



SOCIETY OF ACTUARIES

Article from:

The Financial Reporter

March 2013 – Issue 92

The Financial Reporter

ISSUE 92 MARCH 2013

- 1 PBA Corner
By Karen Rudolph
- 2 Green ... But No Envy
By Matthew Clark
- 8 Implementation
Perspectives on Solvency II
Internal Model Standards
By Fred Ngan
- 12 Practical Considerations
to Implement and
Productionalize VM-20
By Jason Kehrberg
- 15 Sub-Atomic Accounting
By Henry Siegel
- 22 Report on the IAA Meeting
in Nassau, the Bahamas,
Nov. 15–17, 2012
By Jim Milholland
- 26 Financial Reporting
Research Scorecard
By Sam Keller

PBA Corner

By Karen Rudolph

The fallout of the Dec. 2, 2012 Executive/Plenary adoption of the Valuation Manual (VM) has created a bit of speculation regarding the operative date for VM-20. Speculation is interesting, but rather than getting caught up in the absolute latest date on which one needs to be ready, let us review one of the tools available to us in preparing for this work. In this issue of PBA Corner, I introduce you to the American Academy of Actuaries' Economic Scenario Generator (ESG), how it is used, its input requirements, and its output files. Readers may already be familiar with the ESG if doing AG 43 or C3 Phase II analysis. For those new to the ESG, and those benefiting from a refresher, read on!

ESG: WHERE TO FIND IT

Appendix 1 of the VM directs you to the Society of Actuaries (SOA) website (soa.org) to find the ESG. Go to the home page, then *Research*, then *Software and Tools*, then *Economic Scenario Generators*, Related Links (right-hand side), click into *Interest Rate Generator Version 7.0.4*. This site is the official home of the most current ESG workbook tool. The user must agree to a disclaimer before downloading the file titled *AAA scenario generator version 7_0_4.xls*.

The American Academy of Actuaries (Academy) and the SOA have joined resources to manage the ESG that will be used in principle-based approaches. The SOA provides frontline support for the ESG. A joint SOA/Academy oversight group will oversee the generators and assist the SOA in providing technical support and direction for the current and future versions of the generators. Future versions of the ESG tool will include updated historical Treasury yield curve rates along with any other technical or user interface revisions deemed necessary. The version number of the ESG tool will advance with each new release.

CONTINUED ON PAGE 4

For anyone new to the ESG, I recommend first reading through the Frequently Asked Questions (FAQ) dated April 2012. This document is accessed through the second link listed on the SOA Web page.

A complete set of release notes for Version 7 was created in December 2010. This document is accessed via the fifth link listed on the SOA Web page. The release notes provide technical information regarding improvements made in the scenario generation process as the ESG moved from version 7.0.3 to 7.0.4. The release notes also serve as an instruction guide for the user. These notes include the following information:

Attachment 1—Yield curve interpolation method: The stochastically generated interest rate process defines one-year and 20-year maturity rates. A Nelson-Siegel formula is used to derive the remaining points on the curve.

Attachment 2—The dynamic mean reversion point: Before officially approving the ESG, the Life Actuarial Task Force (LATF) of the National Association of Insurance Commissioners (NAIC) developed and adopted its own algorithm for determining the mean reversion parameter (MRP) used in the ESG. The 20-year Treasury bond rate tends toward this MRP. The algorithm uses historical rates as follows: $MRP = 0.20(A) + 0.30(B) + 0.50(C)$, rounded to the nearest 0.25%, where A is the median rate of the 20-year Treasury bond over the last 600 months, B is the average over the last 120 months, and C is the average over the last 36 months. The default setting of the ESG is to use the NAIC algorithm, where the (A), (B) and (C) values depend on the start date coded into the ESG. The default setting can be overridden by the user, but the resulting MRP would not comply with the NAIC's approved ESG process. While the algorithm for the MRP is dynamic, the MRP remains constant for future projected periods and across all scenarios generated once it is determined as of the start date. The release notes provide the exact source for finding the historical yield curve rates. The ESG file on the website is populated with historical monthly curves through Dec. 31, 2011 only. These historical rates capture the final daily

Treasury yield curve rates for each month. It is important to understand that the default MRP rate changes only once per calendar year, in January, for use during that calendar year.

Attachment 3—User Guide to the scenario generator workbook: This is a step-by-step listing of instructions for using the ESG. Attachment 3 is a critical read if you are new to the ESG. This guide walks the user through the input necessary to set up the generator, the format of the output files, and all the tabs found in the ESG workbook file. The reader should note that this guidance is largely focused on the interest rates generated by the ESG, rather than the equity returns.

ESG: BRIEF HISTORY

Looking back to 1999, pre-generated scenarios were posted on the Academy website for use in C3 Phase I calculations. In late 2008, the Academy released a version of the ESG tool called the C3 Phase I Enhanced Interest Rate Generator. These older tools and scenarios can still be found on the Academy website (not the SOA site). Throughout the evolution of the ESG, the Academy working group has used a stochastic lognormal volatility model. This choice drives the resulting parameters used by the stochastic process. These parameters are found on the "Parameters" tab of the ESG workbook. For example, the mean reversion point, τ_1 , and the mean reversion strength, β_1 , are parameter settings found there.

The design of the Academy's ESG is based largely on its intended use—to calculate statutory reserve and capital requirements for long-term liabilities. In 2005, equity scenario generation functionality was added. Over time, the user interface of the ESG has been improved, and the current version 7.0.4, together with the release notes and FAQ, provide a user-friendly ESG package.

ESG: APPLICATIONS

The April 2012 FAQ document provides an overview of applications that use interest rate and/or equity return scenarios and a discussion of whether the ESG would be approved for use in each.

APPLICATION	SCENARIO REQUIREMENTS
C3 Phase I	Until further action by the NAIC, C3 Phase I calculations require the use of scenarios generated by the "Enhanced C3 Phase 1 Interest Rate Generator" file, available at http://www.naic.org/committees_e_capad_lrbc_c3_market.htm . The file is titled <code>committees_e_capad_lrbc_c3_generator_06.xls</code> .
C3 Phase II	Both of these applications allow use of approved pre-packaged scenarios, scenarios generated by the ESG or any other scenario generator as long as the scenarios satisfy the approved calibration criteria.
And Actuarial Guideline 43	
C3 Phase III	Though no formal action has been taken on C3 Phase III, the proposed RBC C3 Requirements for Life Products include a recommendation to use either the ESG or proprietary generators as long as the scenarios used satisfy the required calibration criteria.
VM-20	VM-20 requires use of the Academy's economic scenario generator with certain prescribed parameters, rather than a specified set of scenarios or specified calibration criteria. When used by two different companies, the ESG will produce the same economic scenarios as long as the start date is the same, the parameters have been left at default settings, and the historical curve rates are identical. VM-20 does not allow for use of proprietary scenario generators. See VM-20 Section 7.G and Appendix 1 for more detail on VM-20 requirements.

The deterministic scenario required by VM-20's deterministic reserve calculation is actually found within the 16 stochastic exclusion test scenarios generated by the ESG. Scenario 12 of this set is the deterministic

Generating the scenario files is quite easy; however, there are a few input decisions to be made up front.

scenario. One improvement that could be made to the ESG would be to add functionality that would capture Scenario 12 independent of the others.

ESG: WHAT TO EXPECT

Most actuaries using the ESG will be focused on obtaining interest rate scenario files. It is helpful to know, however, that because several functionalities were coordinated into this one ESG file, the user will also be getting a set of equity scenario files with each run attempt, whether or not they want these. There will be more information on the equity files later. Generating the scenario files is quite easy; however, there are a few input decisions to be made up front. The first is the start date. This is the date the generator will use as the start date and to establish the averages used in calculating the MRP for each scenario generated. The push of a macro button obtains the appropriate rate from the historical rate data tab, assuming the tab has been appropriately populated with historical U.S. Treasury rates. Whether this is true is easy to check by looking in the Historical Curves tab of the workbook. The currently available ESG file is populated with appropriate month-end historical curve rates through December 2011.

The ESG provides the user with options for the number of years over which to project the rates. The ESG needs to know where the user wants the scenario files placed (a path name) and whether .csv files or .xml files are the preferred type.¹ A convenient feature is the ability to append the files with an optional suffix at the user's choice. This feature can be used to distinguish scenarios generated at different dates, for example. The ESG is capable of providing monthly, quarterly, semi-annual and annual time steps. Both bond equivalent and annual

CONTINUED ON PAGE 6

effective rates are supported. Once all the settings are complete, it takes approximately 10 minutes to generate the set of 10,000 scenarios.

While the ESG generates a set number of 10,000 scenarios, it also offers the use of a scenario picking tool to choose a stratified sample subset of 1,000, 500, 200 or 50 scenarios. The ESG will also generate the Stochastic Exclusion Test set of scenarios which is not considered a “subset” and has nothing to do with the scenario picking tool. The scenario picking tool is provided for convenience only and is not endorsed by the Academy. The method used to pick the scenario subsets from the larger set of 10,000 is the Significance Method and is briefly described in the FAQ document. It is the user’s responsibility to justify the number of scenarios used for any application as well as to comply with any calibration criteria requirements, as noted earlier. It is also important to understand that if the choice is made to run the 1,000 subset, for example, without first generating the full 10,000 scenarios, what the user gets is going to be driven by whatever scenario numbers were picked when the scenario picker was last run.

If the user chooses separate .csv files for each term to maturity, then each interest rate file is a matrix of rates, where the time step is across the columns, and the scenarios are listed one per row. One thousand scenarios means 1,000 rows of data, and 100 years of monthly time step means 1,200 columns of projected rates plus one column for the starting rate; in other words, a 1,000 x 1,201 grid of numbers. If the user chooses a single .csv file for the interest rate scenarios, then the resulting data is formatted by scenario and month in the rows, and by term to maturity in the columns.

Regarding the equity scenario files, the option for separate files or a single file does not apply; each file includes gross wealth ratios for a fund tied to specific asset classes. Within each of these equity files, the data begins with 1.00. Subsequent periods represent gross wealth ratios, indicative of the cumulative return for the indicated time period. The ESG will generate equity scenario files whether you need them or not. Each of the nine equity files represents an equity fund corresponding to an asset class. The file *Balanced.csv*, for example, represents returns of a diversified balanced allocation fund. The file names and fund types are listed in the table below. The equity return generator and the interest rate generator processes of the ESG are separate functionalities, having been incorporated into one workbook in 2005 for user convenience. The equity scenarios generated at any start date are not correlated with the starting Treasury curve. According to the FAQ document, however, returns for the fixed income equity funds are integrated with the generator for interest rate scenarios so that fund returns depend on the change in interest rates in the same scenario. The equity return files are formatted with time steps across the columns and scenarios down the rows. Background material on the equity generator and its output can be found at <http://www.actuary.org/content/c3-phase-ii-rbc-and-reserves-project>, under “Reports.”

The manner in which these interest rate and equity return data files are loaded into the user’s software system will vary by system. Some are designed to load the .csv files directly. The generated files carry the default names as shown in the table below.



Filename	Interest Rate	Filename	Equity Rate
UST_3m.csv	Three-month U.S. Treasury rate	AGGR.csv	Aggressive or specialized equity
UST_6m.csv	Six-month U.S. Treasury rate	BALANCED.csv	Diversified balanced allocation
UST_1yr.csv	One-year U.S. Treasury rate	FIXED.csv	Diversified fixed income
UST_2yr.csv	Two-year U.S. Treasury rate	INT.csv	Diversified international equity
UST_3yr.csv	Three-year U.S. Treasury rate	INTGOV.csv	U.S. intermediate-term government bonds
UST_5yr.csv	Five-year U.S. Treasury rate	LTCORP.csv	U.S. long-term corporate bonds
UST_7yr.csv	Seven-year U.S. Treasury rate	MONEY.csv	Money market/short-term equity
UST_10yr.csv	10-year U.S. Treasury rate	SMALL.csv	Intermediate risk equity
UST_20yr.csv	20-year U.S. Treasury rate	US.csv	Diversified large cap U.S. equity
UST_30yr.csv	30-year U.S. Treasury rate		



Karen Rudolph, FSA, MAAA, is a consulting actuary at Milliman Inc. She can be reached at karen.rudolph@milliman.com.

This article was peer reviewed by Nancy Bennett, senior life fellow, American Academy of Actuaries, and Max Rudolph, principal, Rudolph Financial Consulting, LLC. Both have served as the chairperson of the Academy's Economic Scenario Work Group. ■

END NOTES

¹ The .xml format is EconSML, which stands for Economic Scenario Markup Language, a standard file format proposed by the Technology Section of the SOA for facilitating the sharing of such scenarios between different modeling systems.