way to minimize or avoid the deferral of persistent, biased variances. The article ended by making explicit an assumption that is implicit in current practice for unlocking universal life assumptions:

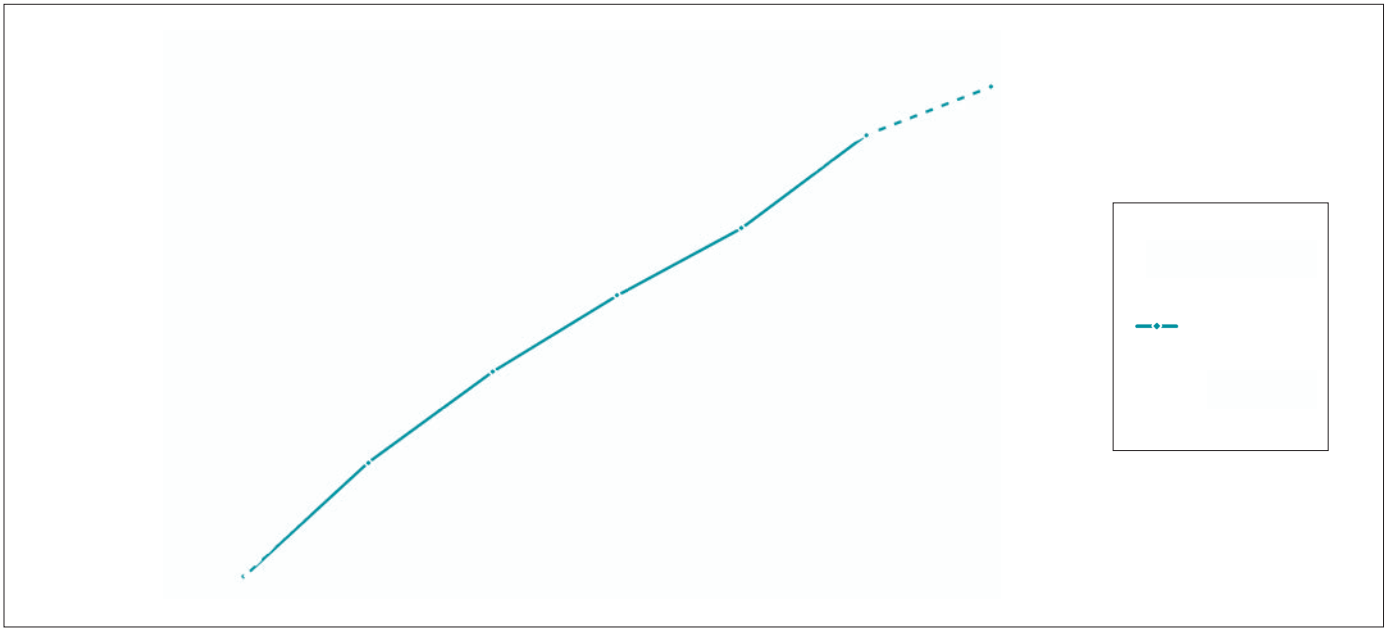
> *With respect to expected future experience, actual experience is given zero credibility until the valuation actuary decides otherwise when updating assumptions.*

Assuming zero credibility in actual experience might be appropriate for a while, but it gradually moves toward absurd. It is certainly absurd once we recognize a need for change but before we actually construct a new assumption.

In discussing alternatives, some FASB members recognized our concern about earnings volatility but noted that in a business as inherently uncertain as long-duration insurance contracts, earnings volatility is to be expected; earnings in any one reporting period can never say much about the overall performance of the business in the way that a retrospective net premium ratio can.

In that discussion, some support for an alternative came from the tendency of the retrospective method to distort the reserve balance when experience deviates from expected over several periods. Figure 1 illustrates this tendency. In this example of a traditional term insurance contract with consistently adverse experience, the original valuation assumption increasingly underestimates the reserve against both expected and ideal measures until the assumption is changed in year five.

Figure 1
Tendency of Retrospective Method to Distort Reserve Balance



(In this and subsequent illustrations, "Expected" shows what would happen if experience exactly follows the original assumption, "Ideal" shows what would happen if the original assumption had correctly anticipated actual experience, and "Retrospective" shows the effect of actual experience when different from the original valuation assumption.)

Rather than moving closer to ideal, replacing expected experience with actual in the reserve calculation without simultaneously updating the assumption moves the reserve away from ideal. Though not always obvious, this tendency arises any time experience is consistently better or worse than expected, even if we're unable to see the trend among random fluctuations.

Even as FASB is considering changes to insurance accounting, the Actuarial Standards Board is preparing an Actuarial Standard of Practice (ASOP) on setting assumptions. Though not yet approved, the exposure draft stated in paragraph 3.1.3(a):

> The actuary should consider to what extent it is appropriate to use assumptions … that have a known tendency to significantly underestimate or overestimate the result.

As illustrated in Figure 1, GAAP reserving assumptions have that tendency if they are carried forward unchanged while experience is trending away from the assumption. Before marrying that tendency to another large class of business (traditional long-duration contracts), it's time to look for an alternative.

CRITERIA FOR EVALUATING ALTERNATIVES

Practically, we know that it is impossible to divine the future from a small number of variations from expected cash flows. That does not mean we should assume no connection between past and future experience.

Any alternative, however, must still comply with applicable standards. In particular, it must meet all the requirements of the retrospective method and it must consider credibility of actual experience in relation to the data supporting the existing assumption—and of the existing assumption in light of actual experience.

Ideally, an alternative approach to unlocking would:

- Reduce or eliminate the tendency to underestimate or overestimate the reserve,
- reasonably balance the credibility of actual experience and of the existing assumption,
- reduce or eliminate the need to reverse prior reserve adjustments when making an explicit assumption change,
- provide a simple connection between past and projected experience until sufficient data exists to support an explicit assumption change, and
- self-correct for random fluctuations from an underlying pattern.

Further, if it reduced the reserve offset to variances from expected benefits (biased or random), earnings variances could more easily be explained in relation to actual cash flows.

AN INTERIM ASSUMPTION ADJUSTMENT

After considering some alternatives, I propose that the retrospective unlocking method can be improved with a simple formulaic adjustment of the projection assumption. The adjustment can be implemented in the form of a present value of excess (future) claims calculated in relation to the accumulated value of (actual) excess claims. As of the valuation date:

$$PV(Excess\ Claims) = PV(Basis) \times Significance(t) \times \frac{AV(Excess\ Claims)}{AV(Basis)}$$

Exactly how this adjustment is applied will depend on system capabilities and professional judgment. As a simple tool for a specific purpose, consistency is more important than precision, however that might be defined. In the examples that follow, I simply added it to the present value of model claims in both the net premium ratio and the reserve calculation. (Model claims and model gross premium are both calculated without any adjustment.)

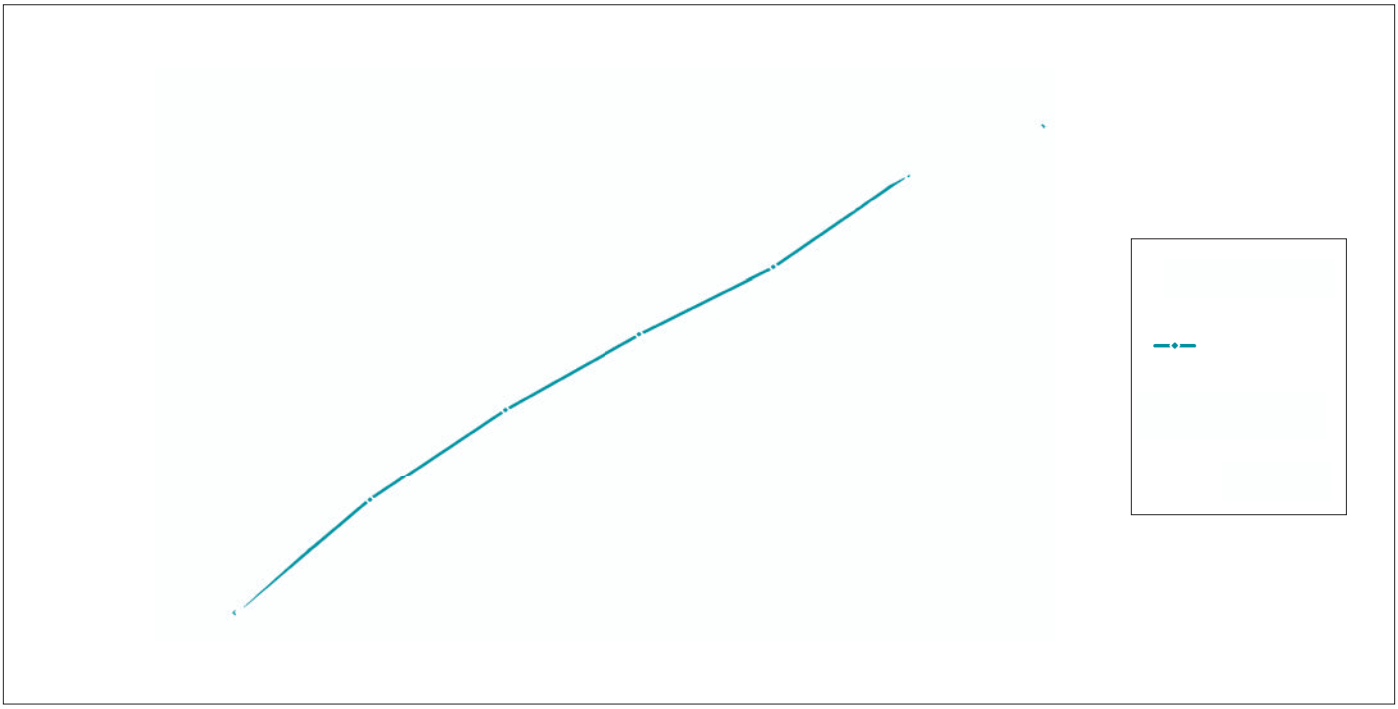
$$Net\ Premium\ Ratio = \frac{AV(Actual\ Claims) + PV(Model\ Claims) + PV(Excess\ Claims)}{AV(Actual\ Gross\ Premium) + PV(Model\ Gross\ Premium)}$$

$$Reserve = PV(Model\ Claims) + PV(Excess\ Claims) - Net\ Premium\ Ratio \times PV(Model\ Gross\ Premium)$$

In the adjustment formula, a reasonable **basis** and **significance** function must be chosen for the extrapolation and t represents time since issue. The familiar retrospective approach can be expressed as a special case of this formula, where **significance** is a constant zero making the adjustment equal to zero regardless of **basis**.

In my examples, I use the amount of insurance in force as a basis and a constant 100 percent significance factor. I believe the

Figure 2
Extrapolated Adjustment to Term Insurance Illustration



amount in force to be a reasonable basis for most traditional life insurance contracts. Later (under ASOP 10, with Chart 7) I'll explain why a flat 100 percent significance factor or something that grades quickly to 100 percent might be best.

Similar to the familiar approach, this approach replaces expected experience with actual. Unlike the familiar approach, the modification regularly adjusts the present value of expected benefits in relation to actual variances from expected experience. At the time of an assumption change, the accumulated value of excess claims is reset to zero.

Any basis for this extrapolation should normally be independent of the funding pattern. In most or all cases, it should also avoid a magnifying adjustment, as would likely occur if expected claims were used for any long-duration contract.

ILLUSTRATIONS

Based on my experience with various traditional and universal life insurance products, I chose the amount of insurance in force as a basis for testing traditional life insurance. With further research, we may find alternative bases that perform better for this or for other products.

Figure 2 adds the extrapolated adjustment to Figure 1's term insurance illustration. Rather than drifting away from ideal, the extrapolated reserve stays close to expected until the assumption is changed. Both approaches converge with ideal once the assumption is updated.

Figure 3 illustrates earnings for the full 20-year term period of the same contract as Figures 1 and 2. As seen in the previous article, retrospective spreads the cost of excess claims over the life of the business but, when the assumption is changed, reverses the deferred portions. By adjusting projected claims, extrapolated does not defer any of the excess costs and therefore has no need to reverse anything.

Statistically, the traditional retrospective approach represents an extreme. In this case, the distribution encompasses possible implications to future experience of actual deviations from the valuation assumption. Except when we have reason to expect future experi-

Figure 3
Earnings for Full 20-Year Term Period

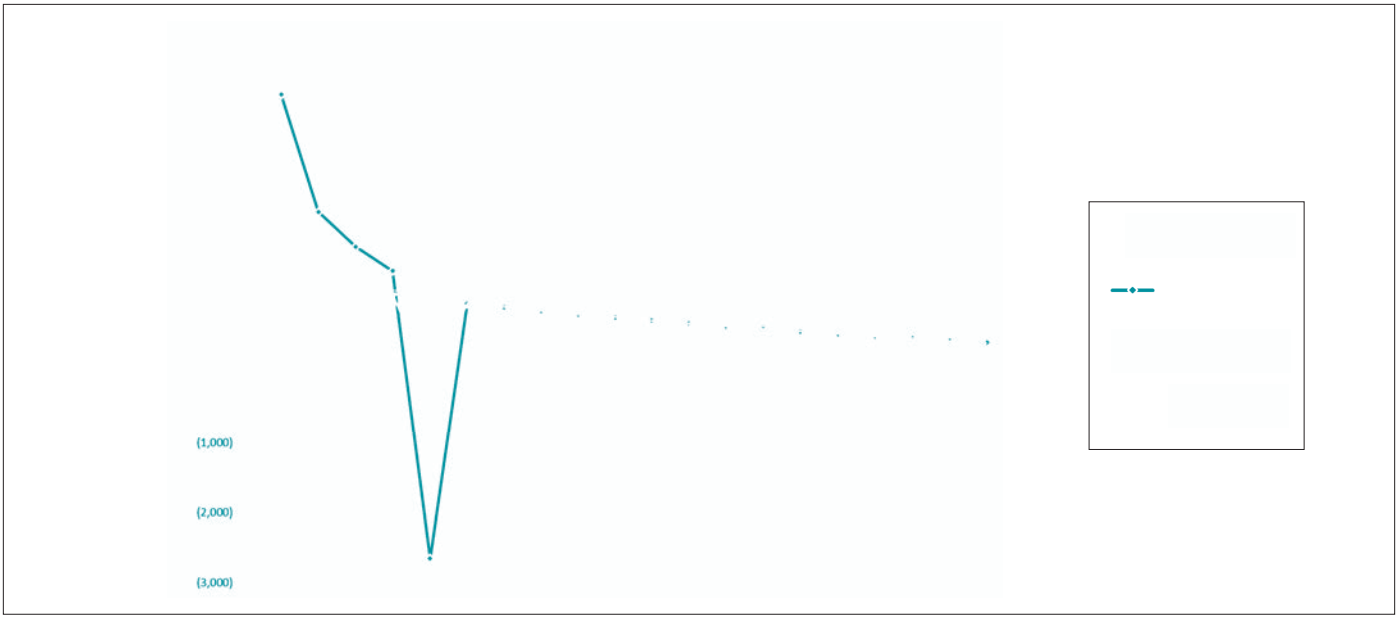
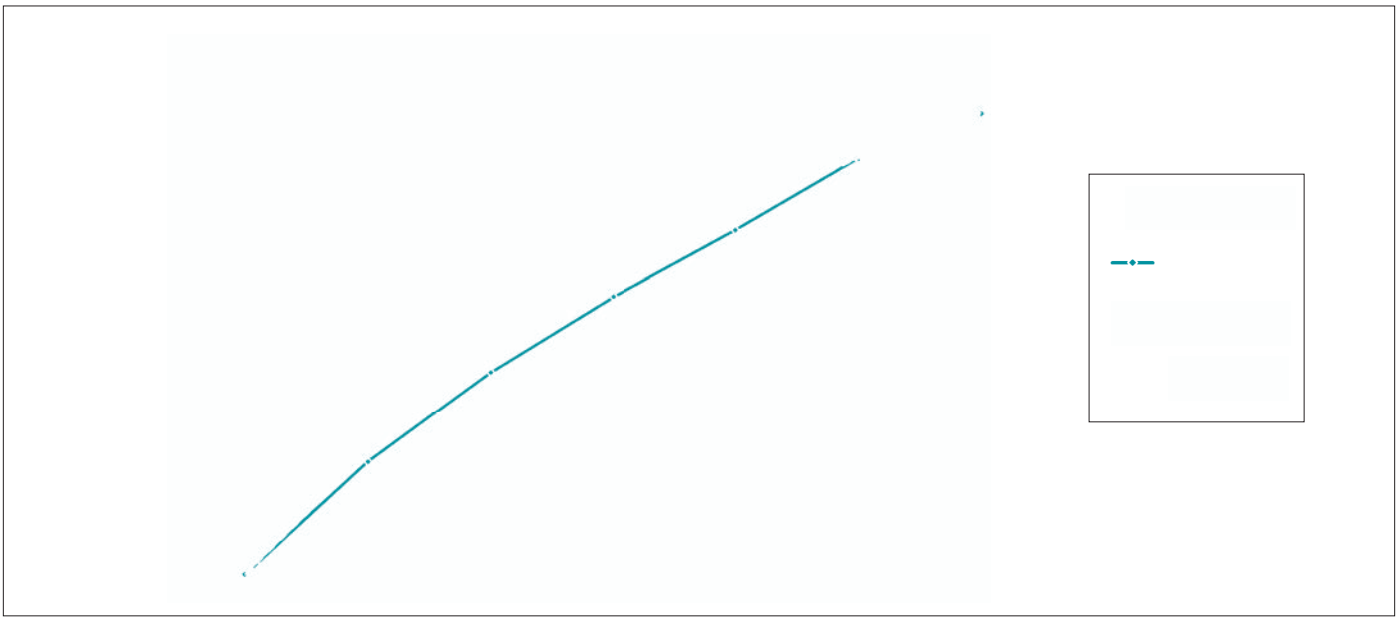


Figure 4
Liability With Gradual Merging of Early Experience



ence to vary in the opposite direction of past experience[3], any assumption change will move consistently with actual experience. (Hence, my assertion that the traditional approach is a statistical extreme.)

An extrapolated approach moves toward the mean of the distribution. In moving toward a mean, we expect to reduce the magnitude of the later assumption change but increase the likelihood of having to adjust in the opposite direction.

Figures 4 and 5 illustrate the same term insurance product, but with adverse early experience gradually merging with expected ultimate experience. Again, the assumption is changed in year five to match the actual experience.

This time, the ideal reserve is slightly below expected since a larger portion of the premium funds early claims. The retrospective reserve is still significantly lower and requires a significant catch up to align with ideal when the assumption is changed in year five. The extrapolated reserve again stays close to expected until the assumption change.

As before, retrospective shows its tendency to understate the reserve when actual claims are higher than expected. In contrast, extrapolated slightly overstates the reserve relative to ideal.

In Figure 5, early claims exceed expected by a larger proportion than the lifetime excess. While retrospective again defers a substantial portion of the excess claim cost, extrapolated passes the full cost of each excess to earnings. When the assumption is changed in year five, retrospective requires a large adjustment to reverse most (but not all) of the deferred excess while extrapolated requires a small positive adjustment. In this case, the new assumption is less severe than the extrapolated adjustment.

In practice, we won't know at the time of unlocking whether we're dealing with a permanent or temporary deviation from the original assumption. Considering credibility, we might prefer an assumption that does not require a large change in the reserve. This will be much easier if we haven't deferred a large portion of the cost of past variances.

The examples have so far been limited to situations where experience deviates from expected right from the start and the typical retrospective approach spreads most of the excess cost over future accruals. Reversal of such deferral often dominates the unlocking adjustment, making for an especially stark contrast between reported earnings, earnings at the time of change and (sometimes) earnings after the change.

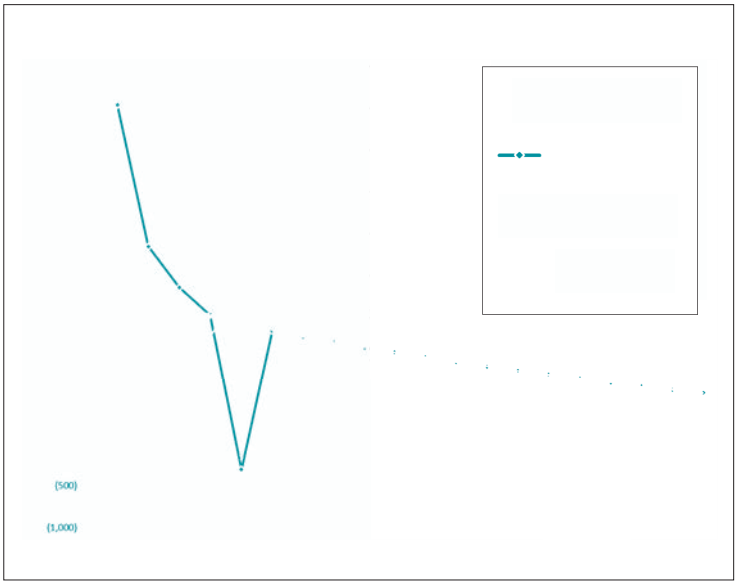
The next example, in Figure 6, returns to the whole life product illustrated in Part 1 of this series of articles.[4] In this example, experience begins to deviate from expected after five years and the divergence is so slow that it takes 10 more years to credibly develop an alternative assumption.

Before the assumption change, retrospective matches more than 80 percent of accumulated claim variances to revenue before the change. Reversal of the deferred 20 percent is small in proportion to the change in projected benefits and we see little difference between extrapolated and retrospective unlocking.

ACTUARIAL STANDARDS OF PRACTICE

I said earlier that any modification must comply with applicable standards. The American Academy of Actuaries' "Applicability Guidelines for Actuarial Standards of Practice" list several ASOPs that might apply in determining the reserve assumptions. Among them, ASOPs 10 and 25 are both relevant to this exercise, as will be the coming standard mentioned earlier on setting assumptions.

Figure 5
Earnings With Gradual Merging of Early Experience



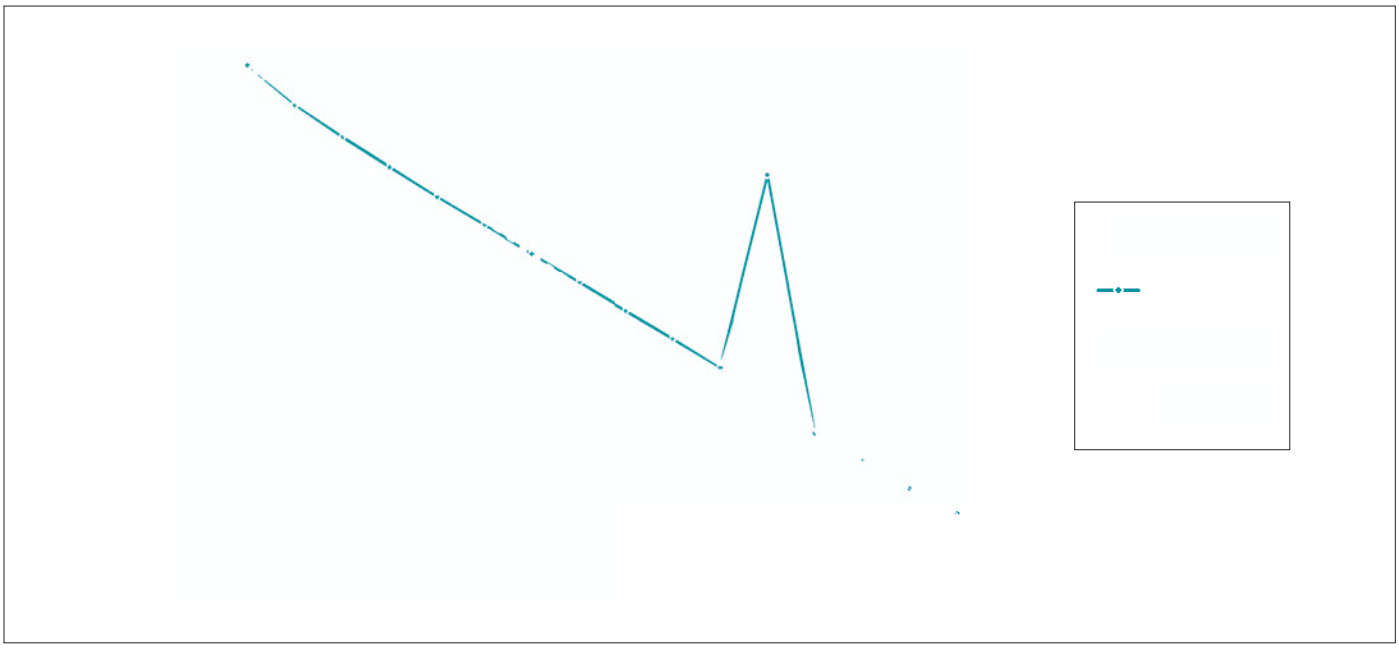
ASOP 10, Methods and Assumptions for Use in Life Insurance Company Financial Statements Prepared in Accordance with U.S. GAAP

ASOP 10's section 3.3 (Best Estimate Assumptions) says that the actuary "should consider the company's actual recent experience data, if, in the actuary's judgment, it is relevant and credible."

Since GAAP requires that actual experience be included in the reserve calculation, actual experience is unquestionably relevant to this GAAP reserve in a way not shared by other valuation methods. (See "Other Situations Using Current Assumptions" section) We must wonder, however, just how credible a simple extrapolation from actual experience might be. But we must also consider that making no adjustment implies zero credibility. Can we really say that zero credibility is appropriate, and remains so as experience accumulates?

My suggested formula includes two factors that help to account for credibility. There is an explicit, time-dependent significance multiplier. And the choice of basis can contain an implicit element of credibility by deliberately choosing a basis that shrinks throughout the projection. Keep in mind that these are not explicit credibility measures, but they are practical tools to help account for credibility.

Figure 6
Whole Life Earnings



In Figures 1–6, I used a flat 100 percent significance factor and a basis that, because of lapses, declines steadily throughout the projection. Figure 7 combines Figure 5's experience with a significance factor that grades to 100 percent over four years.

This highlights a danger of being too cautious with this factor. A low non-zero factor still defers a substantial portion of the cost of early variances, but that deferral is gradually reversed as the factor grades up and experience continues to deviate consistently from assumed. Though this would still reduce distortion of the balance sheet, it might be difficult to explain earnings.

If the selected basis declines significantly in the projection, then a rapid rise of the significance factor to 100 percent seems appropriate and desirable. If the basis is more stable (or increasing), then a longer grading might be appropriate.

ASOP 25, CREDIBILITY PROCEDURES

In the context of ASOP 25, the combination of an adjustment basis and a significance factor is a credibility procedure. We must carefully consider the ASOP's requirements around credibility procedures when deciding on parameters for the extrapolation formula.

Keep in mind, however, that a 100 percent significance factor is not synonymous with assigning 100 percent credibility to actual experience. With a suitable basis, the existing assumption still dominates projected claims.

OTHER SITUATIONS USING CURRENT ASSUMPTIONS

As Figures 1 and 4 help to highlight, if the retrospective method is applied without any adjustment to projected cash flows, it has a tendency to underestimate or overestimate the reserve when experience is inconsistent with the valuation assumption.

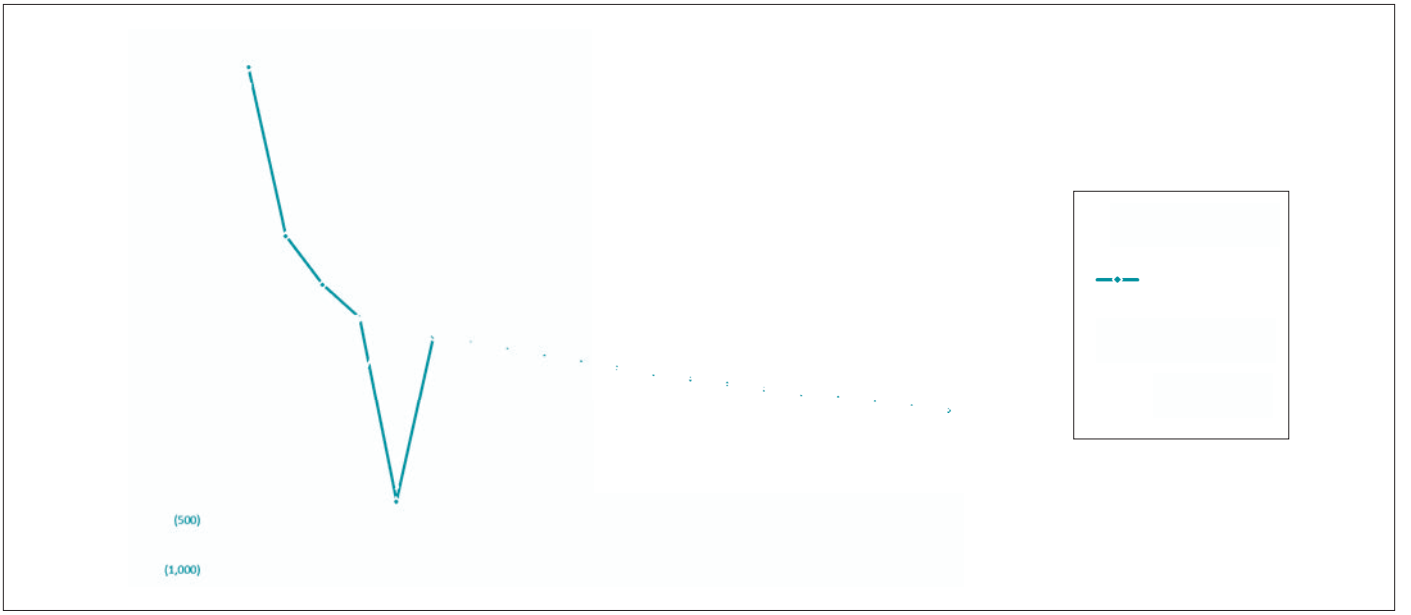
This makes the adjustment important to the GAAP benefit reserve in a way that doesn't matter to other reserving requirements. In GAAP loss recognition and in statutory cash flow testing, for example, adverse claims today do not reduce the gross premium reserve or the amount of assets needed to fund future benefits.

Still, best estimate is best estimate and it might be inappropriate to adjust a best estimate projection for one purpose and ignore the adjustment for another. To reconcile the conflicting concerns, it can help to recognize a dual purpose of the significance factor—to account for the credibility of actual experience and to counteract the retrospective method's tendency to over or under estimate the reserve. Without the latter concern, we can justify a lower significance factor for situations where there is no such tendency.

OTHER ASSUMPTIONS

My testing has been limited to traditional life insurance, where benefits are fixed by contract terms and a claim is a one-time event. Further research will be needed to determine whether or how this technique might work for claim costs of contracts with different characteristics.

Figure 7
Significance Factor Grades to 100 Percent Over Four Years



FASB's proposed changes link interest assumptions (valuation discount rate) for traditional contracts to observable market rates, eliminating actuarial judgment except for the initial determination of appropriate rates to observe.

There is still some ambiguity in what expenses can or should be included in the reserve calculations. Whatever expenses might be included, FASB decided in August to permit lock-in of expense assumptions. This will be a company-wide election; each reporting entity will decide, as a matter of accounting policy, whether to lock-in expense assumptions or keep them current. For any company that chooses the locked-in approach, actual expenses will be irrelevant except to inform assumptions for new cohorts.

Lapse or surrender rates are the only other assumption significant to traditional contract valuation. Unlike deaths, lapses and surrenders typically have a greater effect on subsequent cash flows than on immediate cash flows. Even with cash surrender benefits, the effect of surrender variances on projected cash flows is likely to be at least as significant as the current variance from expected surrender benefits. We'll look at lapses and surrenders in Part 3 of this series. ■

Steve Malerich, FSA, MAAA, is a director at AIG. He can be reached at *steven.malerich@aig.com*.

ENDNOTES

1 In accounting language, this is the "liability for future policy benefits." This is also called the "active life reserve," a distinction that is especially important to contracts such as guaranteed renewable disability income and long-term care insurance for which a separate "disabled life reserve" is established upon inception of a claim.

2 FASB does not insist that actual experience be included immediately as it occurs. Rather, they expect us to exercise judgment in determining whether experience warrants immediate update. At the latest, however, we must incorporate actual experience into the calculation during the annual assumption review process.

3 As an example, consider the early to mid-1990s after AIDS emerged as a serious concern. Actuarial estimates of the AIDS cost on existing life insurance contracts peaked in the early 1990s. By the mid-1990s, experience was proving to be less dire than anticipated. Attributing the improvement to new treatments that delayed but didn't prevent death, we changed the slope of expected mortality for AIDS exposure, thinking that patients would live longer (reducing near-term mortality) but remain in the insured pool (increasing medium-term mortality).

4 For this article, I refined the projections to more realistically reflect quarterly patterns. As a result, Figure 6 is different from Part 1's Chart 3 despite using the same product and the same assumptions.

IFRS 17 Risk Adjustment Confidence Level Disclosure

By Leonard Reback

Under IFRS 17, the new insurance contracts standard under International Financial Reporting Standards (IFRS) which goes into effect in 2021, one element of the reserve for long-duration insurance contracts is a risk adjustment for non-financial risk. This risk adjustment reflects "the compensation that the entity requires for bearing the uncertainty about the amount and timing of cash flows that [arise] from non-financial risk."[1] IFRS 17 does not specify a particular method or technique for calculating the risk adjustment. But if an entity uses a technique other than a confidence level, the entity is required to disclose the "confidence level corresponding to the results of the technique."[2]

This required confidence level disclosure has caused some consternation among actuaries implementing IFRS 17. For many long-duration contracts, techniques other than confidence levels are typically used. For example, Solvency II liability calculations incorporate a risk adjustment, but this risk adjustment is calculated using a cost of capital technique. Many companies also use cost of capital techniques for risk management purposes.

It is not immediately obvious how to convert a risk adjustment calculated using a cost of capital technique, or some other technique such as a cumulative tail expectation, into a confidence level. If the best estimate cash flows were calculated over stochastic scenarios one might be tempted to map the present value of best estimate cash flows plus risk adjustment against the distribution of present values over the stochastic scenarios in order to estimate the confidence level. However, this has a serious flaw. The stochastic scenarios would typically be drawn over financial scenarios, such as interest rates or equity returns. The risk adjustment confidence level we need to calculate is specifically for non-financial risks. So the distribution of stochastic scenarios generated for the purpose of calculating best estimate cash flows may not be relevant to the risk adjustment for non-financial risk. Also, for many contracts it may not even be necessary to generate stochastic scenarios.

CONFIDENCE LEVEL FOR COST OF CAPITAL RISK ADJUSTMENT

If the risk adjustment for non-financial risk is calculated using a cost of capital technique, it may be possible to convert the risk adjustment to a confidence level by applying some fairly reasonable assumptions. Under a cost of capital technique, a low probability adverse scenario is selected as the level of capital that needs to be held. The adverse scenario would typically reflect adverse events over a relatively short time horizon, say one year, which impact all future cash flows in the contract. Different adverse scenario levels may apply, say a 99th percentile event or a 99.5 percentile event or a 97.5 percentile event. The level of required capital is projected over time, and assumed to incur a certain cost. Then the cost of capital projected over time is discounted back to the valuation date in order to determine the risk adjustment.

Let's assume that the risk adjustment was calculated assuming capital was required to be held for a 99th percentile event. If we assume that the present value of cash flows is normally distributed, a 99th percentile event corresponds to an event 2.33 standard deviations from the mean (i.e., the z-score corresponding to a 99th percentile event is 2.33). And under a normal distribution, the best estimate corresponds to the mean itself. So under a normal distribution assumption we have two data points (i.e., the best estimate and the level for which we assume required capital needs to be held) from which we can estimate the mean and standard deviation of the distribution of cash flows under non-financial risk. Using this mean and standard deviation we can calculate the confidence level corresponding to the risk adjustment.

EXAMPLE

Assume we have the following:

- Present value of best estimate cash flows: $100,000;
- present value of cash flows at 99th percentile, used to determine required capital: $150,000; and
- calculated risk adjustment based on these parameters: $20,000.

Under a normal distribution assumption, the mean of the distribution is $100,000. The standard deviation can be determined as:

(150,000 – 100,000)/2.33 = $21,459, where 2.33 is the z-score corresponding to a 99th percentile.[3]

So the present value of cash flows for this contract is assumed to be normally distributed with a mean of $100,000 and a standard deviation of $21,459.

To get the confidence interval associated with a $20,000 risk adjustment we need to find the z-score associated with the present value of best estimate cash flows plus the risk adjustment, or $100,000 + $20,000 = $120,000.

The z-score is calculated as:

(120,000 – 100,000) / 21,459 = 0.93.

So the calculated risk adjustment is 0.93 standard deviations from the mean. Checking a standard normal distribution table tells us that a z-score of 0.93 corresponds to an 82nd percentile. So we can estimate that the calculated risk adjustment corresponds to an 82 percent confidence level.

POSSIBLE OBJECTIONS

There are a number of objections that can be raised against this approach. One possible objection is the fact that the percentiles used to calibrate the normal distribution are somewhat subjective. But this is a function of the risk adjustment itself. To the extent that this subjectivity is appropriate for the risk adjustment itself, it should not be inappropriate for a disclosure about that risk adjustment.

Another possible objection is the time horizon. This approach considers the impact of experience deviations over a shorter period than the life of a long-duration contract, although it does account for the resulting cash flow changes over the entire life of the contract. It could be argued that it would be more appropriate to consider deviations over the entire life of the contract. On the other hand, the most typical applications of confidence level risk adjustment calculations are for short-duration contracts, in which experience deviations would by definition only occur over a relatively short time horizon. Also, IFRS 17 does not specify a term over which the confidence level needs to be calculated. This implies that an approach such as the one proposed, in which deviations over a period shorter than the life of the contract are considered, can be appropriate, presumably with disclosures to describe how the calculation was performed.

Another possible objection is the assumption that a normal distribution is appropriate for calibrating the risk margin confidence interval. Indeed there is no guarantee that the normal distribution will fit the actual pattern of deviations. But to the extent that the performance of the group of contracts is subject to a large number of not too dependent events, a normal distribution is probably a reasonable assumption, and probably no less reasonable than common uses of normal distributions in IFRS 17 calculations, such as projecting economic scenarios.

That said, if one believes that the normal distribution is not a reasonable assumption, there is a possible modification. Of course, if one can specify an alternative distribution for the present value of cash flows from the group of contracts then the proposed approach can be applied to the alternative distribution. If an explicit distribution cannot be specified, one might be able to estimate a few percentile events in addition to the one used in the risk adjustment calculation. For example, if the risk adjustment was based on a 99th percentile, one might also be able to specify a 90th percentile event and a 75th percentile event. With several such data points including the best estimate, assumed to be the 50th percentile event, one can fit a curve using a method such as a cubic spline. Then the confidence interval can be interpolated based on the fit curve. ■

Leonard J. Reback, FSA, MAAA, is vice president and actuary at Metropolitan Life Insurance Company in Bridgewater, New Jersey. He can be reached at *lreback@metlife.com.*

ENDNOTES

1 IFRS 17, paragraph 37

2 IFRS 17, paragraph 119

3 If the required capital was determined at a different level, the z-score would need to correspond to the level used. If 97.5 percent was used to determine required capital then we would use 1.96 as the z-score.

Synopsis of Issue Brief

Claim Reserve Assumption Basis for Long-Term Disability Policies: Use of Date of Incurral Versus Date of Issue

By the Tax Work Group of the American Academy of Actuaries, Barbara Gold, Chairperson

During the past few years, the Tax Work Group of the American Academy of Actuaries (the Academy) has addressed the question of when interest rate assumptions might be determined in the calculation of tax reserves for Long-Term Disability (LTD) claims incurred. The result of this analysis is an issue brief, recently published by the Academy, titled "Claim Reserve Assumption Basis for Long-Term Disability Policies: Use of Date of Incurral Versus Date of Issue."

The issue brief describes the products and reserves under consideration, explores the historical context of the statutory and tax rules, and analyzes the actuarial considerations relevant to the choice of an appropriate interest rate. It discusses the potential rationale for determining the incurred claim reserve discount rate either as of the date of claim incurral or as of the date the policy was issued. In the issue brief, the Tax Work Group concludes that setting the discount rate using the incurral date, rather than the issue date, is an actuarially sound basis for the valuation of group and individual LTD tax claim reserves, and it is also consistent with statutory accounting rules. The issue brief may be accessed at *www.actuary.org/files/publications/Acad_taxwg_brief_LTD_072817.pdf.* ■

Barbara Gold, FSA, MAAA, is chairperson of the Tax Work Group of the Life Practice Council of the American Academy of Actuaries and may be reached at *brg10@optonline.net.*

Financial Reporting Research Update

By Jim Hawke and Ronora Stryker

Research is a primary mission of the Financial Reporting Section and a significant use of our section dues revenue. Here is an update, as of September 2017, on projects in process and those recently completed.

CURRENTLY IN PROCESS …

The 2015 research report on earnings emergence under multiple financial reporting bases is being expanded to examine an additional product and upcoming accounting changes. The original report looked at deferred annuities and term life insurance under U.S. SAP, US GAAP, IFRS, CALM and market-consistent balance sheet approaches. The expanded report will add universal life and make updates for principle-based U.S. statutory reserves, targeted US GAAP changes, and the new IFRS for insurance products. Work on this project is in the early stage.

Waiver of premium in a principle-based environment—the Financial Reporting Section is co-sponsoring this review of pricing, reserving and experience with the Product Development Section. This project is in the middle stage.

Simplified methods for principle-based reserve calculations—this project is in the middle stage. We anticipate completion by the end of the year.

COMPLETED IN 2017 …

PBA change attribution analysis—this project studies the drivers of change in principle-based reserves. This project was published in August. A Society of Actuaries (SOA) webcast was also done at that time and the report is summarized in this issue of the newsletter. *https://www.soa.org/Research-Reports/2017/2017-understand-vm-20-results*

Modern deterministic scenarios—a review of possible deterministic scenario sets which could be useful to company management, regulators and rating agencies under PBA. This project was published in September and the report is summarized in this issue of the newsletter. *https://www.soa.org/Research-Reports/2017/2017-modern-deterministic-scenarios*

"Actuarial Model Governance: A Survey of Actuarial Modeling Governance and the Industry Evolution Report"—an update to the original 2012 report co-sponsored by the Financial Reporting and Modeling Sections. *https://www.soa.org/Research-Reports/2017/2017-01-actuarial-model-governance*

COMPLETED IN 2016 …

Nested modeling—a company survey on the use of nested stochastic modeling and an analysis of ways to reduce run time and improve the efficiency of nested simulations: *https://www.soa.org/Research-Reports/2016/nested-stochastic-modeling*

"PBA Implementation Guide" update and PBA beginning tales: *https://www.soa.org/Research/Research-Projects/Life-Insurance/research-2013-pba-implementation-guide.aspx*

Retention management: *https://www.soa.org/Research/Research-Projects/Life-Insurance/research-quantitative-retention.aspx*

Predictive analytics call for papers: *https://www.soa.org/News-and-Publications/Publications/Essays/2016-predictive-analytics.aspx*

COMPLETED IN 2015 …

Transition from low to high interest rates: *http://www.soa.org/Research/Research-Projects/Life-Insurance/research-2015-rising-interest-rate.aspx*

Multiple measurement bases: *http://www.soa.org/Research/Research-Projects/Life-Insurance/2015-earnings-emergence.aspx*

VBT/CSO impact study: *http://www.soa.org/Research/Research-Projects/Life-Insurance/research-cso-impact-study.aspx*

Tail risk/correlation of risk primer: *http://www.soa.org/Research/Research-Projects/Life-Insurance/2015-extreme-events-for-insurers.aspx*

Many of these projects were co-sponsored with other sections and organizations. Please visit the SOA research website for more information, or contact Jim Hawke or Ronora Stryker. ■

Jim Hawke, FSA, MAAA, is the immediate past chairperson of the Financial Reporting Section. He can be contacted at *jamesshawke@gmail.com.*

Ronora Stryker, ASA, MAAA, is a research actuary for the Society of Actuaries. She can be contacted at *rstryker@soa.org.*

SOCIETY OF ACTUARIES®

475 N. Martingale Road, Suite 600
Schaumburg, Illinois 60173
p: 847.706.3500 f: 847.706.3599
w: www.soa.org

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