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Introducing the Representative Scenarios Method (RSM)-Part 1

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This article is the first of two articles to address the representative scenarios method (RSM). Part 1 focuses on the motivation and goals for this new reserve methodology, together with a description of how the methodology works and what key information can be derived from the analysis. Part 2 will focus on the field tests that have been undertaken to validate the accuracy and practicality of this methodology. Part 2 is scheduled to be published in the March 2016 edition of *Small Talk*.

BACKGROUND

A few years ago, the original idea of PBR seemed promising: Embed risk analysis in reserve calculations to "right-size" reserves through a process similar to cash flow testing that allows companies to reflect their unique experience in the reserve calculations. Over time, this concept morphed into a much more complex and daunting set of requirements in VM-20 for life insurance—especially the assumption-setting process and the stochastic valuation calculations. Resources will be required to implement such requirements, and while resources are short everywhere, they are especially short within smaller companies. Also, many smaller companies have stayed away from the product designs that led to the need for PBR in the first place.

It is with these lower-risk asset and liability profiles in mind that the stochastic exclusion test (SET) was included in VM-20. The basic idea was "less risk-less work." The test involves modeling a handful of scenarios to demonstrate that full stochastic valuation is of little value because the risks at which it is directed are small. The stochastic exclusion test has now gone through field testing and has proven to be successful in sorting lower risk asset portfolios and liability products from higher risk portfolios and products for which stochastic modeling may be needed to properly value the risks.

It was the success of the SET that started the thought process that led to the Representative Scenarios Method (RSM). Ideally, actuaries would be able to stochastically model all the key risks in a block of business, but this isn't practical from a run-time standpoint and would be very difficult to audit for the company, its independent auditors and for regulatory reviewers. But what if, like the SET, a small number of specially constructed scenarios could measure not only the interest rate/market risk in a product but also apply multiple-scenario techniques to risks besides investment returns in order to better evaluate the total risk profile of a product and properly reflect those risks in the valuation?

So, what is RSM? First of all, it is a valuation methodology that was developed in response to the NAIC Life Actuarial Task Force's (LATF's) charge to the American Academy of Actuaries (Academy) Annuity Reserve Work Group (ARWG) to develop PBR for nonvariable annuities. In connection with this charge, ARWG was to prepare a draft of VM-22, the section of the PBR valuation manual that would apply to nonvariable annuities. RSM was developed in response to the challenge of the ARWG chair to not simply cut and paste VM-20 requirements, but rather "advance the ball" in developing the best way possible to calculate PBR reserves. In this way, RSM is the valuation method currently used for the modeled reserve in drafting VM-22 for nonvariable annuities.

Second, RSM approximates the results that would be derived from full stochastic modeling of all key risks associated with a block of business. However, it addresses the practical issues of run time and auditability by being based on a limited number of carefully-constructed scenarios for each of the key risks associated with a block of business. Being a multirisk approach, RSM has the potential to serve as a valuation methodology that could be used for any long-tailed liabilities, including life insurance, variable annuities, and long-term care, as well as nonvariable annuities. In Part 2 of this article, we will discuss the results of field tests where RSM has been used to calculate modeled reserves for these different product types.

Third, RSM is a methodology that requires the identification and analysis of key risks, both the company's current anticipated liability assumptions regarding those risks, plus the distribution around the anticipated experience. For asset assumptions reflecting the environment in which all companies operate, there will likely be provisions in VM-22 to ensure consistency in the modeling of those assumptions over which the company has little or no control, such as asset default rates and credit spreads. The basic paradigm is to calculate a central estimate reserve based on current anticipated experience assumptions and statistical variations around those assumptions, together with the calculation of an aggregate margin. The modeled reserve equals the sum of the current estimate reserve and the aggregate margin.

HOW ARE THE SCENARIOS DEVELOPED?

RSM starts with development of a short list of risk drivers specific to the contracts being valued. RSM is built on the idea that each risk driver has a statistical distribution around its anticipated value, and the actuary (perhaps with guidance) can estimate percentile points on that distribution for the contracts being valued. For example, the distribution of mortality cost might be defined as a percentage of a pricing table, with the 50th percentile of the distribution corresponding to 100 percent of the table. For the block of business being valued, the 80th percentile for one year's experience might be at 110 percent of the table, and the 99th percentile might be at 130 percent of the table.

The scenario generator used in RSM creates a small number of scenarios for each risk driver. One is just the anticipated experience scenario. Each of the other scenarios corresponds to a path of that risk driver's actual experience over time. The experience for all other risk drivers is left at the anticipated level, so each scenario involves experience different from anticipated for only one risk driver.

Each generated scenario is intended to approximate experience over time at a specific percentile level for a specific risk driver. When generating a path over time at a percentile level, one must reflect the idea that a scenario where mortality each year is at the 80th percentile level is, in total over a long period of time, at a percentile level much higher than 80. This is analogous to the idea that flipping a coin and getting five heads in a row is much less likely than flipping it once and getting heads. The scenario generator uses the theory of random walks to adjust for this effect. This is the same theory that was used to develop the scenarios in the stochastic exclusion test.

RSM is intended to include all significant risk drivers, not just investment returns. In order to run RSM scenarios, a cash flow testing model may need to be modified so that a mortality fluctuation specified in the scenario file (say, as a percent of tabular that varies by year) can be simulated within the model.

The whole set of RSM scenarios can then consist of perhaps five scenarios for each risk driver; one at each of the following percentile levels: 99 percent, 84 percent, 50 percent, 16 percent, and 1 percent. The RSM reserve calculation process involves calculating the present value of cash flows for each scenario for each risk driver, and then using those results in a prescribed manner.

WHAT STEPS ARE INVOLVED IN CALCULATING RSM RESERVES?

The six steps involved in deriving a reserve using the RSM are summarized as follows:

Step 1:
Identify blocks of business with substantially similar risks. Identify the block's key risk drivers (KRDs), which are those assumptions whose variability can significantly affect the cost of fulfilling the contract.

Step 2:
Determine the distribution of assumption values for each KRD.

Step 3:
Generate scenarios for each KRD within its distribution. In the field tests of different products, the five scenarios used for each KRD were the median (a.k.a. anticipated experience), +/-1 standard deviation and +/- 3 standard deviations. The total number of scenarios necessary for the determination of the RSM reserve is equal to 1 + (number of KRDs)*(number of scenarios per KRD – 1).

Step 4:
Project asset and liability cash flows. In this step, each scenario is assigned a scenario reserve. The scenario reserve is the level of starting assets required to satisfy all liability cash flows until the contracts expire. This may be estimated as the present value of projected cash flows discounted at the path of book yields, as can be done for the VM-20 deterministic reserve.

Step 5:
Calculate a central estimate as a weighted average of the scenario reserves. Within each KRD, the scenarios are assigned probability weights. Each KRD is also assigned a weight. Combining the scenario reserves using these weights determines the central estimate of the reserve prior to margins. Note that the central estimate is not the anticipated scenario; it is a weighted average of all scenarios.

Step 6:
Add an aggregate margin to the central estimate reserve. Two alternate approaches are proposed for calculating the aggregate margin—the cost of capital approach and the percentile approach.

- The cost of capital approach uses the extreme scenarios for each KRD to calculate a target capital amount as of the valuation date. This target capital amount is then projected forward using values produced as part of the anticipated experience scenario. These target capital amounts are discounted back to the valuation date and a cost of capital rate is applied to produce the value for the cost of capital margin. At a high level, the reserve with a cost of capital margin is similar to the concept of a transfer value, wherein the margin represents the compensation that an arms-length investor would require to accept the risks associated with the block of business.

- The percentile approach is more like the CTE 70 methodology in VM-20, VM-21 and Actuarial Guideline 43. The goal of the percentile aggregate margin is to approximate a percentile level in the distribution of the present value of future cash flows across all scenarios. Since the RSM scenarios are each specific to one

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risk driver, one must aggregate results across risk drivers to approximate this distribution and estimate the desired percentile level.

Part 2 will provide case studies of the application of RSM to nonvariable annuities, term life insurance, universal life with secondary guarantees, variable annuities with guaranteed lifetime withdrawal benefits, and long-term care insurance, including the calculations of the aggregate margins.

POTENTIAL USES OF RSM

The initial goal for RSM is to provide a simple alternate approach to calculating principle-based statutory reserves. In this context, RSM provides the advantages of reducing the number of scenarios required and thereby making it easier to study each scenario in detail for auditing and for the purpose of making judgments about the assumptions in use and the severity of the stresses being tested.

There is potential for the multiscenario analysis carried out for RSM to be used in a much broader context. If field tests show that RSM is suitable for essentially all long-tail lines of insurance, then it could become the common analytical structure to calculate both reserves and required capital for all long-tail lines of business, embedding risk analysis that reflects the risk profiles of each product group and each company.

As such, RSM could be used for asset adequacy analysis. It could also serve as a PBR methodology for not only VM-22, but also as a valid approximation method as provided for in AG 43, VM-20, VM-21, and the future valuation manual sections for long-term care and long-term disability. Each of these current valuation manual sections provides for the use of approximation methods, as long as these methods do not produce systematically lower reserves than the specified PBR methodology.

One can imagine the same analytical structure being applied to both new business and existing business. This could help unify cash flow testing and ORSA analyses. Going further, one could use this approach to estimate the embedded value of each block of business and the total company, and help explain changes in that value over time.

Many smaller companies use a multiple of Life Risk-Based Capital as the target capital used in pricing exercises. Using such an estimate is not only theoretically unsound (there is no inherent meaning in a multiple of RBC other than it is more conservative), but also requires a difficult allocation of RBC to particular products in a top-down approach. As noted before, the more extreme RSM scenarios can be used to calculate target capital for each product type using a bottom-up approach that directly flows from the risk profile of the product group. This measure of target capital could facilitate the allocation of capital to each product group for pricing and to calculate the amount of free surplus that the company has available for its business plan.

THE NEED FOR TESTING

Here are some of the questions and issues that need resolution:

1. RSM starts from the actuary's estimate of anticipated experience. There are no implicit margins. This means some generally accepted rules regarding statutory reserves would be allowed to be modified. For example:
   a. A trend of mortality improvement may be recognized for life insurance reserves.
   b. Reserves, especially central estimates, may be negative in some cases. This issue may be addressed by looking at the total modeled reserve and not the central estimate reserve by itself.
2. Does the small number of scenarios under RSM provide a sufficiently accurate estimate of the results of full stochastic modeling using a large number of scenarios?
3. Are risk drivers for all products expressible in the form of distributions of assumption values that can be used in a cash flow testing model?
4. Can guidance in the development of assumptions and distributions be written to satisfy the needs of actuaries and provide regulators assurance against abuse? What limitations and/or safe harbors will regulators want? To what degree will such limitations or safe harbors amount to implicit margins?
5. Will regulators be comfortable with an "aggregate margin," and if so which form (percentile or cost of capital)?
6. Can the use of a separately calculated margin avoid raising tax concerns through appropriate changes in terminology (e.g. provision for the cost of bearing risk)?

Part 2 of this article will provide results of field testing being done to address some of these issues. ■

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