OLIVER WYMAN

Consulting Actuaries

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GETTING THE MOST OUT OF AXIS

IN THIS ISSUE

THANKS FOR YOUR POSITIVE RESPONSE TO OUR AXIS NEWSLETTER

Editor's words: Following a resoundingly positive response to Volume 1, we are pleased to issue the Spring 2015 edition of our AXIS modeling newsletter. This issue focuses on AXIS's capabilities related to principles-based reserving and long-term care insurance modeling. (The principles-based reserving article is best read in conjunction with the EnterpriseLink and asset modeling articles in Volume 1.) 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.

MARSH & McLENNAN COMPANIES

In a 2012 PBR impact study released by the NAIC, 21 life insurers implemented VM-20 for the first time and only one insurer considered the level of difficulty to be 'reasonable'.

EXECUTIVE CORNER

MODELING PBR FOR LIFE PRODUCTS

SOFTWARE IMPLICATIONS OF A NEW REGULATORY ENVIRONMENT

VM-20 is the section of the NAIC's Valuation Manual that defines the principles-based reserving (PBR) requirements for life insurance products. As of the ACLI's March 2015 PBR update, 25 states have adopted the Valuation Manual. If 42 states representing 75% of premium adopt the manual, PBR will take effect and reserving requirements for U.S. life insurers will change drastically. In a 2012 PBR impact study released by the NAIC, 21 life insurers implemented VM-20 for the first time and only one insurer considered the level of difficulty to be "reasonable". Some of the challenges introduced by PBR include: interpretation of the regulation, selection of appropriate assumptions and margins, difficulties in modeling, and new analyses. This article addresses the implications of PBR on modeling and software requirements. Due to the 75% premium threshold, the adoption of the Valuation Manual largely depends on the state legislative actions on PBR underway in California and Texas.

VM-20 OVERVIEW

VM-20 requires insurers to hold the maximum of three reserve components: a net premium reserve, a deterministic reserve, and a stochastic reserve. Exhibit 1 summarizes the key aspects of each component.

Exhibit 1: Summary of VM-20 reserve components

	NET PREMIUM RESERVE	DETERMINISTIC RESERVE	STOCHASTIC RESERVE
Valuation basis	Net premium valuation	Gross premium valuation	CTE(70) of the Greatest Present Value Accumulated Deficiency under prescribed scenarios
Methodology	Formula-based Similar to CRVM Seriatim required	Principles-based	Principles-based Scenario compression techniques allowed
Scenarios	Flat discount rate	Single deterministic scenario	A set of up to 10,000 prescribed economic scenarios of interest rates and equity returns
Assumptions	Prescribed statutory assumptions	Best estimate assumptions plus margins Margins set according to credibility of experience and level of risk	Best estimate assumptions plus margins Margins set according to credibility of experience and level of risk

VM-20 IMPLICATIONS

VM-20 will have a number of key repercussions for actuarial processes and models, some of which are summarized in Exhibit 2.

Exhibit 2: Implications of VM-20 requirements

1	Efficient coding and processing will be essential	• VM-20 has several requirements which place additional burden on computing resources and increase the model runtime • Insurers must project the net premium reserve on a seriatim basis and calculate the stochastic reserve by projecting a large scenario set • AXIS has clear advantages on this front, with features such as: – GridLink – Projection calculations can be distributed and run in parallel, which can scale run times from days to hours – Stochastic Processing Module – AXIS is coded to maximize calculation and storage efficiency for stochastic runs, and reports with key metrics (e.g., CTE, VaR, and PV of cash flows) are automatically produced – Asset-liability modeling – The Asset Module in AXIS supports modeling of a variety of asset types, and AXIS seamlessly integrates asset and liability projections[1]
2	Integrated modeling platforms will be beneficial	• Many insurers maintain separate software platforms for pricing, projections, and valuation • In the VM-20 environment, all three functions will need to account for the impact of the new reserve requirements, including stochastic asset-liability projections • AXIS provides a flexible all-in-one modeling platform, together with integrated asset-liability modeling capabilities
3	Complex interdependencies must be reflected on the fly	• VM-20 calls for adjustments in real time, such as mean reserve floors, policy exclusion tests and shock lapse adjustments • For policies subject to a prescribed shock lapse under the VM-20 net premium reserve, valuation net premiums after the shock lapse may need to be scaled down to produce a ratio of 135%, with valuation net premiums before the shock lapse scaled up accordingly • AXIS performs the above scaling automatically under the "VM-20 net premium reserve" methodology
4	A range of assumptions will be tested at each valuation date	• Under VM-20, a margin must be applied to each individual assumption, and then the aggregate impact of the individual margins must be reviewed to determine that it is appropriately conservative • The ability to produce output for a range of assumptions in a controlled environment streamlines the margin-setting process • Combining AXIS's stress/sensitivity testing and automation capabilities makes margin-setting an easier task
5	Model risk controls will be emphasized	• VM-20 places additional emphasis on model risk controls • Regulators will expect insurers to maintain a rigorous documentation and review process for models and modeling changes • AXIS minimizes the risk of coding and methodology errors since features are implemented by a central team of GGY developers and tested by a range of companies who license the software • Further, AXIS EnterpriseLink provides a secure enterprise-level environment for AXIS model development, testing and production[1]

CONCLUSIONS

Principles-based reserving will have a significant impact not only on reserve levels, but also on the processes and software used to generate the underlying reserve cash flow projections. Insurers should consider the constraints of their current pricing, business planning, and valuation systems and develop a plan for adapting to the principles-based environment.

1 AXIS EnterpriseLink and AXIS's asset modeling capabilities were highlighted in the prior edition of this newsletter

[The claims cost approach] is favored by many carriers due to its simplicity: for a particular policy, the expected cost of claims for each future incurral period can be expressed by a single number.

IN THE SPOTLIGHT

LONG-TERM CARE MODELING IN AXIS

In today's environment, long-term care (LTC) providers are under significant pressure to have robust actuarial modeling and analytic capabilities to support new product development and inforce product management initiatives. The approach used to model the business can influence reported results and analysis capabilities; therefore, a review of the model methodology should be considered by any company looking to increase model efficiency, granularity, or accuracy.

The goals of this article are to outline two approaches to modeling LTC business: (a) claims cost and (b) first principles. The article will discuss strengths and weaknesses of each approach, as well as reasons why companies might elect one over the other. It will also discuss the modeling of each approach in AXIS, which is done using the Disability (DI) Module.

Let's consider ABC Insurance Company, a mid-sized LTC carrier. ABC has recently acquired a block of individual LTC insurance, with approximately 50,000 insureds issued across multiple states. The acquired business consists of multiple generations of a product, CELTC, which boasts a range of typical LTC product features. CELTC has been subjected to a number of assumption updates and inforce actions. Some product features and inforce actions that add complexity to the administration and modeling of the product include:

- State-specific premium rate increases
- Multiple care centers: Assisted living facility (ALF) , nursing home (NH), and home health care (HHC)
- Reduced paid up (RPU) clause, in case of non-payment of premium
- Waiver of Premium (WOP), once the policyholder is on claim

For a sample policy timeline and definitions of some of the more technical concepts in this article, please see Exhibit 1.

CLAIMS COST APPROACH

The most popular methodology used to model a product like CELTC is the claims cost approach. This approach is favored by many carriers due to its simplicity: for a particular policy, the expected cost of claims for each future incurral period can be expressed by a single number. Under a "total lives" approach, the claims cost in a given period does not vary by the individual's current claim status (healthy, ALF, NH, or HHC), i.e. all lives – whether currently healthy or disabled – are assumed to incur claims. Projected claim costs are subject to modeled decrements and are also used in policy reserve calculations. The modeling methodology is depicted in Exhibit 2.

Exhibit 1: Sample policy timeline and definitions

- Male, Non-smoker, aged 45; standard underwriting class
- Comprehensive plan - 100% home health care (HHC) and assisted living facility (ALF) benefits
- Elimination period of 90 days; benefit period of 10 years

JANUARY 1
- Policy is issued
- Premiums of P1 are paid annually

JANUARY 1
- Elimination period expires
- WOP provision eliminates premiums
- Benefits are paid (subject to daily & lifetime maximums)

JANUARY 1
- A rate increase is approved in the policyholder's home state. Premiums increase to: **$P_2 = P_1 * (1 + \text{increase \%})$**

JANUARY 1
- Elimination period expires
- WOP provision eliminates premiums
- Benefits are paid (subject to daily & lifetime maximums)

Attained Age	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70+
Paid Premiums	P_1	P_1	P_1	0	0	0	P_1	P_1	P_1	P_1	P_1	P_2	P_2	P_2	P_2	P_2	P_2	0	0	0	0	0	0	0	0	
Paid Benefits	0	0	0	B_1	B_2	B_3	0	0	0	0	0	0	0	0	0	0	0	B_4	B_5	B_6	B_7	B_8	B_9	B_{10}	0	

OCTOBER 3
- Qualification for HHC claims
- Elimination period commences, benefits are not paid for 90 days

JANUARY 1
- Policyholder recovers
- Premiums begin again and benefit payments cease

OCTOBER 3
- Qualification for ALF claims
- Elimination period commences, benefits are not paid for 90 days

DECEMBER 31
- Lifetime maximum benefit period of 10 years is reached
- Policy expires

INCIDENCE RATES reflect the probability that a policy goes on claim.

CONTINUANCE RATES reflect the probability that a policy remains on claim.

UTILIZATION RATES reflect the percentage of available benefits expected to be used by the policyholder.

ELIMINATION PERIOD is a period of time (typically number of days) for which a policy that goes on claim must wait before receiving benefit payments.

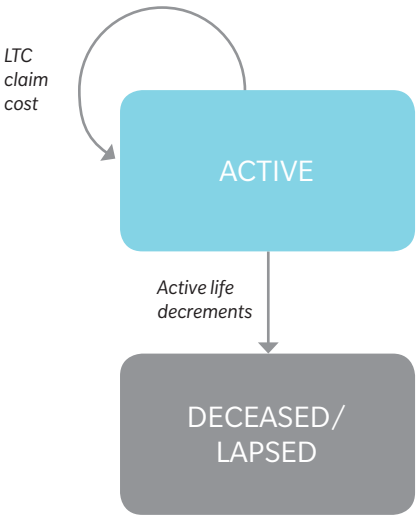
BENEFIT PERIOD specifies the period of time (typically months or years) for which benefits can be paid.

WAIVER OF PREMIUM (WOP) is a policy feature where the policyholder is not required to pay premiums while on claim.

BENEFIT CAP specifies the maximum amount of benefits that will be paid to the policyholder.

REDUCED PAID UP CLAUSE is a policy feature (not depicted in timeline) where, instead of lapsing upon non-payment of premium, the policyholder's available benefit amount is reduced, with no future premiums required.

Exhibit 2: Claims cost modeling blueprint



The greatest argument – simplicity – for using this methodology is also its greatest flaw. Since claims costs must be developed outside the model and cover any number of possible characteristics, the number of claims cost tables can become prohibitive to manage, as depicted in Exhibit 3.

Further, attempts are often made to limit the number of tables required, which leads to model simplifications. For example, one aggregate WOP factor may be used and applied to the entire inforce rather than at a more granular level. Additionally, a claim runoff pattern is required. It is typical to input one aggregate schedule, meaning that all claim payments are assumed to run off uniformly.

TIPS & TRICKS

Split screen view of inputs

It is possible to view two sections of any input screen at the same time.

1. On the top right corner of the input screen, above the scroll bar, there is a tab.

2. Drag the tab down in order to split the screen.

Screen splitting is useful for building or testing a model. E.g., when building a Gross Premium Valuation (GPV) reserve based on pricing assumptions, the Cell level input screen can be split to view both the "Pricing Assumptions" and "Second Reserves" sections at the same time.

Exhibit 3: Tables required for claims cost approach

DISTINGUISHING POLICYHOLDER OR PRODUCT CHARACTERISTIC	SAMPLE NUMBER OF VARIATIONS	CUMULATIVE TABLE COUNT[1]
Product generation	5	5
Plan type: Facility-only (ALF or NH), HHC (5 percentage variations), Comprehensive (ALF or NH)	9	45
Elimination period	4	180
Benefit period	5	900
Demographic factors: gender (2), marital status (2)	4	3,600
Underwriting classes	4	14,400
Waiver of premium rider (Yes/No)	2	28,800
Nonforfeiture clause (Yes/No)	2	57,600
Inflation options	3	172,800

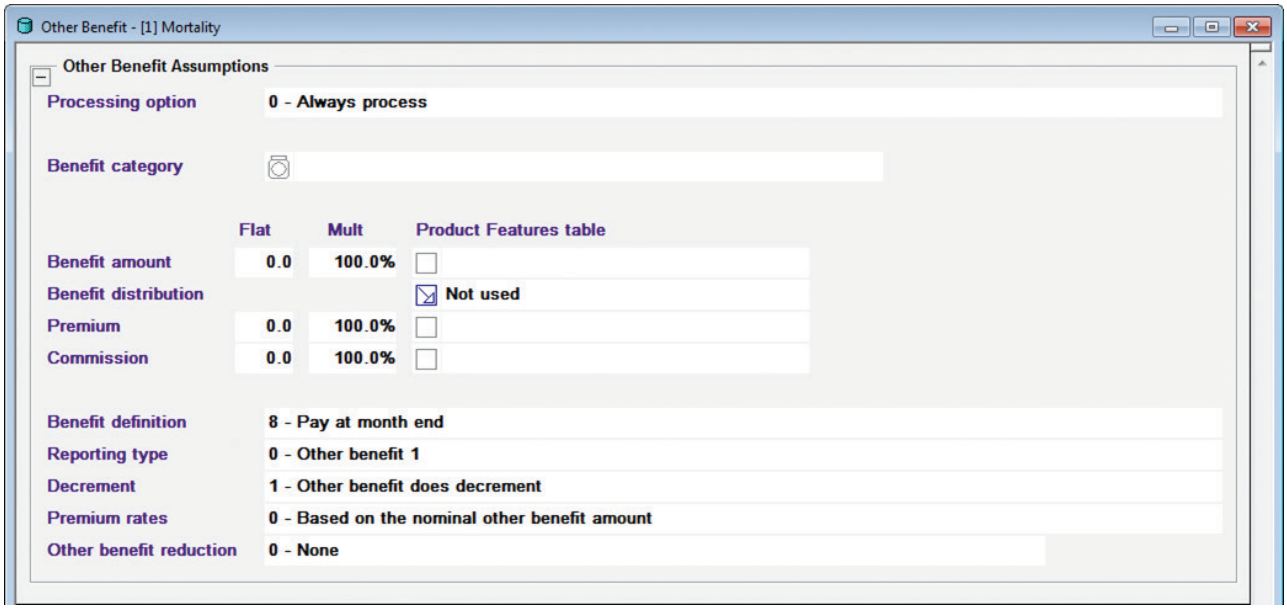
1 Assumes tables are specified by issue year and duration

CLAIMS COST APPROACH – MODELING IN AXIS

The claims cost approach is implemented through "Other Benefits" Objects inside the Cell. Up to 20 unique Other Benefits can be specified in each Cell, and for each Other Benefit there are a variety of benefit-specific features and assumptions that can be specified. However, the claims cost approach can be implemented with as little as two Other Benefits: active life mortality and claims cost inputs.

With respect to active life mortality, implementation can be done through an Other Benefit which decrements the inforce, while paying a benefit of 0. A sample set up is in Exhibit 4. Notable is the setting of the Benefit definition

Exhibit 4: Sample decrementing Other Benefit, benefits are not paid



The claims cost approach is an intuitive approach with a simple implementation; however, the high level nature of assumptions may lead to model simplifications, and the number of claims cost tables required could quickly become unmanageable.

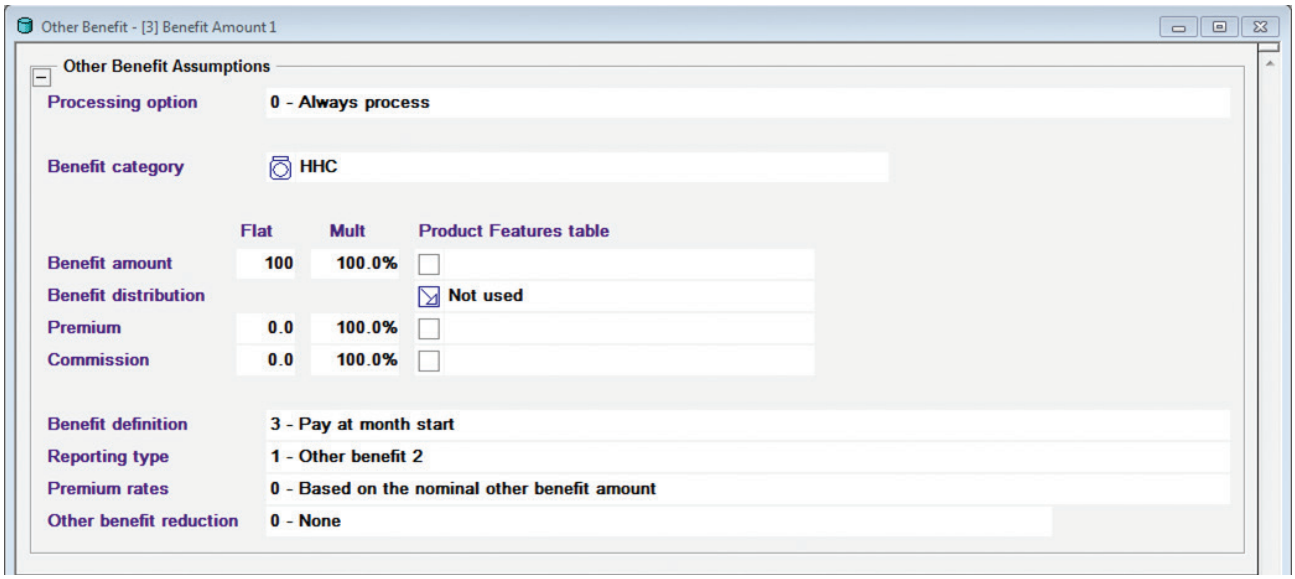
to "8 – Pay at month end". In order for an Other Benefit to decrement, the definition must be set to end-of-month, end-of-year, or uniform-in-year. The Decrement switch is then set to "1 – Other benefit does decrement". The mortality rate inputs are specified in the Other Benefit Rates of the Pricing Assumptions section.

In the claims cost approach, CELTC's RPU clause would be either built into the base claims cost tables or applied as an adjustment, so non-payment of premium (leading to reduction of future benefits) and death effectively lead to the same outcome. Therefore, the lapse assumption is sometimes combined with the mortality assumption in the same Other Benefit. An alternative approach is to separately input lapse rates into the lapse rate field of the Cell.

A sample claims cost Other Benefit is shown in Exhibit 5. Contrary to the mortality Other Benefit, this Other Benefit does not decrement the inforce and does pay benefits. The benefits are set to pay at month start (and therefore cannot decrement), and a flat 100 benefit amount is applied (which will be scaled by the benefit amount specified in the Seriatim record). This amount is multiplied by a set of rates set in the Other Benefit Rates of the Pricing Assumptions section.

Premiums, premium tax, commissions, and expenses can all be reflected in their respective Cell sections. State-specific rate increase assumptions can be assigned as a multiplicative adjustment to premium, either at a Seriatim or Cell level.

Exhibit 5: Sample non-decrementing Other Benefit, benefits are paid



TIPS & TRICKS

Model updates

For models with a static list of regular updates, checking the modified date of Table inputs is useful to ensure that Table updates or imports are as expected.

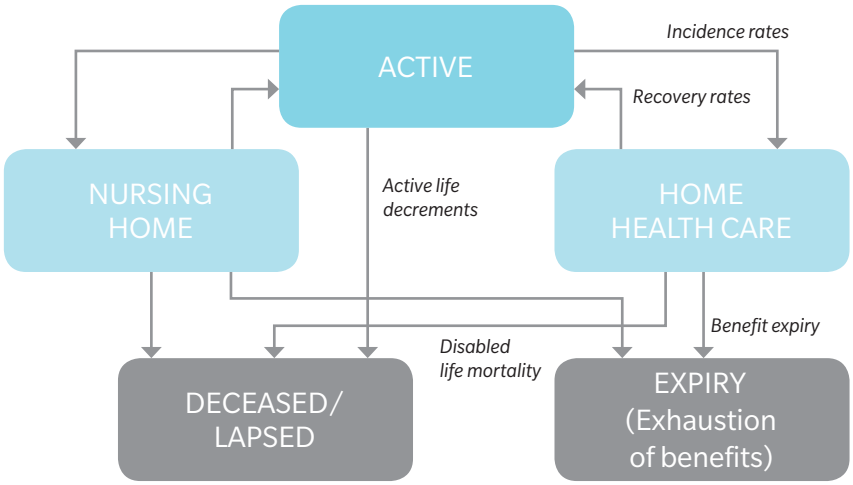
1. Go to any Module and select the Tables section and select "All Tables".
2. Sort by "Time Stamp" to review Tables updated recently.
3. Right click on any Table and select "Advanced" and "Where Used" to get an inventory of where that table is used.

The claims cost approach is an intuitive approach with a simple implementation; however, the high level nature of assumptions may lead to model simplifications and the number of claims cost tables required could quickly become unmanageable.

FIRST PRINCIPLES APPROACH

In contrast to the claims cost approach, the first principles approach employs more granular assumptions which require a greater amount of scrutiny and data for assumption setting, but can result in increased model accuracy. A sample modeling methodology is depicted in Exhibit 6.

Exhibit 6: First principles modeling blueprint



This approach incorporates all the dimensions of LTC risks described in Exhibit 1, including incidence, utilization and claim continuance. Claim incidence rates are explicitly input, and specific benefits are paid depending on which care setting a policyholder is in. Once a policyholder moves from active state to claim, the applicable elimination period is applied before benefits are paid, and benefits are projected for the corresponding benefit period. Additionally, each individual policy is subject to its own daily and lifetime maximums.

For RPU, each policy's benefits (and any related daily or lifetime maximums) are accordingly reduced when premiums cease. This requires explicitly splitting out lapse and mortality assumptions. For the WOP rider, policies can be coded to pay no premiums when on claim.

The first principles approach employs more granular assumptions which require a greater amount of scrutiny and data for assumption setting, but can result in increased model accuracy.

FIRST PRINCIPLES APPROACH – MODELING IN AXIS

In order to model on a first principles basis in AXIS, three key assumptions are required: Incidence rates, termination rates or continuance rates, and utilization rates.

AXIS is capable of modeling three distinct claim states, which typically represent different care settings. Lives can only enter each claim state from active status; they cannot transition between claim states. Incidence rates are specified in the "Cause X qi" switches located in the Pricing Assumptions section. The table can be a base incidence per 1000 table, a compound table, or a formula table.

Termination (or continuance) assumptions are also located in the Pricing Assumptions section and are specified in the "Term/recover CX" switches. AXIS allows for flexibility in how these rates are specified and split into disabled deaths and recoveries. Three popular approaches are specified in Exhibit 7.

Exhibit 7: Three approaches to specifying claim terminations in AXIS

SPECIFY RECOVERIES AND DISABLED LIFE DEATHS	SPECIFY TOTAL TERMINATIONS AND DISABLED LIFE DEATHS	SPECIFY CONTINUANCE ONLY
The user specifies the recoveries per 1000 disabled lives. The "DI deaths" table rate is added to the recovery rate to determine the total termination rate.	The user specifies the total terminations (recoveries plus deaths) per 1000 disabled lives. The difference between the total termination rate and the "DI deaths" table rate determines the recoveries per 1000 lives.[1]	The user specifies the number of lives continuing on claim per 1000 disabled lives, which is the converse of the total terminations.

1 Additionally, the "DI deaths" rate can be capped at the termination rate, or the termination rate can be increased to match the "DI deaths" rate where applicable. This is accomplished using the "DI death rate maximum" switch

The utilization assumption is specified in the "Dis ben utilization" input. It can be set to be 100% of post disability, or could be defined in its own table. The table can be specified by disability age & disability duration, issue age & policy duration, or policy year & disability duration. Each of these tables can also be placed inside a composite table.

For RPU, product features and decrements could be adjusted to reflect the impact of this feature. Further, one of the claim states could be used to reflect a reduced benefit state. The WOP rider can be modeled explicitly using the "Premium waiver" and associated inputs in the Product Features section, and policies can be coded to pay no premiums when on claim.

Like the claims cost approach, premiums, rate increase premiums, premium tax, commissions, and expenses can all be modeled in their respective Cell sections.

TIPS & TRICKS

Suppress blank rows in a report

AXIS reports often have a few key numbers scattered throughout a large default format, potentially making scrolling to find important line items onerous. It is possible to hide the blank rows in a report and thus highlight the important details.

1. In the Report screen, go to Format > Format Preference.
2. Check the option "Suppress blank rows".
3. You can also use the option "Blank for zero" to show or suppress zero values, depending on your desire to highlight key numbers.

Since standardized report formats are an integral part of model governance and controls, we recommend suppression of blank rows only be used in ad hoc development, testing or analysis. An alternative approach is to create custom reports containing only line items of interest.

THE BEST APPROACH FOR YOUR CIRCUMSTANCES

Ultimately, each company is interested in determining the best modeling approach given its unique circumstances. As summarized in Exhibit 8, the first principles approach can have some advantages over the claims cost approach; however, there are two key drivers of companies continuing to model on a claims cost approach.

Exhibit 8: Comparison of two modeling approaches

CLAIMS COST APPROACH	
STRENGTHS	**WEAKNESSES**
• Entire cost of claims for each future incurral period is expressed using a single number • Assumptions are defined on an aggregate basis and therefore are easier to develop • Few calculations are required, reducing model run time • Individual policy results are straightforward to audit/validate	• Number of tables required increases dramatically with each characteristic (see Exhibit 3) • Projection results in incurred claims rather than paid claims output, which requires development and application of claim run off factors • Intricacies like timing of payments and individual policy maximums are not accurately reflected • Understanding variances between modeled and actual results can prove difficult, especially if there is lack of clarity in how the claims cost inputs were originally derived

FIRST PRINCIPLES APPROACH	
STRENGTHS	**WEAKNESSES**
• Assumptions are reflected and input on an individual rather than aggregate basis, facilitating simple implementation • Scalability: additional precision can be reflected in assumptions without drastically increasing the number of tables, or having to rebuild a large number of tables • Payment timing, policy maximums, etc., are accurately reflected • Projected paid claims and claim reserves are output directly from the actuarial model	• Assumptions are more difficult to develop, with additional granularity in experience data required • More calculations are required, increasing model run time • Policy results are more difficult to audit/validate, due to multiple 'layers' of claims

First, the first principles approach calls for additional granularity in experience data. The amount of credible data for the required specificity, and the manner in which data is collected, stored and reported are both major considerations in choosing an approach.

Second is the current state of reserving assumptions. Moving to first principles for cash flow projections while keeping a claims cost approach for reserves may cause difficulties in the auditing and validation of results.

However, in the situation where a company has had to unlock its Statutory or US GAAP assumptions, the opportunity may exist to model both projection cash flows and reserves under a first principles approach.

The best approach will vary by company, and needs to be weighed against additional factors, such as first principles implementation costs. Regardless of the path chosen, we recommend companies utilize as granular an approach as possible, to promote accuracy in modeled results and to facilitate robust and detailed analytics.

WHAT'S NEW IN AXIS

BATCH EXPLORER TOOL (BET)

Description

- Batches displayed in a hierarchy
- Users can easily
  - Navigate complex Batch setup
  - Investigate performance issues

Details

- Version: 20150301

Learn more

- https://www.ggy.com/support/enhancebug/upddetail.asp?id=18962

DATASET FORMULA FUNCTIONS

Description

- Functions added for scripting jobs that automate large distributed runs
- New Dataset Formula functions
  - CreateCYRBatch
  - CopyBatch
  - RedirectDbLinks

Details

- Version: 20150602

Learn more

- https://www.ggy.com/support/enhancebug/upddetail.asp?id=19376

FORMULA TABLES PROFILER

Description

- Enhancement to report on Formula Tables' run time vs. total run time
- New functions
  - StartFormulaTableTimers
  - StopFormulaTableTimers
  - ReportFormulaTableTimers
  - ClearFormulaTableTimers

Details

- Version: 20150602

Learn more

- https://www.ggy.com/support/enhancebug/upddetail.asp?id=19378

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