OLIVER WYMAN

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GETTING THE MOST OUT OF AXIS™

KEEPING PACE WITH NEW MODELING REQUIREMENTS

Editor's words: Welcome to the Spring 2018 edition of our AXIS modeling newsletter. This issue outlines the latest developments in AXIS for US tax reform and also describes how to set up a dynamic PBR mortality assumption – using a case study to demonstrate the impact this can have on projected reserves. You will also find helpful tips and tricks for navigating the system and highlights of new features in recent AXIS releases. We hope you enjoy the newsletter.

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US TAX REFORM 101: WHAT YOU NEED TO KNOW

INTRODUCTION

The US tax reform changes that came into effect in 2018 represent the first major overhaul of the federal income tax structure in over thirty years.

These changes are expected to have an overall positive impact on insurer profitability; however, they are substantial and complex enough to warrant a thorough review of corporate strategies.

This article provides a summary of the tax reform changes as well as an overview of how Moody's Analytics has enhanced AXIS in response to them.

SUMMARY OF TAX REFORM CHANGES

Exhibit 1 summarizes the key changes for various components of taxable income.

Exhibit 1: US tax reform – Key changes

CORPORATE TAX	• Corporate tax rate decreased from 35% to 21% • Repeal of corporate Alternative Minimum Tax (AMT)
TAX RESERVES	• Equal to 92.81% of the statutory reserve with a Cash Surrender Value floor • Applies retroactively with the impact to be amortized over eight years
DAC TAX	• Amortization period increased from 10 to 15 years • Capitalization rate increased from 7.7% to 9.2% for individual life, 2.05% to 2.09% for group life and 1.75% to 2.09% for annuities
OTHER	• RBC factors are currently adjusted to be post-tax using a rate of 35%; they will be updated by the NAIC • Dividends Received Deduction reduced from 70% to 50% • New "base erosion" AMT limits deductions on foreign reinsurance

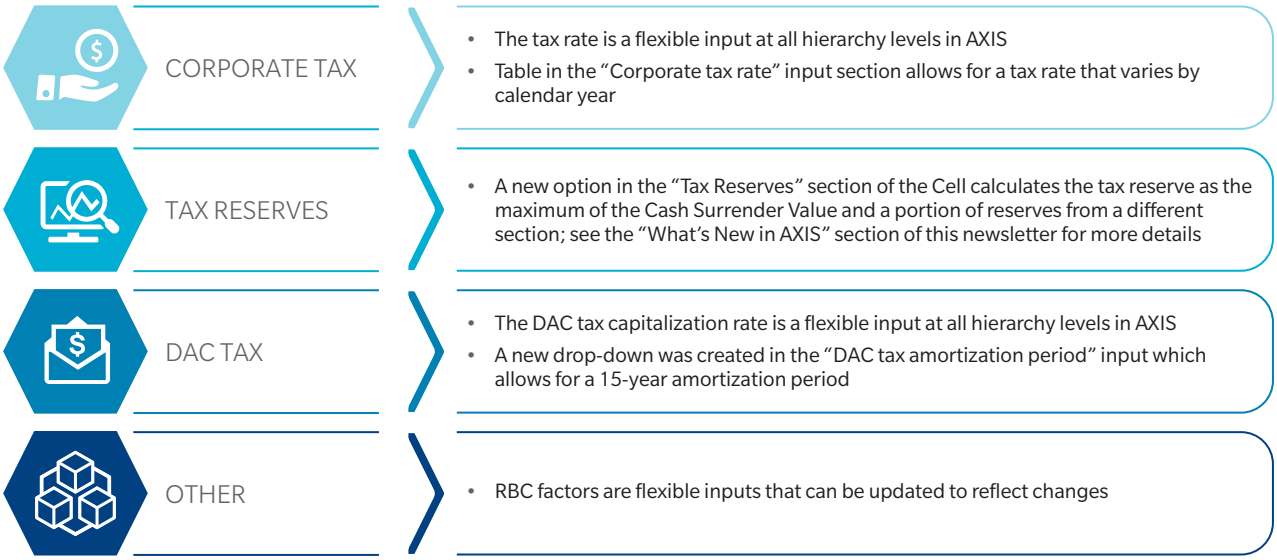
"The US tax reform changes that came into effect in 2018 represent the first major overhaul of the federal income tax structure in over thirty years"

As illustrated in Exhibit 1, there is a substantial decrease in the corporate tax rate. This is offset by changes to the tax deductibility of reserves, less tax-favorable DAC tax capitalization rates and amortization schedules, and stricter accounting for reinsurance.

AXIS IMPLEMENTATION

AXIS was flexible enough to accommodate a majority of the tax changes without the need for system enhancements. However, Moody's Analytics has been enhancing AXIS functionality in order to accommodate and streamline the implementation of these changes.

Exhibit 2: US tax reform – Implementation in AXIS



At the time of writing, additional system enhancements are being made in order to properly calculate tax reserves where statutory reserve calculations are performed at aggregate levels in AXIS, such as Actuarial Guideline XLIII and Principle-Based Reserving. AXIS Knowledge Base article 2139 "US Tax Reform 2018 – Upcoming Changes to AXIS" has a summary of AXIS enhancements along with details on status and timing.

This article can be found at:
https://www.ggy.com/uploadwizard/rkbviewer.aspx?articleid=2139

"AXIS was flexible enough to accommodate a majority of the tax changes without the need for system enhancements. However, Moody's Analytics has been upgrading functionality in order to accommodate and streamline the implementation of these changes"

CONCLUSION

The US tax reform changes create a need for insurers to evaluate their corporate strategies, including the structure of tax-efficient financial reinsurance agreements, profitability targets and product offerings. AXIS users will benefit from recent and ongoing improvements to the system as they update their pricing, financial reporting, and other financial models for these changes.

TIPS & TRICKS

Renaming multiple Scenario objects

Stochastic calculations often require the use of hundreds or thousands of Future Scenarios in AXIS; thus, efficiency is critical in loading these scenarios. Creating new AXIS Scenario objects increases runtime significantly and a user may find this to be undesirable. Recycling existing Future Scenarios eliminates the needs for new AXIS objects and reduces both the number and the memory footprint of Future Scenarios.

When reusing Future Scenarios in AXIS, best practice involves renaming existing Scenario objects to reflect the characteristics of the new scenarios.

Sample code for dynamically renaming multiple Future Scenarios using a Dataset Formula Batch is provided below. In this example, the valuation date and sensitivity name associated with a given set of 1,000 scenarios are updated.

```
ValDate     = "20171231"
Sensitivity     = "BASE"
StartingScenID = 1001

For i = StartingScenID To (StartingScenID + 999)
  ScenNum     = i - StartingScenID + 1
  ScenObjName   = GetObjectName(Scenario , i)
    Select Case ScenNum
      Case 1 To 9
        ScenNumStr = "000" & CStr(ScenNum)
      Case 10 To 99
        ScenNumStr = "00" & CStr(ScenNum)
      Case 100 To 999
        ScenNumStr = "0" & CStr(ScenNum)
      Case 1000 To 9999
        ScenNumStr = CStr(ScenNum)
    End Select
  UpdatedScenName = ValDate & "_SOP03-1 _" & Sensitivity & "_"
  & ScenNumStr
  Call RenameObjectByName(Scenario , ScenObjName , UpdatedScenName)
Next i
```

IN THE SPOTLIGHT

IS THAT YOUR BEST PRUDENT ESTIMATE ASSUMPTION?

DYNAMICALLY ADJUSTING PBR MORTALITY IN AXIS

INTRODUCTION

Under the specifications of Valuation Manual 20 (VM-20), the Principle-Based Reserve (PBR) is the maximum of three reserves: the Net Premium Reserve (NPR), Deterministic Reserve (DR), and Stochastic Reserve (SR). The NPR uses a formulaic calculation which is performed at the policy level using prescribed assumptions, whereas the DR and SR are determined in aggregate using projections based on prudent estimate assumptions.

As more companies implement and interpret PBR and request system enhancements, AXIS functionality grows and becomes more sophisticated. This article highlights new functionality available in AXIS for the implementation of the prudent estimate mortality assumption underlying the DR and SR projections.

PROJECTING A DYNAMIC MORTALITY ASSUMPTION

One of the more complex assumptions underlying the DR and SR is the mortality assumption, which is developed using a blend of company and industry experience with prescribed margins based on the credibility of the underlying experience and without any future mortality improvement.

When projecting future reserves for pricing and forecasting purposes, it may be desirable to unlock this mortality assumption. Two potential drivers for unlocking the assumption are 1) mortality improvement up to the valuation date and 2) additional experience and data credibility.

UNLOCKING HISTORICAL MORTALITY IMPROVEMENT UP TO EACH VALUATION DATE

Under VM-20, a company is not allowed to assume future mortality improvement in the determination of the DR and SR. However, it is acceptable to assume historical mortality improvement from the study date to the valuation date.

As demonstrated in the case study in the following section, unlocking the mortality improvement assumption throughout the projection can have a significant impact on reserve levels.

TIPS & TRICKS

Enabling multiple inforce dates

AXIS does not permit the use of different status (i.e., inforce) dates underlying a given Policy Information Datalink Table. This may be problematic when "as of dates" for inforce records are not homogenous in data extracts.

It is possible to bypass this limitation by leveraging the "Inforce Year" and "Inforce Month" Optional Fields at the Seriatim level. The appropriate inforce date can then be applied for individual policies or cohorts of policies. The values in these Optional Fields supersede the status date specified in the corresponding DataLink File(s) underlying the Policy Information Table(s).

The "Historic mortality improvement" setting in AXIS allows mortality improvement to be applied up to each valuation date with no future improvement thereafter. Using this setting in conjunction with a mortality table that contains improvement will unlock the improvement up to each future valuation date. This functionality works at both the Cell and Embedded Block levels in AXIS.

INCORPORATING FUTURE INCREASES IN DATA CREDIBILITY

The DR and SR mortality assumption is a blend of a company's best estimate mortality with a margin and an industry Valuation Basic Table (VBT) with a separate margin. The margin applied to company experience and the rate at which it is blended with industry experience are prescribed and vary with the credibility of the experience and the number of years of sufficient data underlying it. The margin on industry mortality is prescribed and is not impacted by company experience.

In response to PBR requirements, Moody's Analytics created a "Blended mortality rate [Composite]" table that allows the user to specify two mortality bases as well as the grading factors used to blend the two bases together. One of the allowable options for the "Blending rate (%)" input is a Formula Table, which allows numerous built-in AXIS variables to assist in determining the grading factors. The "BlockPivotYear" variable allows the grading factors to vary based on the valuation year.

"As more companies implement and interpret PBR and request system enhancements, AXIS functionality grows and becomes more sophisticated"

If a company anticipates that the years of sufficient data underlying its mortality assumption will increase in the future, the sufficient data period can be modeled to dynamically increase at future valuation dates as this experience emerges.

By unlocking the sufficient data period in this manner, future inner loop projections will place heavier weight on company experience in the mortality assumption used to calculate the DR and SR. This can have a significant impact on the mortality rates and resulting reserves.

CASE STUDY

The following case study illustrates the impact of incorporating the aforementioned aspects of mortality assumption unlocking on projected reserves.

OVERVIEW

One year of new business was modeled for a portfolio consisting of 10-, 20- and 30-year level term policies. Premiums during the level period were set at industry means and the post-level term premiums were set to 250% of the prescribed CSO table.

NPR and DR amounts were projected with an annual reserve revaluation frequency using the methodology prescribed under VM-20 and the following specifications:

1. The prudent estimate ("inner loop") mortality assumption is improved to each valuation date at a rate of 1% per annum
2. Valuation economic scenarios are generated at each valuation date in order to reflect the impact of changes in the yield curve on the economic scenario generator and associated mean reversion parameter
3. At each valuation date, assets used in the DR projection are solved for using the "Direct Iteration" approach under VM-20
4. The NPR is calculated using the 2017 CSO table and an interest rate of 4.5%
5. Mortality experience is assumed to be 60% credible under the Limited Fluctuation Credibility method with five years of sufficient data
6. The SR is not modeled, as the product is assumed to pass the Stochastic Exclusion Test (SET)

Three scenarios were analyzed to show the impact of unlocking the mortality assumption for improvement and changes in the sufficient data period. The scenarios are described in Exhibit 1.

Exhibit 1: PBR mortality projection scenarios

SCENARIO	DESCRIPTION
1	PBR with historical mortality improvement and sufficient data period locked-in at the beginning of the projection
2	Same as Scenario 1 but with unlocking of historical mortality improvement up to each revaluation date
3	Same as Scenario 1 but with unlocking of historical mortality improvement up to each revaluation date and unlocking of the sufficient data period

The projected NPR and DR amounts are shown in Exhibit 2 for each of these scenarios. Note the NPR is the same across all three scenarios because the mortality assumption is prescribed as the 2017 CSO table.

TIPS & TRICKS

Exporting Dataset comparison results to Microsoft Excel

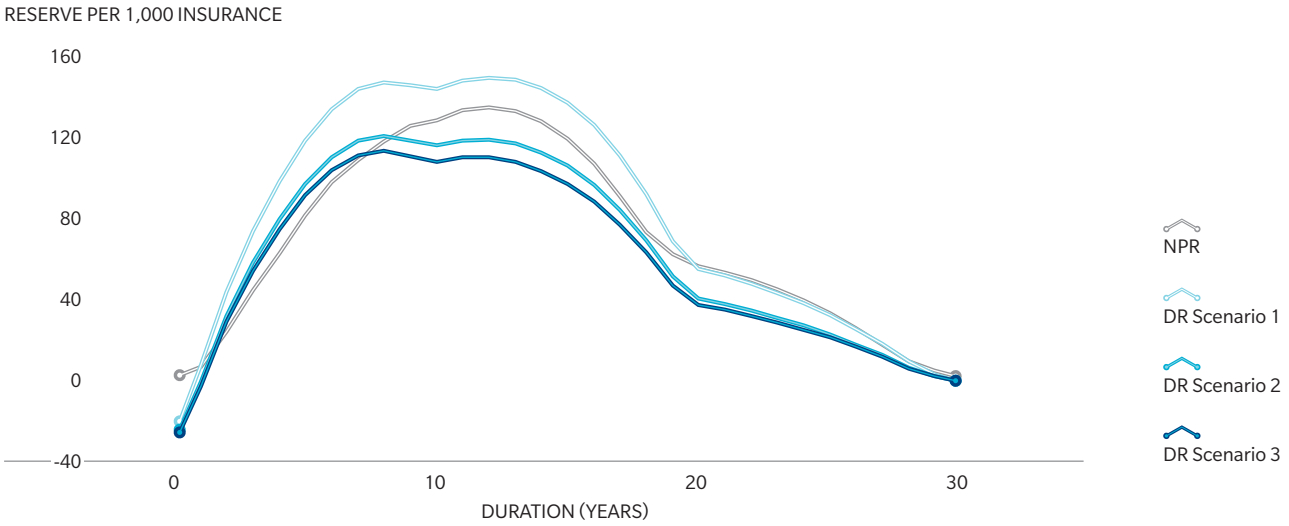
AXIS offers functionality to compare all objects contained in two separate Datasets. The comparison is performed by selecting the Datasets in the EnterpriseLink interface, right-clicking, and selecting "Advanced" > "Compare". This comparison includes Formula Tables and Batches. The results are displayed directly in AXIS. This functionality can be leveraged as part of a broader change control process.

Further analysis of the comparison results can be performed by exporting the results to Excel. Within the AXIS Dataset comparison interface, select "File" > "Export comparison results to HTML". Results can then be viewed in Excel by opening the index.htm file.

Results will be labeled using the following three categories:

1. Missing – when an object with a given name does not exist in one Dataset
2. Different – when any characteristics of a common object are different between the two Datasets; this covers a range of changes, from object IDs to input values themselves. Details are available by clicking the hyperlink in the Name column
3. Affected – when a common object contains any object(s) labeled as "different", such as a given Composite Table having an embedded table of identical name but containing different values

Exhibit 2: PBR reserve components



In Scenario 1, the DR mortality assumption is not unlocked at future valuation dates and the DR exceeds the NPR until projection year twenty.

In Scenario 2, the inclusion of historical mortality improvements results in a 20 to 30% reduction in the DR with greater reductions over time as additional years of future mortality improvement are layered into the assumption. In this scenario, the DR is the dominant PBR amount until projection year eight.

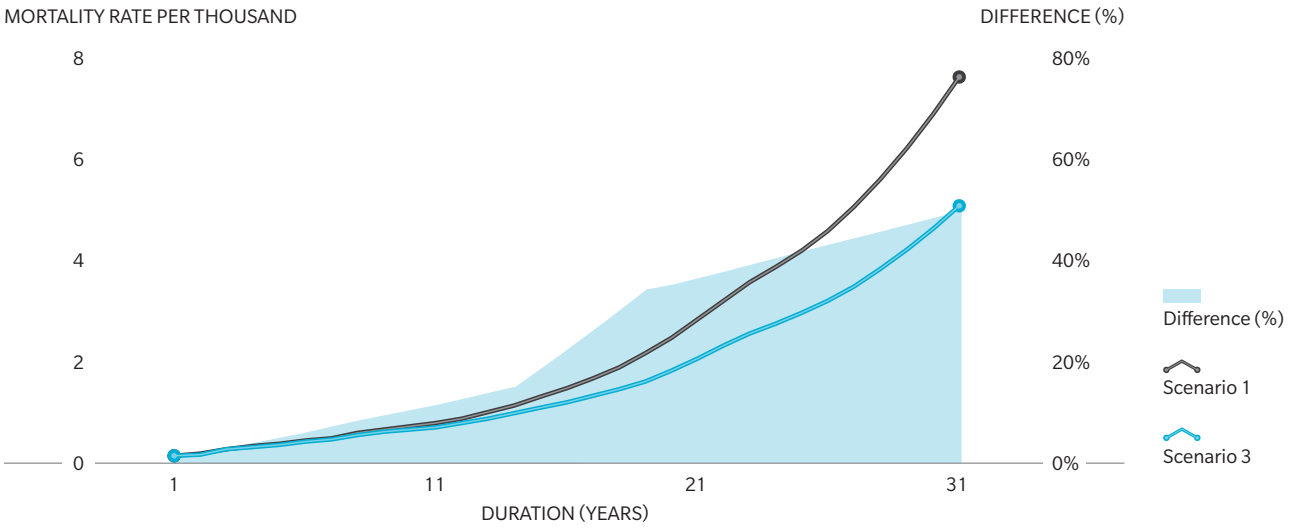
"Significant out-of-the-box PBR functionality has been developed in AXIS, allowing companies implementation flexibility and the ability to perform robust PBR analyses"

In Scenario 3, unlocking the sufficient data period results in a further 5 to 10% reduction in the DR throughout the projection and reduces the number of years where the DR exceeds the NPR to seven.

This aggregate analysis illustrates that using a dynamic mortality assumption in which components are unlocked over time for emerging experience has a significant impact on the development of the DR and overall PBR reserves. The impact can also be observed when analyzing the projected mortality rates for a single policy.

Exhibit 3 shows a comparison of the DR mortality for a representative policy (male, preferred non-tobacco, issue age 35) between Scenarios 1 and 3.

Exhibit 3: DR mortality assumption comparison



As expected, the initial mortality rates are equal; however, the differential in rates grows to nearly 50% over the 30-year projection.

CONCLUSION

Modeling changes in valuation assumptions can have a significant impact on projected reserves under PBR. As such, it is critical for a company to reach internal consensus on the modeling approach for subjective items, such as the unlocking of assumptions. Fortunately, significant out-of-the-box PBR functionality has been developed in AXIS, allowing companies the flexibility to perform robust PBR analyses.

WHAT'S NEW IN AXIS

PREMIUM TABLE WITH SUBSTANDARD BASIS

Description

- In the Regular Life, Par Products and Disability modules, a new table section ("Premium with Substandard Basis [Composite]") has been added to the Cell:
  - The Composite Table has two rows:
    1. "Premium": used to specify the standard premium table
    2. "Substandard multiple extra premium basis": used to calculate the substandard premium
  - Using this table, the total premium is the sum of the standard premium, the substandard flat extra premium, and the substandard multiple extra premium

Details

- Version 20180901

Learn more

- https://www.ggy.com/client/BugEnhance/UpdateDetail/24298/

MVA OPTIONS IN UL MODULE

Description

- In the Universal Life module, the Investment Account now provides the user additional flexibility in defining guaranteed interest MVA rates:
  - The "MVA rate basis" switch has been renamed to "MVA adjusted credited rate"
  - Two new switches, "MVA i rate definition" and "MVA j rate definition", allow multiple choices for the MVA rate calculation
  - A new scalar, "MVA j rate minimum", has been added to floor the MVA j rate
- In the Universal Life, Group Annuity, and Annuity modules, a define option, "Zero out MVA spread", has been added to the "MVA spread (Inv accounts)" table section

Details

- Version 20182101

Learn more

- https://www.ggy.com/client/BugEnhance/UpdateDetail/24822/

US TAX REFORM - TAX METHOD CHANGE TO USE ADJUSTED STATUTORY RESERVE BASIS

Description

- In the Regular Life, Par Products, Universal Life, and Annuity modules, the following switches and table field have been added in the Tax Reserve section of the Cell in response to the 2018 US Tax Reform (Bill H.R.1):
  - A "Reserve processing option" switch to select the tax reserves calculation method
  - A switch to specify the reference reserves section
  - A "Proportion of reference reserves" table field to specify the proportion of reference reserves to be held as tax reserves
- A "Tax reserves floor" switch has been added to specify whether tax reserves are floored at cash value

Details

- Version 20182602

Learn more

- https://www.ggy.com/client/BugEnhance/UpdateDetail/25011/
- https://www.ggy.com/client/BugEnhance/UpdateDetail/25003/
- https://www.ggy.com/client/BugEnhance/UpdateDetail/25008/

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