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# Reinsurance Considerations in the Determination of PBR Reserves

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**W**ith the adoption of Valuation Manual 20 (VM-20) on June 10, 2016, principle-based reserves (PBR) will become effective on Jan. 1, 2017 with an optional three year phase-in period.

The reserve credit for reinsurance under PBR is significantly different than the formulaic approach that insurers have become accustomed to and will require them to take a discerning look at their reinsurance arrangements as well as the assumptions used to model reinsurance cash flows.

This article highlights key PBR reinsurance considerations through a case study focused on the reserving impact of alternative reinsurance structures and assumptions.

## BACKGROUND

### Reserves Under PBR

U.S. Statutory reserves under PBR are calculated as the maximum of the following three components, as specified under VM-20:

1. Net Premium Reserve (NPR)
2. Deterministic Reserve (DR)
3. Stochastic Reserve (SR)

Section 8 of VM-20 pertains to the impact that reinsurance has on these components.

The gross reserve and net reserve are each calculated using a separate PBR calculation. Put another way, the reserve credit is the difference between the gross and net PBR amounts:

$$\text{Max}(NPR_{Gross}, DR_{Gross}, SR_{Gross}) - \text{Max}(NPR_{Net}, DR_{Net}, SR_{Net})$$

### Actuarial Guideline XLVIII

Under Actuarial Guideline XLVIII (AG 48), Term and Universal



Life writers that utilize XXX or AXXX captive reinsurance arrangements have been required to perform PBR calculations to determine the amount of Primary Security to be held.

Prior to the effective date of VM-20, the AG 48 calculation is performed gross of reinsurance and the Primary Security requirement is reduced by the portion of the business retained by the direct writer.

After VM-20 becomes effective, AG 48 calculations must include reinsurance. This applies retrospectively to all business subject to AG 48.

## PBR REINSURANCE CONSIDERATIONS

### Net Premium Reserve

The NPR is calculated formulaically at the policy level using prescribed assumptions. The approach to calculating the NPR

net of reinsurance is the same as that used for formulaic reserves prior to PBR:

- Coinsurance: The NPR is reduced by the percentage coinsured.
- Yearly Renewable Term (YRT): The NPR is reduced by the unearned cost of insurance that is reinsured.

#### Deterministic and Stochastic Reserves

The DR and SR are calculated using an asset-liability model for an aggregate segment of policies using prudent estimate assumptions. The DR and SR gross of reinsurance are calculated by excluding reinsurance cash flows from the model. The net DR and SR are calculated using the same approach, but including reinsurance cash flows.

VM-20 provides general guidance on the modeling of reinsurance cash flows, stating, “The company shall assume that the counterparties to a reinsurance agreement are knowledgeable about the contingencies involved in the agreement and likely to exercise the terms of the agreement to their respective advantage, taking into account the context of the agreement in the entire economic relationship between the parties.”

The proposed ASOP for VM-20 provides substantially the same guidance for the actuary.

### CASE STUDY

#### Modeling Overview

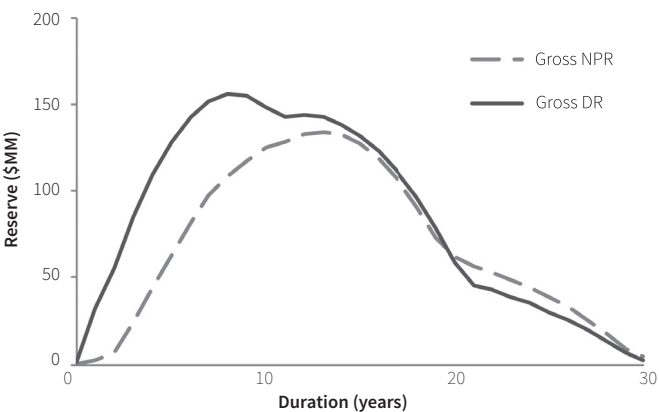
A cohort of new business with \$50MM of first year premium consisting of 10-, 20- and 30-year term products was projected for 30 years. In the projection, the NPR and DR were revalued annually using the terms of VM-20 and the following specifications:

- The prudent estimate DR mortality assumption was improved at a rate of 1 percent per year up to each valuation date.
- Valuation scenarios were regenerated at each valuation date in order to reflect the impact of changes in the yield curve on the scenario generator and mean reversion parameter.
- At each valuation date, starting assets used in the DR were solved for using the ‘Direct Iteration’ approach under VM-20.
- The NPR was calculated using the 2017 CSO table and a valuation interest rate of 4.5 percent.
- Mortality experience was assumed to be 30 percent credible with 10 years of sufficient data.
- The cohort is assumed to pass the Stochastic Exclusion Test (SET).
- Assumptions used and products modeled are for an illustrative term portfolio intended to be reasonably representative of products offered in the market today.

The DR and SR are calculated using an asset-liability model for an aggregate segment of policies using prudent estimate assumptions.

The gross NPR and DR for this cohort of new business are shown in Figure 1.

Figure 1: Reserves Gross of Reinsurance



As shown, the DR starts much higher than the NPR, but the gap closes over time and there is a crossover in year 19. The primary driver of this pattern is that the DR mortality assumption is unlocked for mortality improvement up to each valuation date, whereas the NPR mortality is not.

#### Coinsurance

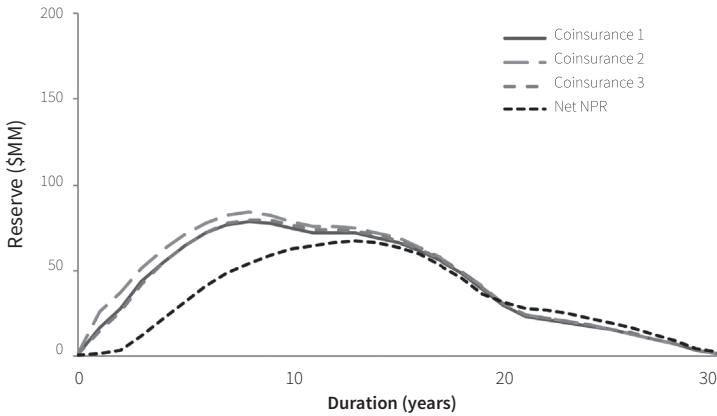
Three 50 percent first dollar coinsurance agreements were modeled and are summarized in Table 1. As is typically the case, the coinsurance allowances were assumed to be guaranteed, requiring no additional assumptions to calculate the DR.

Table 1: Coinsurance Agreements

Coinsurance	Description
Agreement 1	Reimburse proportion of VM-20 prudent expenses and commissions
Agreement 2	Reimburse proportion of best estimate expenses and commissions
Agreement 3	Prudent expense and commission allowance expressed as level percentage of premium

The projected NPR and DR net of reinsurance are shown in Figure 2 for these arrangements.

Figure 2: Net Reserves with 50% Coinsurance



Because the reserves above reflect 50 percent coinsurance, all values are decreased significantly relative to the gross reserves from Figure 1.

The net NPR is shown as the black dotted line and is the same under all three agreements. It is calculated using a proportionate reduction to the gross NPR based on the 50 percent of the business coinsured and therefore follows the exact same pattern as the gross NPR from Figure 1.

In contrast, Figure 2 shows that the three DR curves visibly vary in the first 10 years. Table 2 below illustrates this by expressing the net reserve as a proportion of the gross reserve:

Table 2: Net/Gross Reserve by Coinsurance Agreement

Year 1	Year 5	Year 10	Year 20
50% (DR)	50% (DR)	50% (DR)	50% (NPR)
67% (DR)	55% (DR)	53% (DR)	50% (NPR)
47% (DR)	50% (DR)	51% (DR)	50% (NPR)

Once the reserve reaches the NPR floor in year 20, the ceding company will see a proportionate reserve reduction under all coinsurance arrangements.

Under Agreement 1, the DR is reduced proportionately because the agreement terms were set to reimburse prudent estimate expenses, which is uncommon in coinsurance transactions.

Under Agreement 2, the DR is higher than Agreement 1 because it is only set to reimburse best estimate expenses. Under this arrangement, the ceding company will not realize a proportionate reduction in the DR.

Under Agreement 3, the DR starts off slightly lower than under Agreement 1 but ends up slightly higher. The slight variation relative to Agreement 1 is due to a higher expense allowance in Agreement 3 in the early years and a lower expense allowance in the later years.

Once the reserve reaches the NPR floor in year 20, the ceding company will see a proportionate reserve reduction under all coinsurance arrangements.

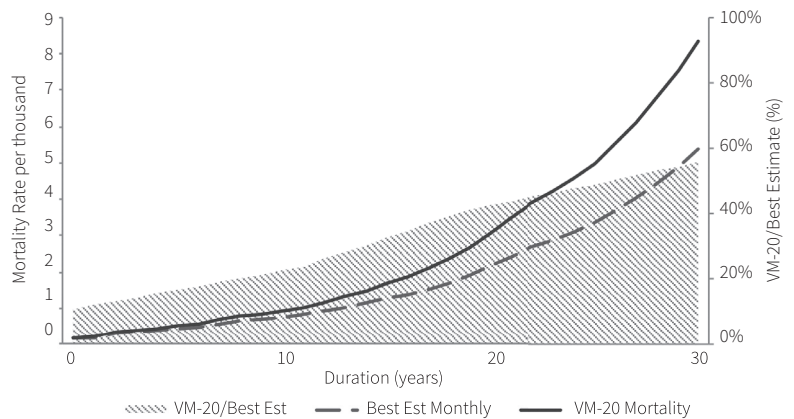
YRT Reinsurance

A 50 percent first dollar YRT reinsurance arrangement with the current premium scale set equal to 100 percent of the best estimate mortality assumption was modeled.

VM-20 mortality is based on a prudent company-specific mortality assumption grading to a prudent industry table when sufficient data no longer exists. The margin applied to set the company-specific prudent assumption is a function of the credibility of the underlying experience.

A comparison of the VM-20 mortality and best estimate mortality is shown in Figure 3 for a 35-year-old male, preferred non-tobacco:

Figure 3: Best Estimate vs. VM-20 Mortality



The shaded area shows that the total effective margin starts at 10 percent and grades to 54 percent over 30 years due to the absence of mortality improvement and the grading to the prudent industry table.

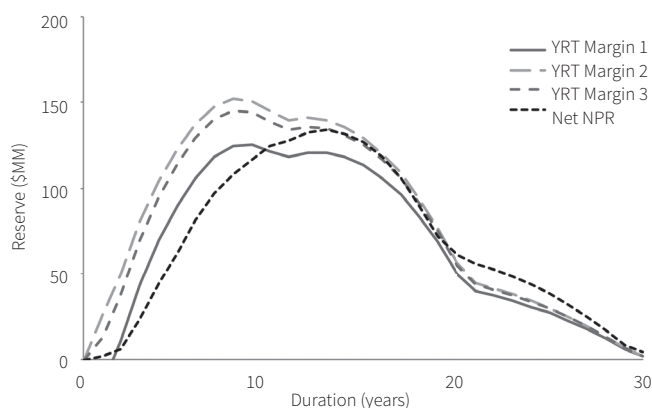
Under this adverse mortality scenario relative to best estimate, we examined the YRT rate change scenarios shown in Table 3.

Table 3: VM-20 YRT Rate Change

Scenario	Description
1	No change in rates
2	Increase rates to remove reinsurance gain
3	Increase rates by 15%

The projected net NPR and DR for the cohort of new business under the three scenarios are shown in Figure 4.

Figure 4: VM-20 YRT Rate Change Scenarios



The net NPR is shown as the black dotted line and is calculated by reducing the gross NPR by the unearned cost of insurance for the 50 percent of the business reinsured. This NPR is only slightly lower than the NPR from Figure 1.

Under Scenario 1, it is assumed that no change is made to the scale of YRT rates and that the reinsurer absorbs losses due to mortality emerging adversely as compared to the current YRT scale. The net DR is significantly reduced as compared to the gross DR and becomes lower than the net NPR in years nine and beyond.

Scenarios 2 and 3 assume that the reinsurer will exercise their option to raise YRT rates to make up for the adverse mortality variance.

In Scenario 2, it is assumed that YRT rates will be reset for the reinsurance treaty to break even at all times (i.e., no gains or loss from reinsurance). In this situation, the only reduction in the PBR reserve realized by the ceding insurer will be due to a difference in cash flow timing (return of unearned premium). The difference between the gross and net DR is similar to the difference in gross and net NPR under this scenario.

Scenario 3 with a 15 percent across-the-board increase in YRT premium is intended to represent a situation where the direct

writer and the reinsurer are ultimately sharing losses due to mortality emerging adversely relative to expected. The Scenario 3 DR falls somewhere between the Scenario 1 DR and the Scenario 2 DR, as shown in the table below.

Table 4: Net/Gross Reserves by Year and YRT Scenario

Scenario	Year 1	Year 5	Year 10	Year 20
1	20% (DR)	74% (DR)	89% (NPR)	99% (NPR)
2	91% (DR)	97% (DR)	98% (DR)	99% (NPR)
3	68% (DR)	91% (DR)	94% (DR)	99% (NPR)

## CONCLUSION

Life writers with AG 48 experience may have a head start with PBR calculations, but the inclusion of reinsurance in the calculations is a new aspect of PBR methodology for everyone.

1. From a pricing perspective, it will become important to not only understand the impact of reinsurance on pricing cash flows, but to also understand the impact on projected reserves and the emergence of distributable earnings.
2. From a valuation and forecasting perspective, financial models will require a sufficient level of granularity to reflect the nuances of the reinsurance structures, which was not a significant consideration in the past.
3. Finally, understanding the implications of reinsurance treaty design and related prudent estimate assumptions under PBR is a critical undertaking for carriers and may drive a need to refine both pricing models and reinsurance strategy. ■

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



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