

Volume 3 | **FALL 2015**

GETTING THE MOST OUT OF AXIS

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STAYING INFORMED AND MANAGING CHANGE

Editor's words: We are pleased to issue the Fall 2015 edition of our AXIS modeling newsletter. This issue introduces some key upcoming structural changes in AXIS and walks through a case study for how to use the new Flexible Scenario Format to produce stochastic scenarios. 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.



Assess opportunities for your company, identifying models that can be simplified...[Determine] the appropriate time for AXIS version upgrade and model transition.



EXECUTIVE CORNER

UPCOMING AXIS STRUCTURAL CHANGES

GGY has unveiled plans for two new AXIS design features to be released in 2016. These features are planned in light of the evolving regulatory environment requiring multiple assumption sets for calculating reserve and capital requirements, and to improve system transparency and flexibility.

CHANGE #1: NEW AXIS CELL STRUCTURE

DETAILS

Future AXIS versions will split assumption inputs into (A) Non-actuarial assumptions, and (B) Actuarial assumptions. For actuarial assumptions such as lapse and mortality, GGY is introducing new “Assumption sets” defined at the Cell level. These “Assumption sets” are currently anticipated in early 2016.

DRIVERS

According to GGY, the change is being introduced to provide more flexibility in the definition and application of actuarial assumptions within a model and is driven, in part, by the following:

- IFRS for Insurance Contracts and several US GAAP reserve requirements which call for three or more sets of assumptions to be referenced; and
- Increased demands for assumption flexibility, such as for stochastic processing.

IMPACT ON BUSINESS AND MODELS

AXIS will automatically organize existing Cell assumptions and inputs to align with this new feature. Adjustments will be required in DataLink for automated Cell creation processes.

HOW TO PREPARE YOUR BUSINESS

- Assess opportunities for your company, identifying models that can be simplified by this change. Additionally, models previously split out due to assumption set limitations may now be consolidated.
- Consider the benefits of the new Cell structure when determining the appropriate time for AXIS version upgrade and model transition.
- Set up fail safes and plan ahead for the change by notifying AXIS users within your organization and gaining familiarity with the new structure in 2015.

Exhibit 1: How to select Cell Actuarial Assumptions

Cell Assumption Sets

Module: Regular Life

No.	Usage	Type
1	Current Business Plan	Pricing
2	Current Canadian GAAP	Reserve
3	Current US GAAP	Reserve
4	Canadian Tax Basis	Reserve
5	Current Best Estimate	Reserve
6	Original Pricing	Pricing
7	Canadian GAAP working	Reserve
8	Proposed IFRS Basis	Reserve

Add Del Up OK Cancel

Exhibit 2: Placement of Actuarial Assumptions within the Cell

Statutory Reserves

Reserve method: Reg PPM

Actuarial assumption: 2 - Current Canadian GAAP

Reserve recalculation

Reserve revaluation: 0 - None

M = 0

Revaluation method: 0 - Based on financial month; interpolate btw recalc points using base reserves

Second Reserves

Reserve method: Reg SFAS 60

Actuarial assumption: 3 - Current US GAAP

TIPS & TRICKS

Remember a list of objects:

When debugging, it is useful to keep track of a list of items that need updating or had errors. To add objects to a list in the current Dataset:

1. Select the object(s) to remember.
2. Right click and select “Advanced” and “Remember Selected Object(s)”, choosing one of the options:
 - a. Overwrite list of remembered objects of this type; or
 - b. Append to list of remembered objects of this type.
3. Recall the selection by right clicking and selecting “Advanced” and “Select Remembered Object(s)”.

CHANGE #2: CELL TAGS

DETAILS

Cell Tags are a new feature that will be added to AXIS and are designed to provide an improved method of reflecting and documenting characteristics of a Cell. This method compares to the current approaches which rely on recognizing or testing the Cell Name, or reading the Notepad. This feature will allow users to select policy characteristics as Cell Attributes. The Cell Attributes will be input values in a new Cell Name Format Table, which will document the components of the Cell Name and link to mapping rules or formulas. A new DataLink action step to form Cell Names will execute the mapping instructions in the Cell Name Format Table and create the Cell Names as well as the new Cell Tags.

An example of how Cell Tags are used is as follows:

Exhibit 3: Example of Cell Tag usage

CELL NAME

AA R F NS 2 S

ATTRIBUTE	POSITION IN CELL NAME	LENGTH	CELL TAG COMPONENT
Plan Code	1	2	<PlanCode = AA123>
Product Indicator	4	1	<ProductIndicator = Reliance>
Sex Code	6	1	<SexCode = Female>
Smoker Code	8	2	<SmokerCode = NonSmoker>
Face Band	11	1	<FaceBand = 50000>
Premium Type	13	1	<PremiumType = Semi-annual>

DRIVERS

GGY is introducing this change as AXIS models are becoming more complex, with an increased number of Cells that are more difficult to manage using only the characteristics codified in the 40-character Cell Name.

IMPACT ON BUSINESS AND MODELS

Cell Tags offer greater model transparency and a structured approach to Cell definition. The new DataLink process that creates Cell Tags will be a systematic method for mapping Seriatim data to Cells. Querying Cell Tags will be more reliable than parsing through the Cell Name to control logic in Formula Tables and DataLink code. Moving to Cell Tags can increase transparency for new users; facilitate peer reviews, model validations and model audits; and simplify the sharing of models between different areas of your organization.

HOW TO PREPARE YOUR BUSINESS

- Evaluate the current methods of mapping Cell Names and assess clarity and flexibility of mapping.
- Identify any models that use the existing formula function that permits testing of a Cell Name within a Formula Table in AXIS. This functionality will be disabled soon after the introduction of the Cell Tags.
- Identify where artificial limits arise from the current 40-character Cell naming convention.
- Collaborate across modeling teams to arrive at consistent Cell Tags and naming conventions throughout your organization.



When the new Scenario Format is adopted, it is recommended that one format be agreed upon and used throughout the organization.



IN THE SPOTLIGHT

USING THE AXIS FLEXIBLE SCENARIO FORMAT

In AXIS release 2013.04.01, GGY introduced a new Flexible Scenario Format which removes constraints on the number of economic variables. The table below shows a comparison of the Flexible Scenario Format to the legacy Fixed Scenario Format. The new format provides more flexibility for products and applications that require a large number of market variables.

Exhibit 4: Comparison of Flexible Scenario Format and Fixed Scenario Format

MARKET TYPE	FIXED SCENARIO FORMAT	FLEXIBLE SCENARIO FORMAT
Interest rates	<ul style="list-style-type: none">• 10 columns• Supports single 10 point yield curve	<ul style="list-style-type: none">• Supports multiple 10 point yield curves• Allows modeling of any number of markets (e.g., Treasuries, Swaps)
Equity	<ul style="list-style-type: none">• 6 columns• Supports 3 equity indices	<ul style="list-style-type: none">• Unlimited user-defined columns and associated equity indices
User rates	<ul style="list-style-type: none">• 10 columns	<ul style="list-style-type: none">• Unlimited number of user-defined columns and associated variables

CREATING A FLEXIBLE SCENARIO FORMAT

The following supporting objects have been introduced to parameterize the main Scenario object:

MARKET OBJECT

A “Market” object defines a financial market. Individual markets are defined by inputting a descriptive name (e.g., “S&P 500”, “TSX Composite”, “Treasury Curve”) and the type of Market (equity, bond, interest rate, managed fund, inflation, portfolio rates, or a user-defined value).

SCENARIO FORMAT OBJECT

The purpose of the “Scenario Format” is to organize and parameterize Market objects. A Scenario Format is created by sequentially adding Market objects (with their Market Type and Market Name, as described above) and defining their properties:

- **Market Shape:** Equity Markets can have four Shapes. There is growth rate (or index value) and dividend rate, and options to include a volatility surface. “10 point yield curve” is a Shape for an Interest Rate Market.
- **Market-specific information:** Information specific to each Market Type is also input into the Format – e.g. Interest Rate Markets have a rate type (bond equivalent yield, annual effective yield, continuous), and a curve type (par or spot). Equity and Interest Rate Markets have interpolation and extrapolation methods, and other market-specific information is input for other Markets.

The picture below shows an example of Scenario Format input.

Exhibit 5: Example of Scenario Format input

ID	Type	Market	Shape	Rate Type	Curve Type	Interpolation Method	Average Cash Rate Method	Extrapolation Method	Scenario Ext.
06	Interest Rate	Interest	10 point yield curve	Bond equivalent yield	Par curve	Linear interpolation	Short rate in current row	Assume level forward rates	N/A
1	Equity	Fixed Equity Index 1	Equity (growth & dividend)	Annual effective rate	N/A	N/A	N/A	N/A	N/A
2	Equity	Fixed Equity Index 2	Equity (growth & dividend)	Annual effective rate	N/A	N/A	N/A	N/A	N/A
3	Equity	Fixed Equity Index 3	Equity (growth & dividend)	Annual effective rate	N/A	N/A	N/A	N/A	N/A
4	Equity	Equity Index 1	Equity (index & dividend) with volatility surface	Annual effective rate	Spot curve	Linear interpolation	N/A	Assume level spot rates	N/A
5	Equity	Equity Index 2	Equity (index & dividend) with volatility surface	Annual effective rate	Spot curve	Linear interpolation	N/A	Assume level spot rates	N/A
6	Equity	Equity Index 3	Equity (index & dividend) with volatility surface	Annual effective rate	Spot curve	Linear interpolation	N/A	Assume level spot rates	N/A
7	Equity	Equity Index 4	Equity (index & dividend) with volatility surface	Annual effective rate	Spot curve	Linear interpolation	N/A	Assume level spot rates	N/A
8	Equity	Equity Index 5	Equity (index & dividend) with volatility surface	Annual effective rate	Spot curve	Linear interpolation	N/A	Assume level spot rates	N/A
9	Equity	Equity Index 6	Equity (index & dividend) with volatility surface	Annual effective rate	Spot curve	Linear interpolation	N/A	Assume level spot rates	N/A
10	Equity	Equity Index 7	Equity (index & dividend) with volatility surface	Annual effective rate	Spot curve	Linear interpolation	N/A	Assume level spot rates	N/A
11	Equity	Equity Index 8	Equity (index & dividend) with volatility surface	Annual effective rate	Spot curve	Linear interpolation	N/A	Assume level spot rates	N/A
12	Equity	Equity Index 9	Equity (index & dividend) with volatility surface	Annual effective rate	Spot curve	Linear interpolation	N/A	Assume level spot rates	N/A
13	Equity	Equity Index 10	Equity (index & dividend) with volatility surface	Annual effective rate	Spot curve	Linear interpolation	N/A	Assume level spot rates	N/A
20	Inflation Rate	Inflation	Inflation Rate	Annual effective rate	N/A	N/A	N/A	N/A	N/A
14	User Value	Default Rate	User value	N/A	N/A	N/A	N/A	N/A	Use values in the table
15	User Value	User value (portfolio rate)	User value	N/A	N/A	N/A	N/A	N/A	Use values in the table
16	User Value	User value 1	User value	N/A	N/A	N/A	N/A	N/A	Use values in the table
17	User Value	User value 2	User value	N/A	N/A	N/A	N/A	N/A	Use values in the table
18	User Value	User value 3	User value	N/A	N/A	N/A	N/A	N/A	Use values in the table
19	User Value	User value 4	User value	N/A	N/A	N/A	N/A	N/A	Use values in the table
20	User Value	User value 5	User value	N/A	N/A	N/A	N/A	N/A	Use values in the table
21	User Value	User value 6	User value	N/A	N/A	N/A	N/A	N/A	Use values in the table

TIPS & TRICKS

Aliased fields:

Use the User Defined Value Fields Dictionary to give meaningful names or “aliases” to the User Defined Fields in AXIS and then use those aliases throughout the Dataset.

To create a User Defined Field:

1. Open a DataLink table and select “Append/Insert”.
2. Choose field type “Optional Field”, select one of the User defined value 1–200 fields and click “Append”.

Use the Dictionary to define the aliased name by:

1. Double clicking on the User Defined Field and opening the optional menu beside the “Original Name” field;
or
2. Editing the Dictionary directly through “DataLink Dataset Parameters”.

Once the Market objects and the Scenario Format object are created, a new Flexible Scenario can be created.

SCENARIO REFERENCE OBJECT

Scenario Format objects are referenced with a Scenario Reference Object (SRO). In the Fixed Scenario Format, a specific Scenario column needs to be referenced from AXIS tables. In a Flexible Scenario Format, the SRO is specified instead. The SRO functions as an indexing tool and defines the Market and Market property that can be referenced. In the case of Interest Rate Markets, the term can either be specified or left as a general case and instead specified in the table that uses the SRO.

IMPLEMENTATION BEST PRACTICES

When activating the Flexible Scenario Format in a Dataset that was initially using Fixed Scenario Format, a number of items may change in the transition. A full list of those items is provided in GGY AXIS Knowledge Base article 1625.

When the new Scenario Format is adopted, it is recommended that one format be agreed upon and used throughout the organization. Having multiple formats can create compatibility issues when data and models are shared.

When a new Scenario is created, it is also necessary to create (or convert) the Historic Scenario to have consistent Markets. All Markets in the Future Scenario need to be contained in the Historic Scenario also.

To learn more on the topic of Flexible Scenarios, please see GGY AXIS Knowledge Base articles 1382, 1625, and 1678.

CASE STUDY: IMPLEMENTING THE AMERICAN ACADEMY OF ACTUARIES ECONOMIC SCENARIO GENERATOR IN AXIS

The AXIS Flexible Scenario Format can be integrated with a stochastic Market Model to provide a powerful solution for producing stochastic economic scenarios. AXIS comes with multiple Economic Scenario Generators (ESGs). AXIS also allows users to code their own ESG using a User Defined Stochastic Market Model (UDSMM).

This case study provides an overview of how to produce stochastic scenarios using the Academy Interest Rate Generator (AIRG) with the Flexible Scenario Format, and provides additional detail around specific modeling components.

As background, the American Academy of Actuaries (AAA) and Society of Actuaries (SOA) jointly manage an ESG, which produces interest rate curves, equity returns, and bond returns that are appropriate for reserving under Actuarial Guideline XLIII (AG43) and calculating capital requirements under Risk Based Capital C3 Phase 2 (RBC C3P2). GGY Knowledge Base article 1678 provides a sample AXIS Dataset, which contains code that replicates the AIRG and forms the starting point of our example. The code can be changed and customized by the AXIS user.

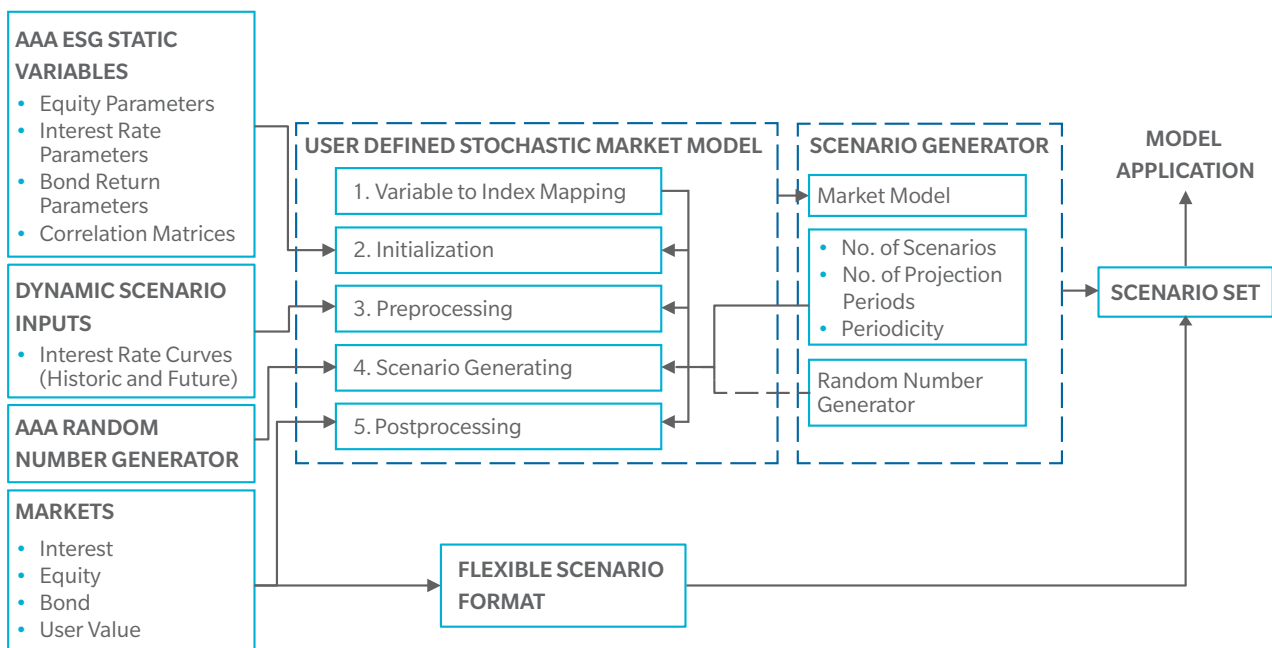
MODEL

The sample Dataset from GGY contains the following key objects:

- Scenario Formats for Historic and Future Scenarios
- User Defined Stochastic Market Model
- Scenario Generator
- Scenario Set

Exhibit 6 illustrates how the various AXIS objects and ESG inputs are integrated to produce economic scenarios.

Exhibit 6: Components of an economic scenario



TIPS & TRICKS

Table Buffer options:

Table Buffer options can be used to store table contents or the results of calculations based on table contents. One example of how to use the Table Buffer options is to ratio two tables:

1. Open a table and select “Buffer options” and “Store table in buffer”.
2. Quit the first table and open the table to be divided by the stored table.
3. From the second table, select “Buffer options” and “Divide table by buffer”.

The components to produce economic scenarios are further described in the sections below.

SCENARIO FORMATS

Scenario Formats are defined for Future and Historic Scenarios using the Flexible Scenario Format.

USER DEFINED STOCHASTIC MARKET MODEL

Within the UDSMM, input variables are loaded, scenarios are generated based on the AIRG algorithm, and the results are written to Markets within the Scenarios. The UDSMM is comprised of five Formula Tables.

1. Variable to Index Mapping

The UDSMM allows users to store variables in an array within one table and pass the variables through to subsequent tables. To access and store variables, AXIS allows users to either call the array by an index number or by a given name. The name is a more straightforward and transparent way to access the data in the array than the index number. In the Variable to Index Mapping table, the function below assigns the name “startingVol_USD” to index number 1371:

Call `SetIndexForDoubleParameter (“startingVol_USD”, 1371)`

In future parts of the code, the value stored in the array can be called by its name “startingVol_USD” instead of the index number.

2. Initialization

The AIRG requires calibrated ESG parameters for generating equity returns, interest rate curves, bond returns, and the associated correlations between variables. These inputs are coded in the Initialization Formula Table within the UDSMM, and are based on the calibration used in AIRG version 7.0.4.

3. Preprocessing

The Preprocessing Formula Table is used to read in scenario inputs and performs calculations to set up the model for the Scenario Generating Formula Table. The AIRG requires an initial yield curve, which will either be read from the Historic Scenario (for valuation) or Future Scenario (for inner loop reserve revaluation at future dates in the projection).

4. Scenario Generating

The AIRG ESG algorithm is coded in this Formula Table. To initialize the table, parameters and variables stored in arrays and defined in the previous Formula Tables are loaded into declared variables. After the parameters are loaded, the model stochastically forecasts monthly economic values based on the AIRG algorithm. These values are stored in an array using the function “SetTemporaryArrayValue”, and are later called in the



If a company uses different Markets than those defined in the sample Dataset, the code within the Postprocessing Formula Table will need to be modified to include those Markets.



Postprocessing Formula Table. The scenario length (number of periods) and number of scenarios to be generated are defined.

5. Postprocessing

The Postprocessing Formula Table writes the scenarios developed in the Scenario Generating Formula Table to a Market within a Future Scenario, using the function “WriteMarketByRow”. For example, the annualized growth rate for the Equity Market “US Diversified”, in the fifth projection month, is written to the Future Scenario using the following code:

```
Call WriteMarketByRow (“US Diversified”, EQ_MRKT_GROWTH, 5, return)
```

This function is called in a loop to write out all of the interest rate and equity returns to the specified Markets for all projection months within a Scenario. Consistent with the Scenario Generating Formula Table, the Postprocessing Formula Table is called the same number of times as there are scenarios defined in the Scenario Generator object.

If a company uses different Markets than those defined in the sample Dataset, the code within the Postprocessing Formula Table will need to be modified to include those Markets.

SCENARIO GENERATOR

A Scenario Generator object in AXIS is used to define the number of scenarios, number of projection periods and periodicity of projection periods. Within the Scenario Generator certain random number generators (RNG) can be defined to generate the Scenarios. The Scenario Generator is then used as an input into a Scenario Set, discussed in the following section.

There are two important considerations for creating a Scenario Generator object using the UDSMM provided in the sample Dataset. First, the periodicity of the projection periods defined in the Scenario Generator does not affect the basis of the scenario generation in the UDSMM; the economic values are always generated on a monthly basis. Instead, the periodicity affects how the values are written to Markets. Second, the RNG defined in the Scenario Generator is not used in the UDSMM. Within the Scenario Generating Formula Table there is an RNG algorithm coded to match the AIRG Excel example. This can be modified for certain applications if desired.

SCENARIO SET AND APPLICATIONS

The Scenario Set object combines the Scenario Generator object, containing the UDSMM, and Scenario Format. When building a Scenario Set, the Markets contained in the Scenario Format need to be consistent with the Markets in the UDSMM; otherwise an error may occur if the UDSMM attempts to write to a

Market that is not included in the Scenario Format. Scenario Sets with a UDSMM can be used for the following applications:

Exhibit 7: Applications of Scenario Sets with a UDSMM

APPLICATION	STEPS
Embedded Blocks (e.g., AG43, or RBC C3P2)	<ul style="list-style-type: none"> Input the Scenario Set in the Stochastic Scenarios section of the Block Projection Assumptions
FAS 133/FAS 157	<ul style="list-style-type: none"> Select the Scenario Set under "Multiple Valuation Scenarios" in the Dataset Parameters

CONCLUSION

The Flexible Scenario Format requires some effort and education to implement and convert models to use it, but it provides powerful support for advanced actuarial modeling applications requiring multiple interest rate or equity markets. The Flexible Scenario Format supports the input required for principles based valuation, hedging, pricing of embedded options, and other advanced modeling applications.

WHAT'S NEW IN AXIS

IMPROVED DOLLAR COST AVERAGING ACCOUNT FUNCTIONALITY

Description

- Option added in the Annuity Module to allow the Pending Account to define a Dollar Cost Averaging (DCA) account
- Within the DCA account, users can define the pattern of funds transferring out to other Investment Accounts

Details

- Version: 20151202

Learn more

- <https://www.ggy.com/support/enhancebug/upddetail.asp?id=20199>

ENHANCED SYSTEM LOG AND SYSTEM LOG VIEWER

Description

- New features added to the system log viewer:
 - Additional columns provide more details for each message
 - "Filter by condition" added to system log messages
 - Ability to export only displayed records
 - Option to view a previously saved log file

Details

- Version: 20150602

Learn more

- <https://www.ggy.com/support/enhancebug/upddetail.asp?id=19198>

IMPROVED BATCH LOG VIEWER IN JOB MONITOR

Description

- Several options added for viewing logs in GridLink:
 - View All/Errors/Warnings/Info/Summary
 - Download and View
- The "Download and View" option should be used for large log files

Details

- Version: 20150602

Learn more

- <https://www.ggy.com/support/enhancebug/upddetail.asp?id=19391>

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