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Asset Modeling Challenges for VM-20 Projections

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With the first year of the NAIC VM-20 transition period under the U.S. life insurance industry's belt, there has been significant focus on overcoming modeling challenges for principle-based reserve (PBR) valuation. In light of companies' efforts to turn the page from implementing point-in-time PBR reserves for statutory reporting to projecting PBR reserves at future dates, this article aims to unmask the technical challenges around asset modeling for projecting reserves. In the following sections, we will not only cover technical issues related to nested structures and inner and outer loops, but also profile challenges around projected starting assets, future hedges, negative reserves and modeling simplifications.

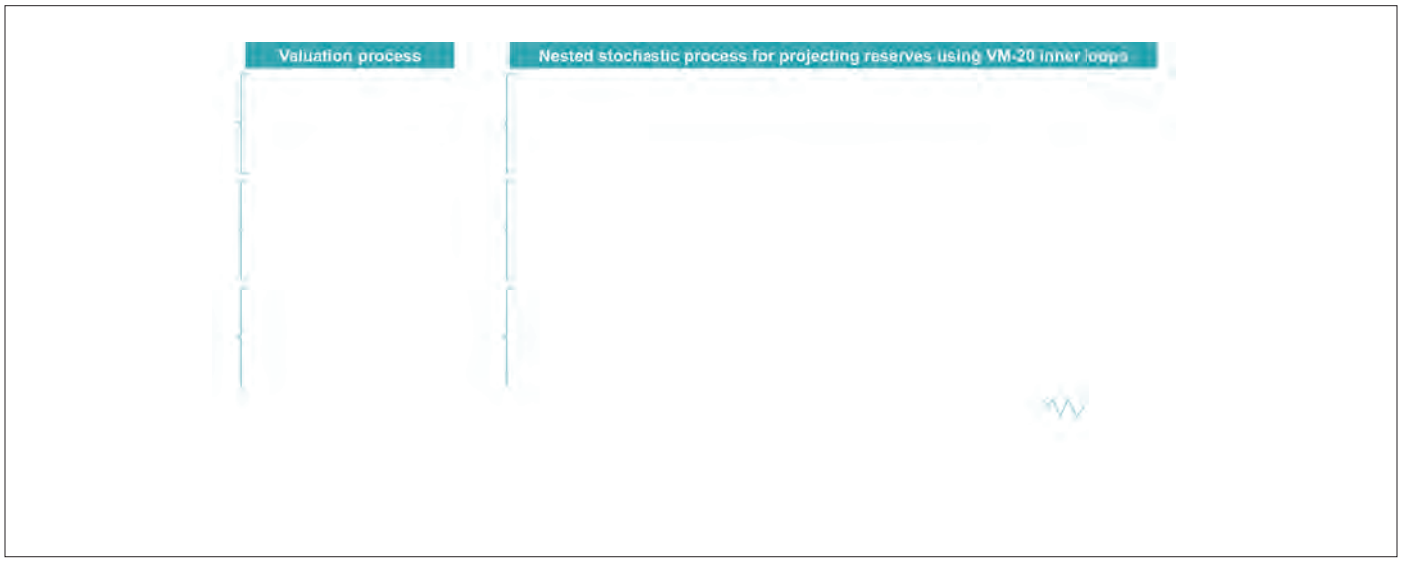
FUTURE RESERVE ASSUMPTIONS: INNER VS. OUTER LOOPS

A key challenge when projecting VM-20 deterministic reserves (DR) and stochastic reserves (SR) past the valuation date is that we do not know what prescribed scenarios and statutory valuation asset assumptions will be at future points in time. VM-20 prescribes these assumptions for calculating reserves at the valuation date, but not beyond.

Let's first consider the situation of projecting VM-20 cash flows for a time zero valuation. Starting Treasury rates and spreads are based on market values observed on the valuation date, and ultimate (baseline) spreads and default rates are based on historical market averages. Starting default rates are determined by adjusting baseline default rates for the difference between starting and ultimate spreads, with a final adjustment if the preliminary net spread for the entire portfolio exceeds a specified threshold.[1] VM-20 prescribes that initial spreads and default rates grade to ultimate values by the beginning of projection year four. Finally, future Treasury rates are generated from starting Treasury rates using the prescribed generator.[2]

Now let's consider the situation when projecting future VM-20 reserves for pricing, ALM and other internal forecasting exercises. A general nested stochastic approach to project reserves past the valuation date involves an outer loop projection based on experience assumptions set at company discretion, and sets of inner loop projections for each future valuation date based on valuation assumptions. These inner loop projections not only follow VM-20 requirements, but are also consistent with the market environment dictated by the outer loop on the future valuation date. In addition, each set of future inner loop projections is used to calculate a future VM-20 reserve for the outer loop projection. This concept is illustrated in Figure 1.

Figure 1
Nested Stochastic Approach for Projecting Reserves



How can we determine future valuation asset assumptions for Treasury rates, spreads and default rates that not only follow VM-20 requirements, but are also consistent with the market environment dictated by the outer loop?

An inner loop projection starts with the Treasury rates and spreads assumed by the outer loop at that point in time. The future Treasury rate scenarios can then be generated from the prescribed scenario generator using Treasury rates from the outer loop at that point in time. In addition, because the ultimate spread and baseline default rate assumptions are based on long-term historical market averages, some actuaries may find it reasonable to use the same ultimate spreads and baseline default rates that were prescribed at time-zero for all future projected valuation dates. Alternatively, others may prefer to modify these assumptions to better reflect the economic conditions in the outer loop at that time. Finally, once the baseline default rates for a future valuation date are determined, the corresponding initial default rates can be calculated using the process prescribed for the time zero valuation.

On top of developing processes for determining future valuation asset assumptions, there are also challenges related to embedding those processes within the projection model itself, which determines the assumptions needed in VM-20 reserve projections. For example, models may contain embedded processes for generating future Treasury rate scenarios. But are those processes consistent with the logic contained in the prescribed scenario generator? As another example, let's consider the process to determine starting default rates for future inner loop projections. Depending on the level of rigor desired, the model may need to recalculate each asset's weighted average life, option adjusted spread, and maximum net spread adjustment at each future valuation date.

Finally, cash flow models at many companies make use of external systems to project certain assets. However, there are challenges that must be overcome when using externally projected assets (EPAs) for future inner loop projections.

- If the cash flow model relies on importing EPA files produced by the external system, the volume of data and time spent handling it can be severe. A company can avoid this by using an application programming interface (API) approach, which allows the modeling platform to dynamically call the external system and read-in external asset projections as needed.

- To preserve specific calibrations, some external systems have limited functionality for overriding starting Treasury rates and market values. In such cases, projecting external assets for future inner loops may require starting at the beginning of the outer loop, using outer loop assumptions to project to the start of the inner loop, and using the inner loop assumptions thereafter.

STARTING ASSET COLLAR IMPLICATIONS

VM-20 requires that the aggregate annual statement value of starting assets, after deducting the pre-tax interest maintenance reserve (PIMR) balance, used to model the DR and SR must be at least 98 percent of the final modeled reserve and no greater than the maximum of 102 percent of the final modeled reserve, net premium reserve (NPR) and zero. Since VM-20 only applies to new business, in the early years of PBR valuation, the level of starting assets backing the modeled reserves may be substantially smaller than the actual asset portfolio if the portfolio also supports years of business that are outside the scope of PBR. This issue will recede over time as pre-PBR policies terminate, but initially can have several impacts on the projected asset portfolio used for point-in-time PBR valuations.

A low level of starting assets due to the asset collar leads to a larger portion of the portfolio being made up of future projected purchased assets over time. This affects the future asset mix of the projected PBR portfolio and may cause projected PBR portfolio rates to grade to scenario new money rates faster than the actual portfolio would grade in reality.

This will impact both the DR and SR. Under the gross premium valuation (GPV) method[3], the DR is sensitive to the portfolio rate, or net asset earned rate (NAER), because it is used to discount the DR cash flows. In a low interest rate DR scenario, the projected NAER will fall quickly, leading to a lower discount rate and a higher DR. The DR calculated using the direct iteration method (DIM), in addition to the SR, will also be sensitive to the interest rate environment in each scenario, as the investment income earned will be heavily dependent on new money rates. Furthermore, guardrails on the modeled investment strategy, such as requiring that fixed income reinvestment assets are no more favorable than public non-callable corporate bonds with a credit rating blend of 50 percent A2/A and 50 percent Aa2/AA (VM-20 Section 7.E), may drag down modeled portfolio yields when a large portion of the portfolio is made up of newly purchased assets.

How should a company manage the discrepancy between the projected modeled PBR portfolio and the expected actual portfolio? To produce reasonable projections with the modeled portfolio, a company must ensure that assumptions that rely on the portfolio rate are aligned with the modeled portfolio rates (e.g., crediting rates and competitor rates modeled as spreads off of the portfolio rate).

The starting asset collar requirement creates additional implementation complexities when a company projects future PBR

reserves. At the beginning of each inner loop projection, assets should once again be scaled to meet the starting asset collar requirement. Ideally, a company would project its entire block of business, comprised of PBR and non-PBR business, up to the projected valuation date, then scale assets to within the asset collar before beginning the PBR projection. However, simplifications may be made, such as modeling only the PBR business in the outer loop or not rescaling at the beginning of future inner loops.

MODELING OF DERIVATIVE PROGRAMS

VM-20 requirements for modeling derivative programs, covered in VM-20 Section 7.K, are also complex. They divide derivative programs into three types, each with its own requirements: clearly defined hedging strategies (CDHS), non-CDHS hedging programs, and non-hedging derivative programs. All existing derivative instruments already held to support liabilities on PBR policies must be modeled, but the treatment of future derivative instrument transactions will depend on the type of program into which the transaction falls, which can introduce modeling challenges.

CDHS

A company is required to model future derivative transactions associated with a CDHS. Furthermore, a company is required to calculate an SR for any group of policies for which there is at least one CDHS. An example of this may be an automated hedging program for an Index Universal Life (IUL) product.

Non-CDHS Hedging Programs

In contrast, a company is not permitted to model future hedging transactions that are not associated with a CDHS. Interestingly, VM-20 includes a guidance note mentioning that this requirement was added due to concerns that reserves could be unjustifiably reduced by including a hedging program that is not certain to be executed. However, the guidance note also indicates that excluding these hedging transactions may not be in the spirit of PBR. So while VM-20 requires excluding future non-CDHS hedging programs that decrease VM-20 reserves, it is unclear how to treat those that increase VM-20 reserves.

Non-Hedging Programs

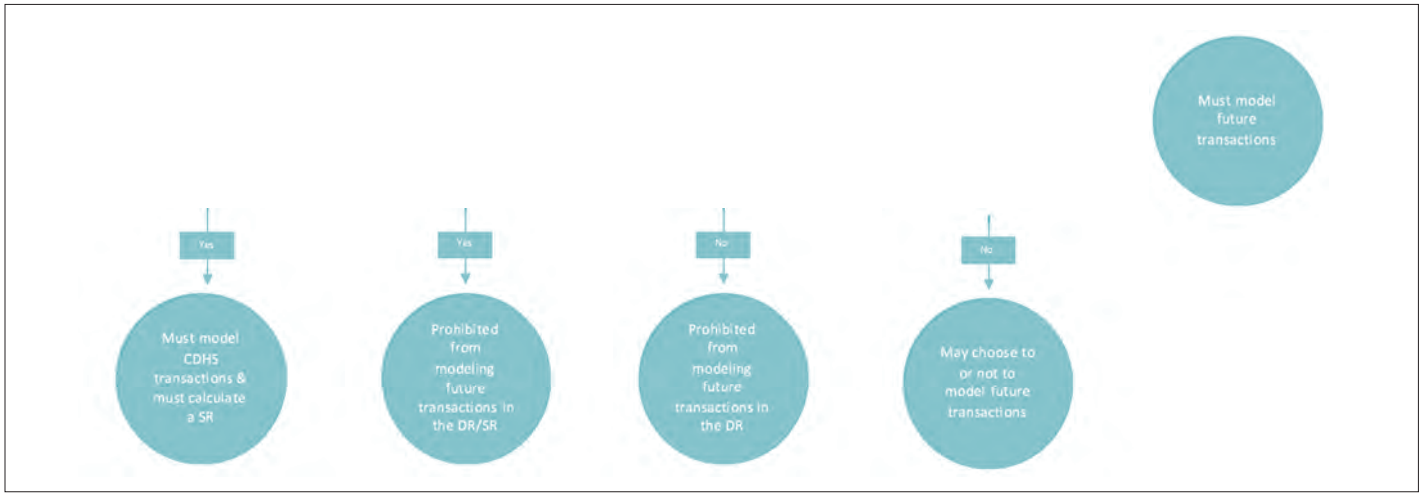
Finally, a company can model non-hedging derivative transactions in certain cases. If a group of policies is excluded from the SR requirements, future non-hedging transactions associated with those policies cannot be modeled for the DR as per VM-20 Section 4.A.5. However, if an SR is calculated and the derivative program is part of the company's risk assessment and evaluation process, future non-hedging transactions must be modeled.

These hedging requirements, summarized in Figure 2, impact a company's implementation of PBR. First, a company must be prepared to model an SR for any group of policies that employs a CDHS, even if it would otherwise be excluded from calculating an SR. As it may take company resources to implement the SR for the first time, valuation actuaries must know in advance if a CDHS will be added to a group of policies. Additionally, as hedging programs that are not part of a CDHS cannot be modeled, modeled reserves may differ from what the actual investment strategy would indicate. However, companies should monitor changes to VM-20 over time, as the restrictions on modeling hedging programs could change as the industry and regulators become more comfortable with PBR.

NEGATIVE ASSET CONSIDERATIONS

As stated, the starting assets must be at least 98 percent of the final modeled reserve and no greater than the maximum of 102

Figure 2
Modeling Future Derivative Programs in VM-20



percent of the final modeled reserve, NPR and zero. So what happens when the final modeled reserve is negative?

In the case of negative modeled reserves, a company can avoid modeling negative starting assets by flooring at zero. However, if the company chooses, starting assets may be negative if no less than 98 percent of the final modeled reserve. But why would a company choose to model negative starting assets? Intuitively, assuming higher starting assets will generate more investment income and lower the SR[4]. However, if the DR prevails, then if new money rates are expected to increase, there may be incentive to grade into new money more quickly at the onset of PBR implementation.

Note that negative modeled reserves may be a common situation. Several analyses, such as the SOA VM-20 Product Development Report[5], show examples of a negative DR for term products in early durations. Even if modeled reserves are negative, the final PBR reserve will always be floored at the NPR, which in turn is floored at the cost of insurance.

There are not only considerations for negative starting assets, but also for negative future assets. Starting assets must either cover the liquidation of benefit and expense payments (DIM) or be set within the required range of the final reserve level (GPV method). In both cases, there are roughly zero assets remaining by the end of the projection. However, in theory, there may be multiple numerical solutions to this constraint. For instance, there may be a numerical solution in which assets become negative before returning to zero. In this situation, as invested assets approach zero, the NAER calculated for the GPV method may artificially inflate as the denominator decreases. This could produce an unreasonable DR level. Companies may avoid this for the GPV method by implementing guardrails, such as ensuring the NAER is never more negative than the borrowing rate or never more positive than a specified yield.

POTENTIAL MODEL SIMPLIFICATION TECHNIQUES

As outlined in this article, there are many complications for projecting future PBR reserves. Since projected reserves are not for reporting purposes, what simplifications can companies use? Below are common approaches:

- Proxy Estimate: Companies can express the DR and SR as percentage factors of the NPR or the gross premium reserve (GPR) using best estimate assumptions. Using the NPR as a proxy may be crude if the NPR reserve pattern varies significantly from modeled reserves. The GPR using best estimate assumptions may serve as a better proxy for modeled reserves, since it represents an "un-margined" DR. If the GPR assumes best estimate assumptions, then there is no split between inner and outer loops, making it easier to project at future points.
- Reduced Scenarios/Policies: Use a subset of the population or, for the SR, a subset of scenarios.
- Reduced Durations: Project reserves at periodic durations, such as every five years, and then interpolate between. This will reduce model run-time.
- Asset Simplifications for Non-Interest-Sensitive Business: For products that are not sensitive to economic risk (for example, short liability duration products such as term), assets may not need to be modeled. Instead, a moderately adverse constant discount rate can be assumed.
- Investment Strategy Guardrail Demonstration: For situations in which the portfolio contains a material amount of callable bonds, the company may consider comparing the average credit quality of a portfolio's fixed income assets to the VM-20 guardrail of 50 percent AA/50 percent A public

Negative modeled reserves may be a common situation.

non-callable guardrail rather than projecting reserves twice to see which is higher.

CONCLUSION

With VM-20 inching closer, companies should feel encouraged to go beyond the day one big picture items, and explore the vast terrain of nitty-gritty details required for PBR projections. While projecting reserves at future valuation dates may not be critical for point-in-time statutory reporting, this capability assists companies in conducting business forecasting, pricing and modeling economic capital in a post-PBR world. ■

The views reflected in this article are the views of the authors and do not necessarily reflect the views of their employers.

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ENDNOTES

1 The process for determining starting default rates on fixed income assets with an NAIC designation is prescribed in VM-20 Section 9.F.1. If an asset does not have a PBR credit rating then prescribed spreads and defaults cannot be determined and its net yield is capped at 104% of the corresponding Treasury rate plus 25 basis points, as prescribed in VM-20 Section 9.F.5.

2 VM-20 Appendix 1 provides details on the prescribed scenario generator, which is available in spreadsheet form on the SOA's website at www.soa.org/tablescalcs-tools/research-scenario/.

3 VM-20 Section 4.B (direct iteration method) describes an approach in which companies may solve for starting assets that result in the liquidation of future benefits and expenses. Section 4.A (gross premium valuation method) also provides an alternative approach of net asset earned rate (in compliance with the starting asset requirement in Section 7.D.2 in VM-20) to discount projected cash flows for the reserve calculation. The two approaches should result in solutions that are close, but may not be equal.

4 The stochastic reserve accumulates starting assets at the projected portfolio rate and then discounts cash flows at 105% of the 1-year treasury, per VM-20 Section 7.H.4, before subtracting the initial starting asset amount. Therefore, the spread of the excess of the portfolio rate over the discount rate on starting assets results in a decrease to stochastic reserves.

5 Keating, Jacqueline. Fedchak, Paul. Rudolph, Karen. Sobel, Uri. Steenman, Andrew. Stone, Rob. Impact of VM-20 on Life Insurance Product Development, Society of Actuaries. Pages 20-21. November 2016. https://www.soa.org/Files/Research/Projects/2016-impact-vm20-life-insurance-product.pdf.