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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/>