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To: AAA Life RBC Task Force: C-3 Subgroup

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Subject: Instructions for the Scenario Generator and C-3 Calculation Spreadsheet

The Excel file "RbcC3Scn.xls" is a tool that can generate yield curves, then calculate a C-3 factor based on statutory surplus projected using the generated yield curves. The purpose of this document is to outline the steps needed to calculate the C-3 factor using the spreadsheet.

### Getting Started

Open the file "RbcC3Scn.xls" in Excel. It may ask you if you wish to disable the macros; if it does, you should enable the macros so that the programs will work. It may also prompt you (in Excel 97) that the "Visual Basic macro modules are now edited in the Visual Basic Editor, not the workbook." If so, go ahead and click "OK." Please note that in order to use the spreadsheet, Microsoft Excel 95/5.0 or later is required.

### Generating Scenarios

1. Go to the sheet called "Assumptions." This is the sheet from which yield curves will be generated.
2. Enter an initial Treasury yield curve. These should be coupon-paying yields, expressed in a basis consistent with your projection software's yield curve expectation (bond equivalent yields, annual effective yields, etc.).
3. Select the frequency at which you wish the yield curves to change by entering a value in the cell labeled "Frequency Value." The choices here are (1) annual, (2) quarterly, and (3) monthly.
4. If generating the set of 12 "standard" scenarios, click the macro button labeled "Click to Calculate 12 Standard Scenarios." If generating the set of 50 "standard" scenarios, click the macro button labeled "Click to Calculate 50 Standard Scenarios."

The macro will run for a while, generating the scenarios. It will provide status updates in the status bar at the bottom of the screen, indicating which scenario it is currently generating or writing to the output sheet.

When the program is finished running, the yield curves for the selected set of scenarios are displayed in the sheet called "Scenarios." The results are the same basis as the initial curve you input (bond equivalent or annual effective). The column labeled "Scenario" is a sequential label from 1 to either 12 or 50 (depending on the set selected). The column labeled "Orig Scen#" is actually the seed used to generate the scenario. This number corresponds with the numbers originally used to distinguish the "standard" scenarios.

The rates generated in the program are those that change monthly. To convert these to rates that adjust quarterly or annually (if so selected), the "Trapezoid Rule" is used. The use of the "Trapezoid Rule" is consistent with the assumption that cash available for investment is uniformly distributed during the period.

#### Using the Generated Scenarios to Project Statutory Surplus

1. Move the scenarios from the "Scenarios" sheet into your projection software.
2. See Mike Zurcher's March 1, 1999, document entitled "Measurement – Deriving the RBC C-3 Factor" for detailed instructions on how to initialize your models.
3. Run your projections and generate statutory surplus for each calendar or projection year, for each scenario.

#### Calculating the C-3 Factor

1. Go back into "RbcC3Scn.xls" in Excel. Go to the sheet called "C3Factor."
2. Indicate which set of scenarios was used (either (1) "Standard 12" or (2) "Standard 50").
3. Enter the valuation or projection date (end of month).
4. Indicate whether the projected statutory surplus values are on a calendar year or projection year basis. For example, if the projection date is 9/30/1996, the end of the first full calendar year will be 12/31/1997, but the end of the first full projection year will be 9/30/1997. Please note that if "Calendar Year" is used, the first fractional year (9/30/1996 to 12/31/1996 in this example) will be discarded.
5. Enter the beginning statutory reserve level, as of the valuation or projection date.

6. Enter the Federal Income Tax rate to be applied when discounting statutory surplus.
7. Drop in the statutory surplus values for all scenarios available. If projections are on a “Calendar Year” basis and the projection month is not December, S(1) should be the statutory surplus at the end of the first full year of the projection. For example, if the projection date is 9/30/1996, S(1) should be the projected surplus at 12/31/1997. The input area will accommodate projections of lengths up to and including 50 years.
8. Click the macro button labeled “Calculate RBC C-3 Factor.” The macro will prompt you to make sure that the initial curve in the sheet “Assumptions” is the same as the one you used to generate the yield curves used for your projections. If it is not (or you are not sure) click “No” and enter the initial curve you used into the “Assumptions” sheet before proceeding. If it is, go ahead and click “Yes.”

This program will take about as much time to run as the scenario generator. It needs to regenerate the vector of one-year rates that it will use for discounting. It generates all rates on a monthly basis, then converts these to annual rates by compounding twelve monthly rates. Compounding is used instead of the “Trapezoid Rule” here because the rates are used to discount discrete end-of-year surplus values.

The program displays a C-3 factor along with a weight for each scenario. When running the “standard” set of 12, the second- and third-largest C-3 factors each carry a weight of one while all the others are zero. When running the “standard” set of 50, the 92<sup>nd</sup> – 98<sup>th</sup> percentiles (including the ½ percentiles) are used to calculate a weighted average C-3 factor centered at the 95<sup>th</sup> percentile. The percentiles are computed under the assumption that these are the worst 50 scenarios from the original set of 200. The final weighted average C-3 factor is displayed in the gray highlighted cell labeled “RBC C-3 Factor.” When running the “standard” set of 12, the C-3 factor will not be lower than 50% of the worst scenario.

The sheet “C3Factor” also contains a sample calculation of the C-3 factor for the first scenario. The program displays the one-year Treasury rates from the first scenario, and the spreadsheet uses these to re-create the C-3 factor for Scenario 1 shown below. This sample calculation is provided to help the user manually step through how the C-3 factors were calculated.