

Volume 2 | **FALL 2019**

# PROFITING FROM PROPHET

## PREPARING FOR THE FUTURE

**Editor's words:** Welcome to the Fall 2019 edition of our Prophet modeling newsletter. This issue takes a look at the modeling impacts of US variable annuity ("VA") statutory reform and the use of Prophet Assumptions Manager in supporting the controls and governance of actuarial assumptions, a common industry "pain point". You will also find helpful tips and tricks and a summary of Insurance Data Repository ("IDR"), an exciting new Prophet product. We hope you enjoy the newsletter!

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# US VARIABLE ANNUITY STATUTORY AND CAPITAL FRAMEWORK REFORM: PREPARING FOR IMPLEMENTATION

## INTRODUCTION

Major regulatory reforms are impacting US life insurers. In our Spring 2019 Executive Corner, we covered the modeling considerations for US GAAP long duration targeted improvements (“LDTI”). In this edition, we will cover another major industry change: NAIC variable annuity statutory and capital reform.

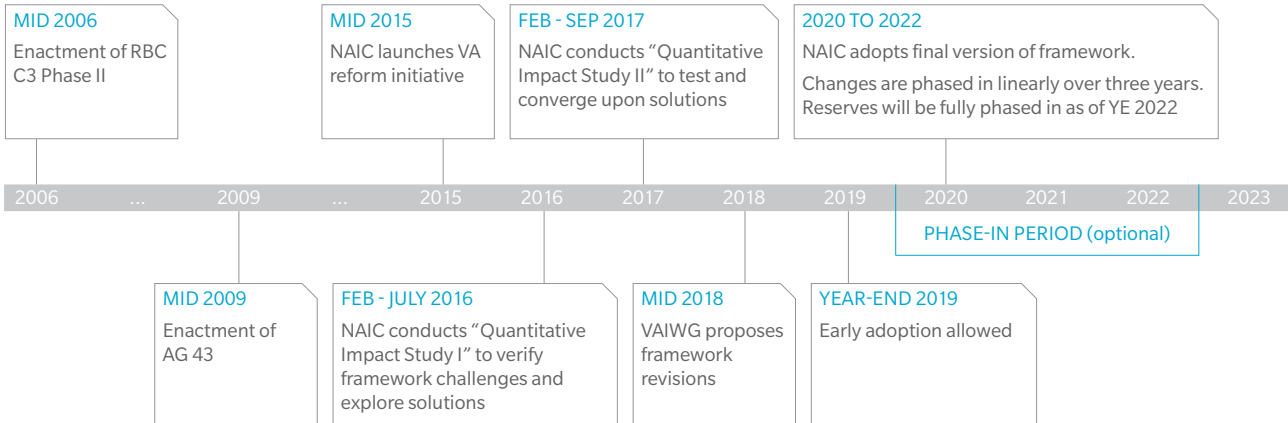
Over the past four years, the Variable Annuities Issues Working Group (“VAIWG”) has worked to establish a new framework for determining US statutory reserves and risk-based capital with the intention of reducing non-economic volatility in reserves and decreasing utilization of captives.

Two quantitative impact studies (“QIS”) were performed leading to most of the recommended changes addressing the VAIWG’s goals. The VAIWG met in March and May of last year to review each recommendation. In a joint session with the VAIWG, the Financial Condition Committee met on July 31, 2018, and unanimously voted to adopt the new VA framework<sup>1</sup>. Since then, a final revision of the VA framework was completed and adopted at the NAIC Summer meeting in August 2019. The framework is set to take effect on January 1, 2020 with a three-year optional phase-in-period<sup>2</sup>, as well as an option for early adoption. It applies retroactively to all in-force business, not only new business. Exhibit 1 summarizes the VA reform history and key dates.

*“[VA reform] is set to take effect on January 1, 2020 with a three-year optional phase-in-period, as well as an option for early adoption.”*

1. New York, as part of the VAIWG, voted against the adoption of the framework  
 2. Companies may elect a longer phase-in period, up to 7 years, with approval of domiciliary commissioner

**Exhibit 1: VA statutory reform history**



## SUMMARY OF VA STATUTORY REFORM CHANGES

Exhibit 2 summarizes many key changes associated with the adopted framework.

### Exhibit 2: VA statutory reform – key changes\*

CHANGE	DESCRIPTION
<b>Standard Scenario</b>	<ul style="list-style-type: none"> <li>Calculates the Total Standard Projection Amount (“TSPA”) as a scenario GPVAD using the same mechanics as the CTE 70 “adjusted” run and prescribed policyholder behavior</li> <li>Standard Scenario becomes an “add-on”, calculated as the difference between the TSPA and the CTE 70 adjusted, net of a buffer</li> <li>Two options are available to calculate the TSPA: (1) use 40 prescribed market paths and calculate the average GPVAD for the two scenarios closest to the CTE 70 adjusted or (2) use the same set of stochastic scenarios as the CTE 70 adjusted run, but with prescribed policyholder behavior</li> </ul>
<b>Asset modeling and greatest present value of accumulated deficiencies (“GPVAD”) calculation</b>	<ul style="list-style-type: none"> <li>Removes working reserve (aligns with VM-20)</li> <li>Discounts deficiencies at the net earned rate on additional assets; allows starting assets to be iteratively solved for such that the average GPVAD in the tail scenarios is zero</li> <li>Follows VM-20 guidance on general account assets (NAIC prescribed gross spreads and default costs, with company investment expense assumptions); disallows CTE amount to be lower than what would be calculated from a reinvestment portfolio of 50/50 AA/A bonds</li> </ul>
<b>Other Implications</b>	<ul style="list-style-type: none"> <li>Designates VM-20 scenario generator as prescribed interest rate and separate account return generator, including the parameterization specified in VM-20. Prescribed mean reversion parameters will likely be lower than what most companies use, thereby increasing unhedged reserves for those companies</li> <li>Allows the use of an alternative economic scenario generator (“ESG”) <b>if and only if</b> it does not materially reduce the total asset requirement</li> </ul>

\* There are additional proposed changes not covered in this article (e.g., C-3 capital calculation, treatment of hedges, disclosure requirements). The full list of changes can be accessed on the VAIWG’s website.

## MODEL IMPLICATIONS

Modeling implications resulting from VM-21 VA reform requirements are significant.



### TOTAL STANDARD PROJECTION AMOUNT

The updates to the Standard Scenario calculation, now named the Total Standard Projection Amount, require a new set of prescribed assumptions that will need to be incorporated into models. As mentioned in Exhibit 1, the new framework offers two methods to generate the TSPA. Prophet has released out-of-the box functionality to support both methods. Depending on the chosen method, models may also need to be configured to support two sets of scenarios: a deterministic scenario set and a stochastic scenario set. The TSPA may be the most challenging aspect of VA reform to implement and test in models.



### STOCHASTIC RESERVE

Updates to the stochastic reserve calculation will also require updates to current models. One major change is to the determination of the scenario reserve. First, the model calculation for accumulated deficiencies will need to be updated to exclude the “working reserve”. Second, the method for discounting accumulated deficiencies was changed and now may require iterative processing. There are two options to determine the final scenario reserve: (1) directly solving for the starting assets needed to produce no future deficiencies or (2) solving for a net asset earned rate on additional assets to discount projected accumulated deficiencies.



### ASSUMPTIONS MANAGEMENT

The necessary capability to manage and store additional assumption sets is another key model implication. Asset modeling requirements were updated under VM-21. Company-owned assets must use prescribed default costs, while reinvestment assets must use prescribed asset spreads and default costs. Additionally, the CTE amount cannot be lower than the amount that would be calculated assuming a reinvestment strategy with 50/50 blend of AA/A corporate non-callable bonds. Therefore, asset and reinvestment assumptions may have to vary between VM-21 calculations and other company uses (e.g., plan).



### ECONOMIC SCENARIOS

While a company is permitted to use an alternative ESG than the Academy Interest Rate Generator (“AIRG”), the alternative ESG cannot reduce the reserve. Due to this restriction, it is expected that the prescribed scenario generator will be predominantly used for calculating stochastic and standard scenario reserves. An implication of moving to the prescribed scenario generator is that the mean reversion parameter for most companies will drop, increasing reserves that are not Rho hedged. In terms of implementation, models will need to either be updated to be able to generate scenarios consistent with the prescribed scenario generator or be modified to accept imported scenarios produced externally. The implementation effort for this change is expected to be relatively minimal, as Prophet already supports importing AIRG scenarios and will soon support on-the-fly generation of AIRG-compatible scenarios.

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*“The [Total Standard Projection Amount] may be the most challenging aspect of VA reform to implement and test in models.”*

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## LEVERAGING PROPHET FOR YOUR VA REFORM IMPLEMENTATION

Prophet has released out-of-the-box functionality to facilitate implementation of VA reform.

The current US 360 Life & Annuity (“US 360”) and Asset Liability Strategy (“ALS”) offering supports VM-21 through both nested and point-in-time runs with shared code and product bases. US 360 also supports the flexible toggling of prescribed VM-21 assumptions within a liability projection, allowing products to be shared between VM-21 or general projection use.

A summary of key functionality can be found in Exhibit 3 below. The full VM-21 offering in the US 360 library is expected to be available by year-end 2019.

Exhibit 3: Prophet VM-21 reform functionality availability

LIBRARY	VM-21 FUNCTIONALITY AVAILABILITY	UPDATE PERIODICITY
<b>US 360 Life &amp; Annuity</b>	Already available <ul style="list-style-type: none"><li>Additional Standard Projection Amount calculations</li></ul> Expected in Q4 2019 <ul style="list-style-type: none"><li>New reserve base to allocate reserves back to policy level</li><li>C3 Phase 2 updates</li></ul>	Frequent
<b>Asset Liability Strategy</b>	Already available <ul style="list-style-type: none"><li>ALS updates needed for final VM-21 reserves computations</li></ul>	Frequent
<b>NA US Life &amp; Annuity</b>	Expected in 2020 <ul style="list-style-type: none"><li>VM-21 Prescribed Assumptions</li><li>C3 Phase 2 updates</li></ul>	Periodic

## CONCLUSION

VA statutory and capital framework reform requires modeling updates, careful validation, and subsequent management review of impacts. Insurers are working to understand how their statutory financials will be impacted by the adopted framework and strategically planning their implementation efforts. Thus, model developers and end-users should understand the upcoming VM-21 regulatory changes and related Prophet functionality enhancements.

## TIPS & TRICKS

### Prophet Excel Reporting Functions

Prophet's ability to fluidly connect run outputs to Excel is a powerful feature widely used to support audit recalculation questions as well as internal reporting needs. Most Prophet users are familiar with common Prophet Excel functions such as *Proj\_Result* and *Stoch\_Result*. However, many users may be unaware of a number of lesser known but equally valuable Prophet Excel functions. A full list of Prophet Excel functions can be found in Prophet's help feature under the "Prophet Excel Reporting Worksheet function summary" section. This section includes a description and syntax definition for each function.

A few particularly useful and oft-overlooked Prophet Excel functions are summarized below:

- **Dim\_Size and Dim\_Description:** Returns the dimension size/description of the specified array variable
- **Prod\_Detail:** Returns a specified aspect of the defined product/accumulation. Examples of aspects include the date the product was last modified, a description of the product, and the library linked with the product. Product names are generally abbreviated in Prophet and not always intuitive; as such, this function can be a key documentation enhancement
- **Results\_Date\_Time:** Returns the date and time of a results file's last modification. This function is particularly useful from a controls perspective to ensure the workbook is pulling data from the correct model run file(s)
- **Results\_Detail:** Returns details from a defined Prophet results file, including the start year, past and future accumulation period, and company year-end valuation month
- **Var\_Detail:** Returns a specified aspect of the defined Prophet variable. Aspects include the variable description, the number of decimal places specified in the Workspace, and whether the variable is a Balance Sheet item. In particular, variable descriptions can significantly improve workbook documentation

For examples of the various ways in which Prophet Excel functions can be utilized, users may reference one of the numerous pre-designed Prophet reporting templates. These templates are accessed under the Prophet ribbon in Excel by selecting the "Templates" icon on the menu bar.

# PROPHET ASSUMPTIONS MANAGER BEST PRACTICES

## INTRODUCTION TO ASSUMPTIONS MANAGER

Prophet's Assumptions Manager is an enterprise-level tool intended to help establish centralized governance of assumptions for Prophet runs. By allowing for a controlled, automatable, and auditable process for maintaining and updating Prophet tables across multiple workspaces, companies can better analyze, update, and govern crucial model inputs.

Assumptions Manager facilitates the organization and sharing of assumptions across models by managing assumptions independently from the underlying Prophet tables, leveraging the multi-user nature of Prophet Enterprise ("PE") to institute software-level controls across the organization.

Subsequent sections of this article will explore how Assumptions Manager can facilitate the core objectives of assumptions governance, key functionality and benefits of Assumptions Manager, and important considerations when working with Assumptions Manager.

## WHAT'S NEW IN PROPHET

### Insurance Data Repository ("IDR")

Due to shifting regulatory requirements, insurers are experiencing increasing demands on data management and processing capabilities. Prophet's Insurance Data Repository presents an auditable, client-customizable solution for storing, accessing, and processing data.

IDR is a framework hosted in Microsoft SQL Server that is able to:

1. Consolidate and transform data from various sources within and outside the Prophet ecosystem
2. Act as a centralized data warehouse by integrating Prophet projection output, in-force data, and other sources of data
3. Process data for downstream use cases, such as financial systems and reporting applications

By having a persistent source of data, users can benefit from consistent and reliable access to information generated by Prophet runs; this is particularly important for workflows which rely on historical outputs as inputs.

Though the benefits of IDR are significant, it is critical that an organization analyzes how IDR fits within its overall technology framework and strategy before embarking on an implementation. Critical areas of implementation activities include IDR data model design, data transformation, and process integration.


# KEY OBJECTIVES OF ASSUMPTIONS GOVERNANCE


Enterprise-level assumptions governance should target four primary objectives, as outlined in Exhibit 1.

## Exhibit 1: Primary objectives of assumptions governance

### ① ONE SOURCE OF ASSUMPTIONS

All current assumptions should be identified, cataloged, and inventoried within a centralized repository that acts as a “single source of truth”.


 **Common pain point:** To date, most companies have not built a central warehouse of assumptions. Homegrown solutions can be expensive and time-consuming to develop, and they often do not include additional analytical capabilities.


 **Assumptions Manager remedy:** Shared assumptions can be applied to multiple Prophet models. Common assumptions which were previously set in multiple tables or portions of tables can be consolidated and managed in aggregate, enabling a broader view.

*“Assumptions should be periodically reviewed under an established approval process.”*

### ② STREAMLINED IMPACT ANALYSIS


The financial impact of any changes to assumptions should be readily quantifiable and auditable. In addition, historical versions of the assumptions used in model runs should be accessible and easily compared.


 **Common pain point:** Impact analysis can be difficult to perform and validate during tight production timelines, especially if it is a manual and time-consuming process.

 **Assumptions Manager remedy:** Rollforward runs and sensitivities are automated within Assumptions Manager against baseline assumptions, allowing the user to both (a) quickly and accurately capture the impact of each step in an attribution without manual input and (b) apply consistent sensitivities.

### ③ OWNERSHIP OF ASSUMPTIONS


A feedback loop should be established between the modeling team and the assumptions development team to ensure that ownership of assumption-related tasks is clear and that assumptions are correctly interpreted and implemented.


 **Common pain point:** Breakdowns in the communication chain may result in poor assumptions governance. The modeling team may also fail to correctly interpret and apply assumptions.

 **Assumptions Manager remedy:** Assumptions Manager can leverage PE controls to separate assumptions input and assumptions sign-off, allowing assumptions input to be delegated to one group and sign-off permissions granted to another group. To assist with sign-off, Assumptions Manager tracks and supports the querying of the entire history of changes made to assumptions, creating an auditable log for expedited review.

### ④ REGULAR MONITORING

Assumptions should be periodically reviewed under an established approval process. There should be a clear and controlled process to ensure that all necessary stakeholders approve of changes to the assumption and how those changes are reflected in the model.

 **Common pain point:** The assumptions review history is often not transparent or easily auditable. As a result, assumptions may not be reviewed regularly as intended, and companies may be unaware of the current state of the assumptions.

 **Assumptions Manager remedy:** Assumption changes by date can be easily identified. Assumptions which do not change in a given period can be hidden from view.

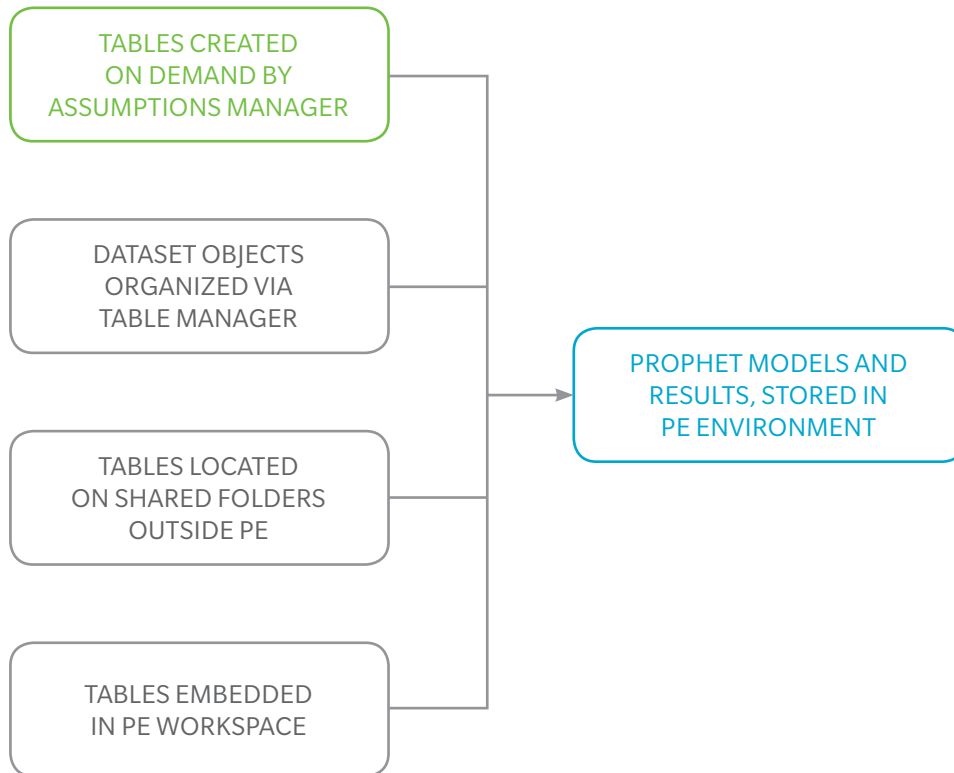


## ASSUMPTIONS MANAGER FUNCTIONALITY

Assumptions Manager operates as a table generation engine and is one of several options for provisioning tables to Prophet runs, as outlined in Exhibit 2. Rather than storing assumptions within Prophet tables, Assumptions Manager stores assumptions in new PE objects that are linked to Prophet tables. In this way, the actuarial assumptions are decoupled from the Prophet tables which house them.

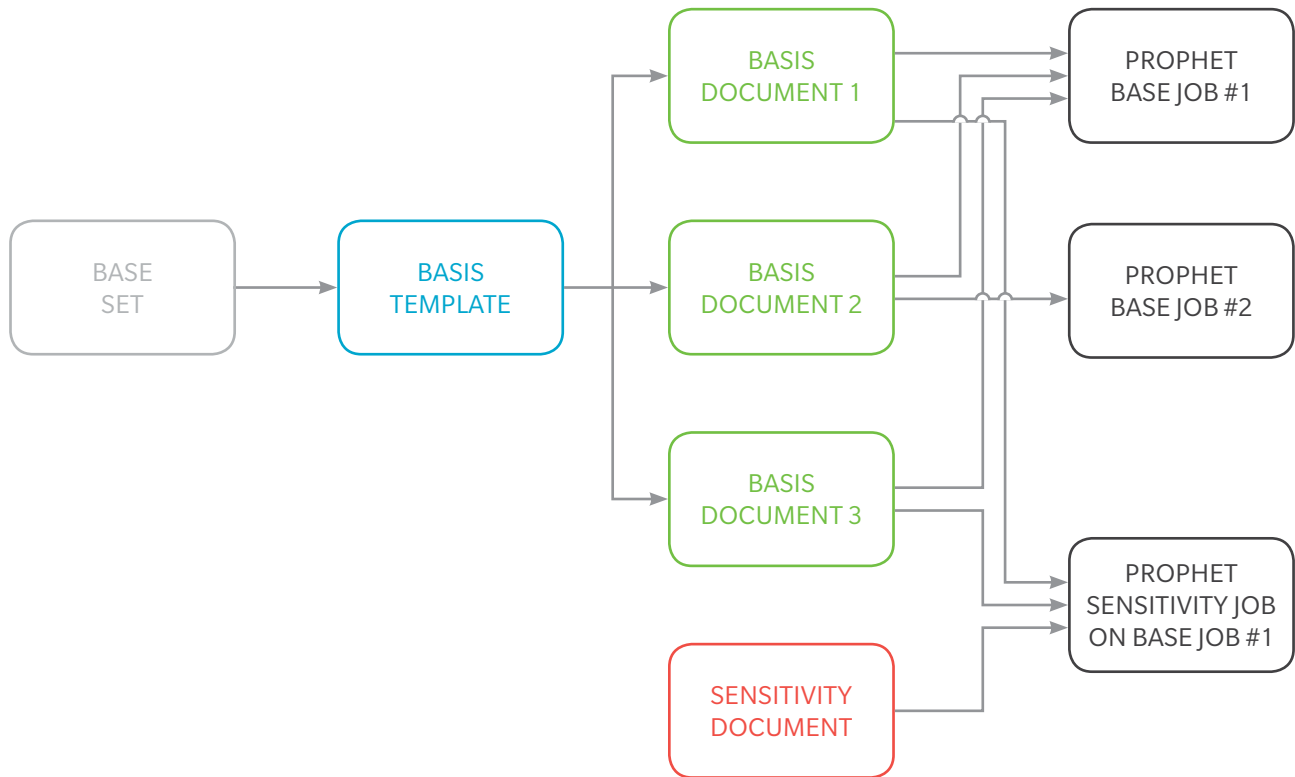
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Exhibit 2: Options for providing tables to Prophet Enterprise runs



Assumptions Manager decouples the actuarial assumptions through the introduction of four main PE objects, described in Exhibit 3.

Exhibit 3: Key Assumptions Manager Components



BASE SET	BASIS TEMPLATE	BASIS DOCUMENT	SENSITIVITY DOCUMENT
<ul style="list-style-type: none"> <li>• Holds a list of Prophet tables across multiple time periods</li> </ul>	<ul style="list-style-type: none"> <li>• Defines a mapping of assumptions to tables</li> </ul>	<ul style="list-style-type: none"> <li>• Defines actual assumptions to be used</li> <li>• Created from a Basis Template</li> <li>• Stores assumptions from multiple time periods within the same object</li> <li>• Used to define rollforward steps to be quantified and applied simultaneously</li> </ul>	<ul style="list-style-type: none"> <li>• Makes formulaic or direct changes to Basis Document assumptions</li> <li>• Allows for a range of sensitivities tables to be generated simultaneously</li> </ul>

## BENEFITS OF ASSUMPTIONS MANAGER

Assumptions Manager can significantly improve the management of model inputs and play a key role in supporting a strong assumptions governance framework. These outcomes can be achieved by leveraging (a) Assumptions Manager’s ability to manage assumptions outside of Prophet tables and easily generate sensitivities and rollforwards alongside (b) PE’s multi-user platform with per-user permissions and tracked history. Key benefits are summarized in Exhibit 4 below.

Exhibit 4: Key Benefits of Assumptions Manager

BENEFIT ASSUMPTIONS GOVERNANCE OBJECTIVE ACHIEVED	COMMENTARY
<b>Organized assumptions</b> ① ONE SOURCE OF ASSUMPTIONS ④ REGULAR MONITORING	<ul style="list-style-type: none"> <li>Inputs can be aligned to business needs, rather than to the Prophet tables where assumptions are housed. Static or unused assumptions can also be hidden, presenting assumptions “as needed” and reducing the risk of inadvertent table changes</li> </ul>
<b>Shared common assumptions</b> ① ONE SOURCE OF ASSUMPTIONS ③ OWNERSHIP OF ASSUMPTIONS	<ul style="list-style-type: none"> <li>Assumptions that are shared across multiple Prophet runs or workspaces can be set in common, reducing redundant input by users and the risk of inconsistencies</li> </ul>
<b>Streamlined rollforward runs</b> ② STREAMLINED IMPACT ANALYSIS	<ul style="list-style-type: none"> <li>Multi-step attributions can be executed from a single run. By tagging sets of assumptions which change on a recurring basis, a rollforward can be established once and reused period-over-period, significantly streamlining the production process and enhancing consistency. Importantly, changes to one step of the rollforward can be handled with ease</li> </ul>
<b>Consistent and repeatable sensitivities</b> ① ONE SOURCE OF ASSUMPTIONS ② STREAMLINED IMPACT ANALYSIS	<ul style="list-style-type: none"> <li>Sensitivities can be defined against and applied consistently to assumptions, regardless of their current values, run number, or model. This allows for large numbers of assumption runs to be produced without manual management of assumptions tables. It also ensures that standard sensitivities are applied consistently period over period</li> </ul>
<b>Enhanced auditability and governance</b> ③ OWNERSHIP OF ASSUMPTIONS ④ REGULAR MONITORING	<ul style="list-style-type: none"> <li>PE innately logs all activity by users on its objects, which in the case of Assumptions Manager extends to all assumptions. A reviewer can produce an audit trail that details changes to assumption values of interest through easy-to-use queries, as all historical value changes are permanently stored</li> <li>Each assumption can only be modified once during a rollforward, preventing inadvertent changes and establishing the rollforward steps as mutually exclusive updates</li> <li>Assumptions Manager allows the organization to set permissions at a user level, ensuring changes are only implemented by approved users</li> </ul>
<b>Outsourced assumptions input</b> ① ONE SOURCE OF ASSUMPTIONS ③ OWNERSHIP OF ASSUMPTIONS	<ul style="list-style-type: none"> <li>The assumptions source (e.g., warehouse) can be linked directly to Assumptions Manager, bypassing the need for “translation” by a modeling resource. This significantly reduces the risk of misinterpretation or inconsistent application of assumptions</li> </ul>

*“Multi-step attributions can be executed from a single run.”*

## CONSIDERATIONS FOR ASSUMPTIONS MANAGER IMPLEMENTATION

To fully realize the benefits of Assumptions Manager, users will need to consider the compatibility of their current models and tables against Assumptions Manager's functionality. Assessing how assumptions are organized across models and runs may expose inconsistencies that need to be resolved before a successful Assumptions Manager implementation can take place.

The criteria in Exhibit 5 should be proactively explored prior to any Assumptions Manager implementation.

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### Exhibit 5: Primary considerations for Assumptions Manager implementation



#### MODEL READINESS

By design, Assumptions Manager is workspace-agnostic. The ability to generate assumptions and tables that can be shared across workspaces is a critical model development objective. However, if certain existing models have not been developed with this in mind, an implementation may require suboptimal solutions that can only be remedied via changes to modeling approach. Existing tables and/or models may also not be designed with Assumptions Manager features or intended use in mind, particularly for more software-reliant tasks such as rollforwards and sensitivities.

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*“Existing tables and/or models may also not be designed with Assumptions Manager features or intended use in mind, particularly for more software-reliant tasks.”*

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#### ASSUMPTION ALIGNMENT

An Assumptions Manager implementation relies upon a review of legacy assumptions and table structures to derive a minimal set of assumptions, which may require follow-up regression testing to explain impact drivers. In addition, the future state vision for assumption granularity should be considered when designing tables across workspaces.



#### INTENTIONAL RIGIDITY

Assumptions Manager is intended to function as a controlled production platform, intentionally limiting inadvertent mistakes. This can result in an inflexible platform for modeling tasks that requires frequent changes to table structures.



#### TABLE RESTRUCTURING

Models that were built prior to Assumptions Manager implementation may need to be reconfigured to be compatible with and maximize use of Assumptions Manager functionality. Required changes can include:

- Consolidation of managed tables into shared formats
- Resolution of conflicting table names across different workspaces
- Restructuring of table indices

Further, applying the following tips in Exhibit 6 can help ensure a smooth and successful implementation of Assumptions Manager.

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#### Exhibit 6: Lessons learned from prior Assumptions Manager implementations



##### INTEGRATED ASSUMPTIONS

Model development often drives changes to tables and input structures. Therefore, the design and functionality of Assumptions Manager should be considered during model development cycles, rather than addressing inconsistencies after the fact.



##### MANAGED VALUES

The assumptions managed in basis documents – which define the relationships between assumptions, tables, and default values – should be locked down for production. This can be achieved through the PE permissioning system and serves to significantly improve assumptions governance.



##### WELL-PLANNED IMPLEMENTATION

Assumptions will need to be assessed for consistency across bases, time, and other dimensions prior to an Assumptions Manager implementation to ensure that they are managed efficiently and support current workflows. This requires robust planning and awareness of system capabilities.



##### STATIC INPUTS

Model inputs such as model point files, economic scenarios, and mortality tables will need to be identified as Static Tables. Also, individual tables with large amounts of data will need to be implemented as Static Tables to support sensitivity jobs. Further, Assumptions Manager will not alter the contents of Unlinked tables and will instead use the latest version of the table as of a given reporting date. The classification of tables into this type should be made and consistently held over the long term, so plan carefully!



##### SYSTEMIC CHANGES IN TABLE STRUCTURES

Large-scale changes in table structures may require new generations of Basis Documents and Sensitivity Documents. Just as models themselves may see overhauls that fundamentally change them, the Assumptions Manager framework that governs their table inputs should also anticipate generational leaps.

## CONCLUSION

Assumptions Manager is a powerful tool that can be used to support assumptions governance objectives, particularly in a production setting. However, companies will need to assess whether their models and assumptions are currently compatible with Assumptions Manager, as well as the potential effort involved in maximizing the benefits of Assumptions Manager. Ultimately, each company should evaluate how Assumptions Manager can best be positioned in the context of its current and future state vision for model and assumptions governance.

## TIPS & TRICKS

### Clarifying Uses of Variable Groups

While Prophet variable groups are powerful and often necessary tools for reducing model runtime and memory usage, they can also cause confusion for modelers. Specifically, there are four separate locations in which to define a desired variable group for a particular run: one located within the run structure, and three located within the run setting. A distinct variable group can be defined for each of these four definitions.

Each of the four types of variable group specifications is detailed below, starting from the broadest to the most granular.

- **Run Structure variable group:** The broadest and generally most useful Prophet variable group classification resides within the run structure, under 'Calculated Variables' in the Configuration tab. This section allows modelers to select a subset of variables for which to calculate results. This is known as variable or run "targeting" and can significantly reduce runtime.

The selected variable group denotes the variables whose calculation is required for reporting. Prophet will calculate all variables included in the variable group, as well as all necessary upstream variables, including those in other products. Variables not included in a selected variable group will be unavailable for output, regardless of what is selected in the run setting.

- **Standard and Stochastic File variable groups:** The second and third applications of variable groups can be found within the applicable run settings under 'Standard Files' and 'Stochastic Files'. Variable groups selected in these sections identify those output variables necessary for projection and stochastic results files.

When variable targeting is employed, the results files are typically set to the same variable group, though this is not required. That is, users may define a separate variable group including only the subset of fields required in projections output, primarily serving to reduce the memory necessary to store results.

- **Model Point File variable group:** A fourth use of variable groups can be found within run settings under 'Individual Model Point Files'. This variable group defines the variables for which seriatim valuation date results are desired. A recent system enhancement provides the ability to output seriatim results for a second time step, which is useful in nested runs.

It should be emphasized that variable groups used to control run setting outputs should be a subset of calculated variables defined in the run structure.

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