

Volume 6 | **SPRING 2017**

GETTING THE MOST OUT OF AXIS

DEVELOPING BEST-IN-CLASS MODELS

Editor's words: Welcome to the Spring 2017 edition of our AXIS modeling newsletter. This issue shares guiding principles for model development and illustrates AXIS functionality for advanced Universal Life (UL) premium persistency and dynamic surrender modeling. 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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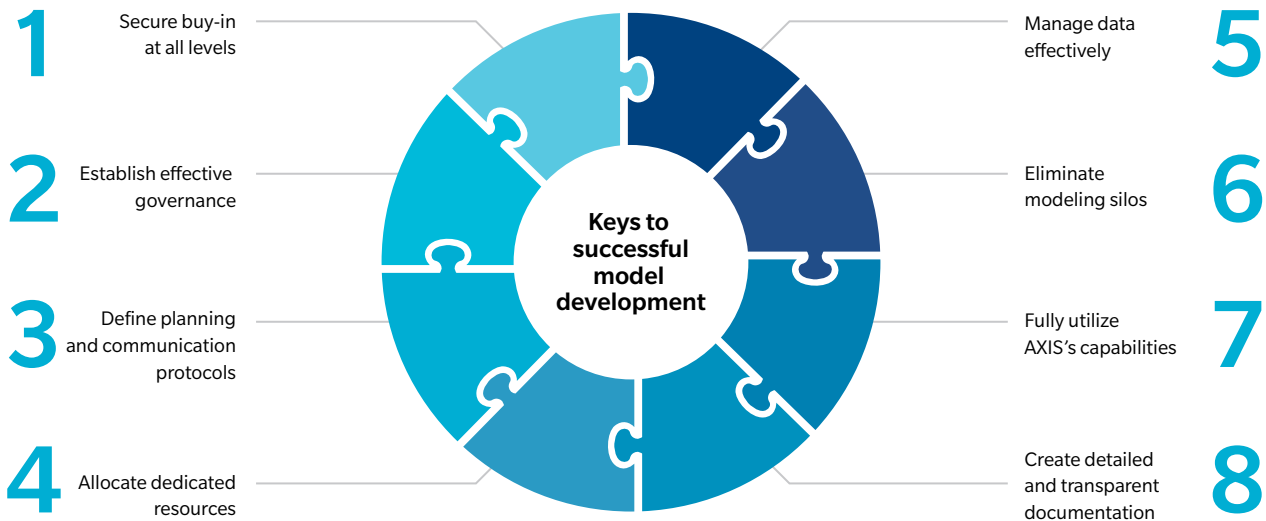
WHAT'S NEW IN AXIS

KEYS TO SUCCESSFUL MODEL DEVELOPMENT

Building, enhancing and reviewing models are core components of many actuarial departments' day-to-day activities. Hence, it is important to develop models in a structured manner so that they are robust and adaptable to current and future stakeholder needs.

This article outlines eight guidelines for successful model development, including a desired outcome and a key consideration associated with each.

Exhibit 1: Eight guidelines for successful model development



1. SECURE BUY-IN AT ALL LEVELS

Desired outcome: The final model meets the needs of all stakeholders

Key consideration: Senior management involvement

Model development is typically performed in reaction to or in anticipation of internal or external change. It is crucial that all impacted stakeholders have a say and a role in defining the model scope, required functionality and output design.

Senior management involvement plays a crucial role in ensuring goals are clearly defined, communicated and understood and is instrumental in setting the tone around the model's importance to all involved.

2. ESTABLISH EFFECTIVE GOVERNANCE

Desired outcome: Model development is robust, comprehensive and timely

Key consideration: Documenting research and rationale behind – and approvals of – key decisions

As part of model development, all significant model methodology, model design and assumption recommendations should be reviewed and approved by a panel of key stakeholders and subject-matter experts prior to implementation.

Establishing a governance committee with the directive of reviewing, approving and documenting key model decisions helps ensure the model is robust and also adds an important layer of model auditability.

Further, forming a steering committee of senior stakeholders with the mandate of guiding overall model development helps ensure achievement of major goals and milestones and adherence to budget.

“Effective governance...[helps ensure] model development is robust, comprehensive and timely”

3. DEFINE PLANNING AND COMMUNICATION PROTOCOLS

Desired outcome: Model developers and stakeholders are aligned on progress, with no surprises

Key consideration: Accounting for and communicating with all required parties

Before undertaking any form of model development, it is essential to outline a development plan or roadmap.

The roadmap should capture:

- A. Clear and realistic goals
- B. Major planning, development, testing and documentation work steps
- C. Potential roadblocks
- D. Staffing requirements (core developers, data providers and subject-matter experts)
- E. Interim tollgates and final deliverables
- F. Timelines

The roadmap should be communicated effectively to all stakeholders to ensure they are aware of and on board with expectations and given an opportunity to provide feedback.

TIPS & TRICKS

Dealing with duplicate table values

As a model is updated over time, multiple versions of the same table (i.e., with different names but identical values) may proliferate. This creates redundant effort to maintain the model, and introduces risk that updates are not properly made to all applicable tables. For instance, two tables containing tax valuation interest rates would need to be updated when the latest calendar year rate becomes available. Thus, it is generally cleaner and more robust to eliminate duplicate tables.

In order to address duplicate tables:

1. Right click in the Tables section of AXIS and hover over “Advanced” and then “Tables”
2. Select “Find Duplicated Tables...” where you can then select to search all tables in the Dataset or only those in a current list
3. A list of tables with duplicate values will be generated. From here the user can click “Remove All Duplicates”, which will set the first table from each group of duplicates to be used in place of the others. The duplicated tables will be deleted from the Dataset

This functionality will identify duplicate table values, grid values, and Formula and Rules Table code. The user should be mindful, however, of Composite Formula Tables since the functionality will currently identify duplicate code even if the child tables are different (being addressed by job #47383).

Mapping processes in DataLink or outside of AXIS will need to be updated to reflect the subset of tables remaining.

Finally, clearly-defined communication protocols within and between the model development team and key stakeholders should be established. Channels for ongoing feedback, status updates and governance and steering committee meetings should be decided at the onset of the development effort.

4. ALLOCATE DEDICATED RESOURCES

Desired outcome: Model development is efficient and effective

Key consideration: Knowledge transfer to model end-users

It is often beneficial when dedicated resources, with limited distractions from other responsibilities, are allocated to model development. One developer at 100% is typically more effective and focused than five developers at 20%, thus promoting momentum. Part-time resources are generally limited to subject-matter experts or oversight roles.

If few model end-users are involved in day-to-day model development, it becomes more important to (1) communicate and promote knowledge transfer throughout the duration of the development effort, and (2) create effective model documentation and provide training to end-users at the conclusion of development.

⚠️ AXIS, like most actuarial systems, only allows for one user or developer to be actively using a given model at any one time. Thus, smaller development teams tend to be preferable for coordinating and merging multiple model changes.

5. MANAGE DATA EFFECTIVELY

Desired outcome: Timely access to accurate and complete data

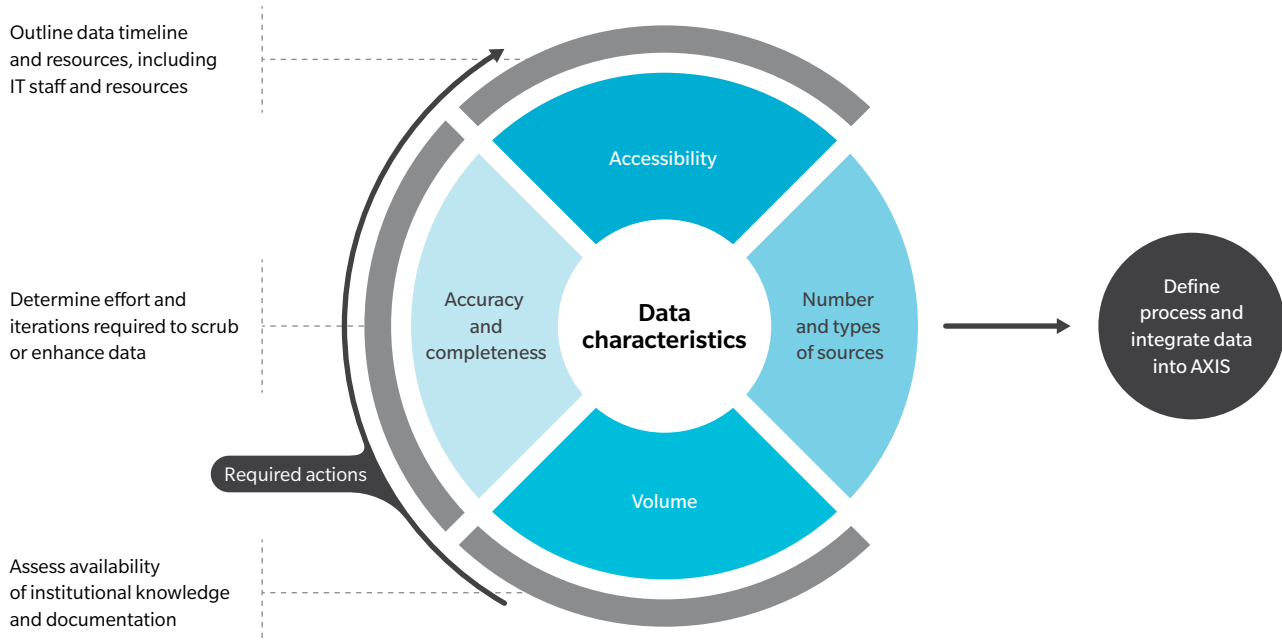
Key consideration: Data management is often the driving force behind model development success or failure

There is typically a significant amount of data required to develop an actuarial model. Policy-level and plan-level information often accounts for the majority of data volume; however, other data elements, such as assumptions, are also required.

All applicable data sources and formats should be identified as early as possible in the model development process. A plan should be in place to effectively automate and consolidate the data management process.

“Data management is often the driving force behind model development success or failure”

Exhibit 2: Considerations and actions required to secure appropriate data for model development



- ⚠ **AXIS can consume both pre-defined static data and dynamic data on-the-fly. A well-planned data infrastructure can unlock desirable AXIS capabilities, including automatically running production without user involvement. These types of processes are easily scalable, such that new runs can be added or removed without altering the underlying model.**

6. ELIMINATE MODELING SILOS

Desired outcome: Models that span multiple functional areas or product lines

Key consideration: Rigidity of organizational structures

Actuarial models are required for a variety of purposes depending on the functional or product area within a company. Modeling silos exist when multiple platforms, models or processes are used. For example, maintaining a valuation model and pricing model for a particular product may result in overlapping processes, model inputs and outputs. Thus, building, validating and maintaining multiple models leads to wasteful duplication of effort. Developing a minimal number of models (i.e., single model or model suite) capable of handling multiple functions can help break down these silos.

- ⚠ **AXIS has the functionality to combine and standardize multiple actuarial functions such as pricing, projections and valuation into a consolidated model. Further, multiple reporting bases can be projected in a single run. Developing consistent model structures and naming conventions are crucial elements in maximizing AXIS model portability and adaptability.**

7. FULLY UTILIZE AXIS'S CAPABILITIES

Desired outcome: A flexible, adaptable and transparent end-to-end modeling and reporting process from data to results

Key consideration: Best-in-class implementation requires deep platform expertise

Best practice involves developing a full end-to-end modeling and reporting process from data to results. Minimizing the use of external spreadsheets, manual interventions and outside-of-model adjustments are important steps in developing a robust, flexible, adaptable and transparent model.

⚠️ AXIS offers a wide range of modeling capabilities, meaning that there often exist alternative approaches to achieving a desired result. As certain approaches may address a need better than others, developers should consider a range of criteria (e.g., efficiency, flexibility, transparency) before committing to a specific model design.

8. CREATE DETAILED AND TRANSPARENT DOCUMENTATION

Desired outcome: Strong institutional knowledge and improved model usability and auditability

Key consideration: Model documentation should be updated alongside the model

Creating robust and user-friendly model documentation is just as important as developing the model itself. All key methodology decisions, simplifications, approximations and data limitations should be clearly documented to ensure understanding and portability. A consistent set of standards for model maintenance and testing should also be codified.

IN CLOSING

Following these eight simple guidelines promotes the development of efficient and flexible models which satisfy current and future stakeholder needs.

IN THE SPOTLIGHT

MODELING UNIVERSAL LIFE DYNAMIC POLICYHOLDER BEHAVIOR

INTRODUCTION

Defining features of most Universal Life insurance and its variants (i.e., Indexed UL, Variable UL) are (1) the level and timing of premium payments is flexible and (2) the policyholder can surrender at any time for a cash surrender value. Consequently, there exists a wide range of potential financial outcomes driven by policyholder behavior. Inadequate reflection of these potential outcomes in financial models carries a number of risks, including:

1. Inaccurately portraying policy overfunding or underfunding
2. Ignoring late duration claims (i.e., mortality risk) by reflecting premature policy termination
3. Disregarding the in-the-money-ness (ITM) profile of policies with material guarantees, such as secondary guarantees

Current industry best practice involves the segmentation of UL policies into distinct behavioral “buckets” for modeling purposes. (The process for policy segmentation may take a number of forms.) From a financial modeling perspective, a segmented approach promotes a holistic view of policyholder behavior when coupled with dynamic adjustments to modeled premiums and surrenders based upon policy-specific and market conditions.

“From a financial modeling perspective, a segmented approach promotes a holistic view of policyholder behavior...”

This article will discuss four common behavioral buckets and provide an overview of associated AXIS modeling functionality and implementation considerations.

DYNAMIC PREMIUM FUNDING

As for any modeling approach, assumed UL policyholder behavior and the corresponding modeling implementation of each behavioral bucket inherently demonstrate notable benefits and limitations. There also exist a number of data considerations which fall outside the scope of this article.

TIPS & TRICKS

Font settings

For a Dataset with hundreds or thousands of Cells, quickly comparing the naming convention – and thus the characteristics – of each may be difficult. For example, the names of the first few Cells may appear on screen as follows:

TERM10-M-SN-2013

TERM20-F-PN-2014

WL -F-SS-2012

WL -M-PS-2013

Even though the Cell names adhere to a pre-defined naming convention, the risk classes and issue years are difficult to identify because the characters are different widths, i.e., the “W” for the Whole Life plan takes up more room than the “T” in the Term plan. To line up each character position, use a fixed width font.

From the top menu, select “Tools” > “Set Font for All Views...” and then select a fixed width font like “Courier.” All the names should then line up as follows:

TERM10 -M-SN-2013

TERM20 -F-PN-2014

WL -F-SS-2012

WL -M-PS-2013

This trick also works for other AXIS objects, such as Tables and Subfunds.

Exhibit 1: Illustrative premium funding approaches

BEHAVIORAL BUCKET	ASSUMED POLICYHOLDER PREMIUM FUNDING APPROACH	BENEFITS	LIMITATIONS
Minimum funders	Policyholder continues to fund at current premium levels until there is insufficient fund value to keep the policy in force. At this point, the policyholder pays the minimum monthly premium required to keep the policy in force	<ul style="list-style-type: none"> • Captures tail risk by preventing early termination • Policy-specific adjustments prevent distortion of ITM profiles 	<ul style="list-style-type: none"> • For mis-bucketed policies, does not account for potential overfunding
Paid-ups	Premium funding will be maintained at current levels until either the current fund or secondary guarantee become fully funded. After this point no premium will be paid	<ul style="list-style-type: none"> • Limits projected overfunding and associated profits, which are unlikely to be realized • Policy-specific adjustments prevent distortion of ITM profiles 	<ul style="list-style-type: none"> • Paid-up logic may not be forward looking (i.e., overfunding may still exist if credited rates increase) • Does not account for underfunding and, thus, may ignore tail risk
Active investors	The policyholder has an expected fund value accumulation pattern in mind, and frequently reviews and adjusts premium funding patterns based on this benchmark	<ul style="list-style-type: none"> • Captures tail risk by preventing early termination • Prevents modeling unrealistic profits due to overfunding or underfunding • Calibration to benchmark funding level keeps both fund value and ITM profile on an expected path 	<ul style="list-style-type: none"> • Complex to implement and requires additional testing
Passive investors	Similar to the active investor but reviews and adjusts premium funding patterns less frequently	<ul style="list-style-type: none"> • Same as for active investors • Also allows for drift between actual and benchmark funding level 	<ul style="list-style-type: none"> • Same as for active investors

For each of the aforementioned buckets, the following sections include an illustrative example of an in-force “sample policy” currently in duration 10 and having an original issue age of 65 and maturity age of 121. In each case, the “initial premium” level is assumed equal to the current premium funding level as of the model start date.

OVERVIEW OF AXIS FUNCTIONALITY

AXIS offers a range of functionality for determining the level and pattern of modeled premiums. One approach is to start with a policy-level input premium and then to calculate and apply adjustments. The policy-level adjustments in the examples below were calculated by AXIS and are automated, dynamic to market conditions and compatible with the modeling of Principles Based Reserves.

Generally, the minimum funder bucket can be implemented in AXIS using available switches, while the other buckets require the use of Formula Tables.

“AXIS offers a range of functionality for determining the level and pattern of modeled premiums”

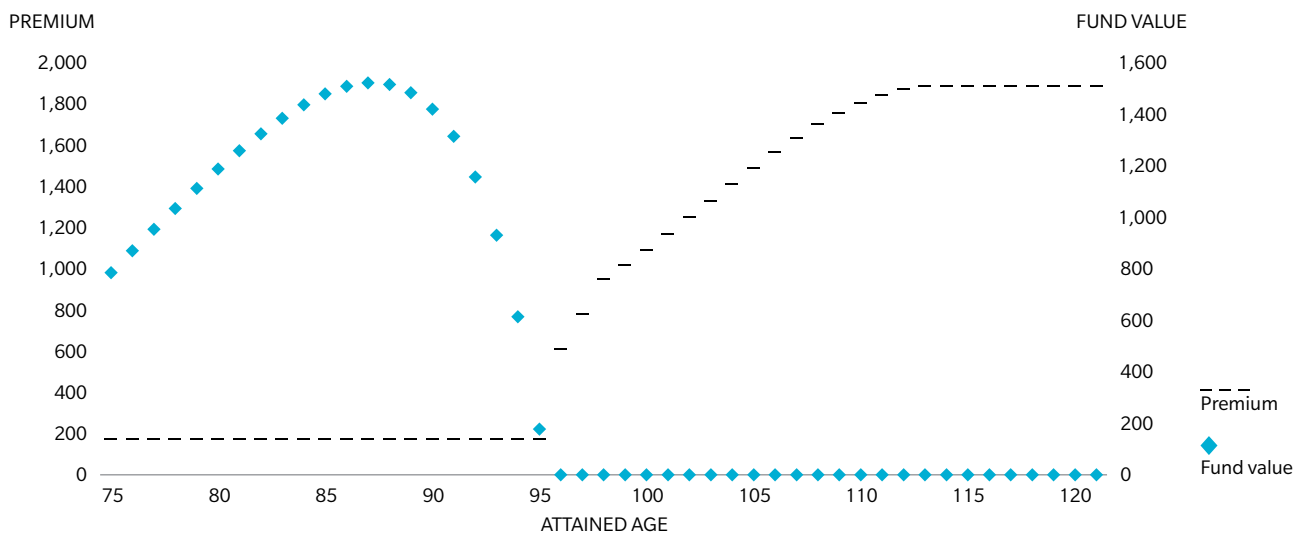
MINIMUM FUNDERS

AXIS contains a switch “Dynamic premium adj” which allows required additional payments to be based upon current fund value, shadow fund (notional account or “NA”) value, or the larger of the two, at the point there exists insufficient fund value to keep the policy in force. For example, option “6 – Pay extra premium monthly to avoid early termination of main acct or NA” considers both the current and the shadow fund in determining the monthly required premium.

For cumulative premium (or very complex) secondary guarantee designs, Formula Table logic may be required.

As illustrated in Exhibit 2, the initial premium is insufficient to carry the sample policy to maturity. The minimum additional monthly premium is automatically calculated by AXIS to keep the policy in force.

Exhibit 2: Illustrative minimum funder premium and fund value projection



PAID-UPS

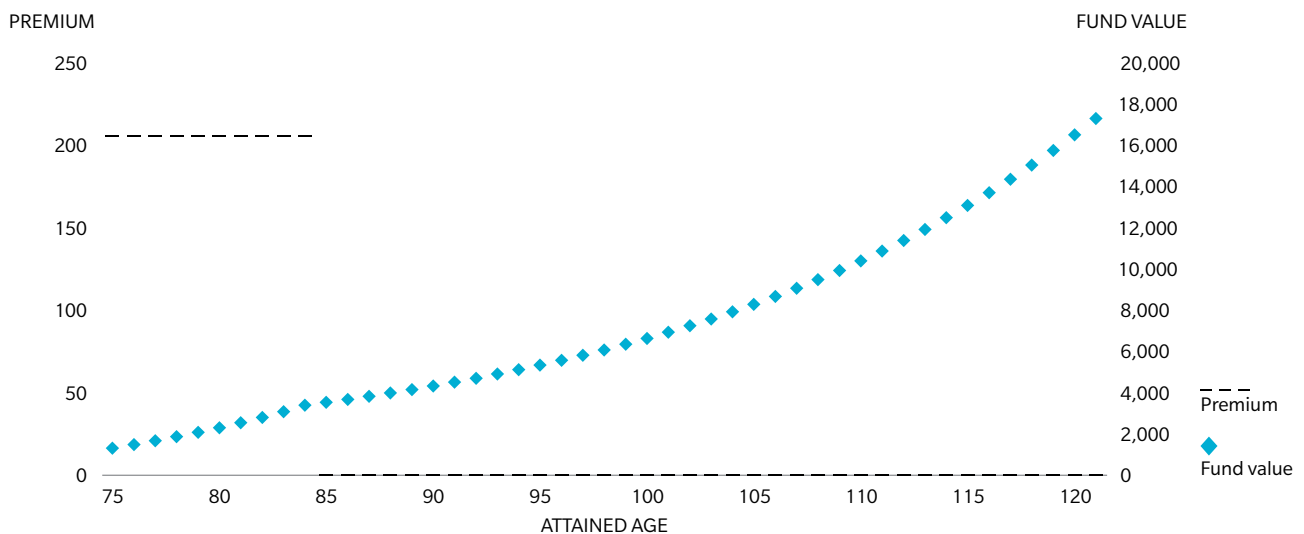
AXIS contains functionality to determine, on-the-fly, whether a policy is paid-up through the use of Formula Table “FT: Total prem with calc table”:

- In the “Premium Calculation Table” section, the model developer should enter product specifications and the expected credited rate
- The function “AnnualizedLevelPremiumFromPremCalcTable” can then be used to calculate future premium required to keep the policy in force to maturity

There are a few considerations for implementation. First, paid-up logic typically relies on current credited rates; if future modeled credited rates emerge higher or lower than expected, then the policy will be projected to be overfunded or underfunded. Second, there may be noise in the solving routine relative to the actual policy projection due either to rounding or simplifying assumptions made by the model developer. To avoid an unintended early fund lapse, the developer may decide to revert to modeling the initial premium if the policy loses its paid-up status later in the projection.

As illustrated in Exhibit 3, continuing to fund the sample policy at the initial premium level would overfund the policy; thus, AXIS dynamically adjusts future modeled premiums to zero once paid-up status is reached. Ultimately, rather than running down to zero at maturity, fund value continues to accumulate due to favorable future credited rates relative to those assumed when solving for paid-up status.

Exhibit 3: Illustrative paid-up premium and fund value projection



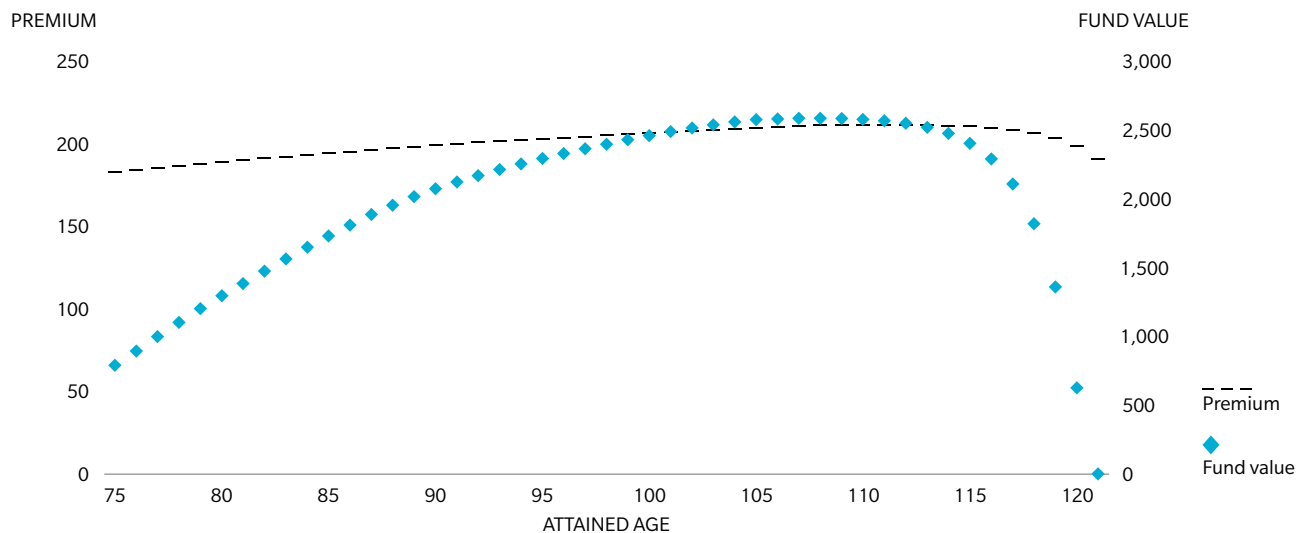
ACTIVE INVESTORS

The active investor is assumed to calibrate premium up or down in order to hit the expected accumulation benchmark (either current fund or shadow fund). AXIS contains functionality to determine, on-the-fly, the current funding level relative to a benchmark using either Formula Table “FT: Total premium” or “FT: Total prem with calc table”:

- A combination of static variables and standard input variables such as “RiskChargeLM” can be used to track the benchmark funding level (i.e., fund value)
- In the “Premium Calculation Table” section, the model developer should enter product specifications and the expected credited rate
- The function “AnnualizedLevelPremiumFromPremCalcTable” can then be used to calibrate the premium to target the benchmark funding level

As illustrated in Exhibit 4, at policy issue an assumed premium funding level is solved for under a constant credited rate. However, market conditions deteriorate, leading to a lower credited rate. Additional premium is required to carry the sample policy to maturity, which the active investor frequently revisits, resulting in a smooth progression of modeled premiums.

Exhibit 4: Illustrative active investor premium and fund value projection

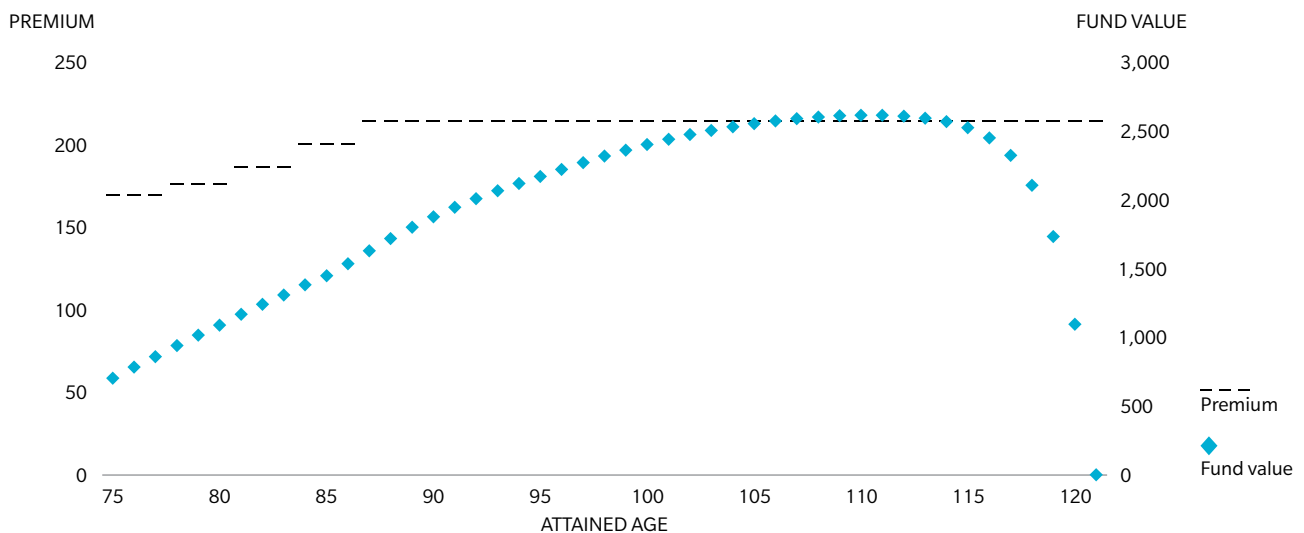


PASSIVE INVESTORS

The passive investors bucket is similar to active investors, where the model developer codes logic such that a new premium is solved for periodically.

As illustrated in Exhibit 5, at policy issue an assumed premium funding level is solved for under a constant credited rate. However, market conditions deteriorate, leading to a lower credited rate. Additional premium is required to carry the sample policy to maturity, which the passive investor revisits only periodically, resulting in a step-wise progression of modeled premiums.

Exhibit 5: Illustrative passive investor premium and fund value projection



DYNAMIC SURRENDERS

Current industry best practice involves the reflection of dynamic surrender behavior in UL models. Surrender rates could vary by the following, which are often interrelated:

- A. Premium funding level
- B. Policy funding level (i.e., current fund value)
- C. ITM profile, for policies with a secondary guarantee
- D. Paid-up status
- E. Competitor benchmarks (i.e., credited rates)

A company's UL product design and historic and anticipated experience typically dictate the degree to which – and manner in which – dynamic surrenders are reflected. For example, depending on whether a policy is sold primarily for protection or accumulation, premium and surrenders could either be negatively or positively correlated.

Below are some illustrative dynamic surrender implementations in AXIS and notable associated benefits and limitations. All these approaches can be implemented in AXIS using the Formula Table “FT: Extra Lapse”.

Exhibit 6: Illustrative dynamic surrender approaches

BEHAVIORAL BUCKET	ASSUMED DYNAMIC SURRENDER APPROACH	BENEFITS	LIMITATIONS
Minimum funders	No surrenders when fund value is zero	<ul style="list-style-type: none"> Reflects ITM profile of secondary guarantee Captures tail risk by preventing early termination 	<ul style="list-style-type: none"> Reflects a binary approach
Paid-ups	Zero surrenders when paid-up	<ul style="list-style-type: none"> Reflects ITM profile of secondary guarantee Captures tail risk by preventing early termination 	<ul style="list-style-type: none"> Reflects a binary approach
Active and passive investors	Adjust surrender rate per dynamic premium adjustment	<ul style="list-style-type: none"> Can be custom-fit to company experience and product design Dynamic adjustments typically cover a range of values rather than being binary 	<ul style="list-style-type: none"> Complex to implement and requires additional testing

CONCLUSION

Current best-practice UL modeling involves a holistic approach that considers both dynamic premium funding and surrenders by segmenting policies into distinct buckets and assigning each a set of behavioral characteristics. AXIS has a range of built-in functionality that makes it well suited to reflect such a holistic modeling approach.

TIPS & TRICKS

Alternative to Formula Table debugging

Coding AXIS Formula Tables may involve a lot of debugging. An alternative to iterating through the code using the built-in AXIS Script Debugger or FormulaLink module is to print values of particular variables or interim calculations to a text file.

Sample code that could be used in the Extra Lapse Formula Table, for instance, is as follows:

```
Dim FHandle As Long
FHandle = FOpenForAppend ("<INSERT PATH TXT FILE>")
Call FPrintSingle (FHandle, CurrentPolicyMonth)
Call FPrintString (FHandle, ",")
...<code to print interim variables>...
Call FPrintSingle (FHandle, ExtraLapseTM)
Call FPrintNewLine (FHandle)
Call FClose (FHandle)
```

WHAT'S NEW IN AXIS

ACTUARIAL ASSUMPTION SETS

Description

- For Regular Life, Universal Life, Par Products, Disability, Annuity, and Group Annuity modules, the pricing and reserve assumptions in AXIS have been encapsulated into groups called Assumption Sets
- The user can choose up to 99 separate sets of assumptions per module
- An Assumption Set can be applied for multiple assumption bases within the Cell

Details

- Version 20170501

Learn more

- <https://www.ggy.com/Client-Content/News/Assumption-Sets-2016-11/> (video demonstration)
- <https://www.ggy.com/client/BugEnhance/UpdateDetail/22602/>

VM-20 RATING SPECIFIC DEFAULT CHARGE COMPOSITE TABLE FOR SUPPLEMENT TABLE ASSETS

Description

- For Asset and Reinvestment Cells, a new type of table called "Rating specific def charge [Composite]" has been added
- This table determines a default rate that replaces the input under Pricing Projection Assumptions. The default charge and margin in the composite table are based on credit rating and a calculated weighted average life
- A new "Credit rating" switch has been added in the "Supplement table processing" section to allow use of the rating for assets modeled using Supplement Tables

Details

- Version 20170701

Learn more

- <https://www.ggy.com/client/BugEnhance/UpdateDetail/22616/>

SWITCH TO AUTOMATICALLY SHIFT ISSUE DATES TO MONTH END OR MONTH START

Description

- In the Annuity module, a new switch called "Seriatim issue date modification" has been added
- This switch provides the option to shift the issue date of seriatim policies to:
 - Month start
 - Month end
 - Closer of month start and month end

Details

- Version 20170401

Learn more

- <https://www.ggy.com/client/BugEnhance/UpdateDetail/22372/>

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