



Modern Deterministic Scenarios for Interest Rates – Addendum 2020





Modern Deterministic Scenarios for Interest Rates – Addendum 2020

AUTHOR

Mark E. Alberts, FSA, MAAA
Alberts Actuarial Consulting

SPONSOR

Smaller Insurance Company Section
Financial Reporting Section
Committee on Life Insurance Research
Modeling Section

Caveat and Disclaimer

This Addendum addresses the questions received to date about the research paper, *Modern Deterministic Scenarios for Interest Rates*, published by the Society of Actuaries in 2017 and the current low interest rate environment. To respond as soon as possible, no peer review was performed by the Project Oversight Group on this document. Therefore, the suggestions and opinions expressed and conclusions reached by the author are his own and do not represent any official position or opinion of the Project Oversight Group, the Society of Actuaries or its members. The Society of Actuaries makes no representation or warranty to the accuracy of the information.

Copyright © 2020 by the Society of Actuaries. All rights reserved.

Modern Deterministic Scenarios for Interest Rates – Addendum 2020

As of September 30, 2020, the original version of Appendix J – the Excel scenario calculation file – of the Society of Actuaries research report, *Modern Deterministic Scenarios for Interest Rates* (MDS) generates calculation errors in some scenarios. A revised version of Appendix J, 2017-modern-deterministic-scenarios-appendix-j-REV OCT2020.xlsx, has been posted to address these and certain other issues in the file. This addendum presented in question and answer format: i) provides instructions for correcting these errors in the original version of Appendix J; ii) discussed all changes made in the revised version of Appendix J; and iii) addresses other potential questions with respect to the MDS scenarios in the interest rate environment that prevails in the second half of 2020. This addendum has been prepared by Mark Alberts, author of the 2017 research report, but without review or comment from the Project Oversight Group.

Question 1: Why does the original version of Appendix J, the MDS Excel-based scenario calculator, return errors for scenarios 5-12, and how do I eliminate those errors?

Answer: *Scenarios 5-12 utilize interest rate groupings, and the lower bound for these groupings was set based on historical rates for the period 2015 and prior. Long rates at September 30, 2020 are below this lower bound, resulting in lookup errors.*

These errors can be corrected by making two changes on the “Scen Parm” tab:

1. *Cell F35 is the lower bound of Interest Rate Group 1 for long rates and was originally set at 2.00. Change this field to a value at least 25 basis points lower than the average of the 20-year and 30-year treasury rates on the valuation date, and this should eliminate all lookup errors. For his own modeling purposes, the author is planning to reset this value to zero.*
2. *Cell H35 represents the midpoint of Interest Rate Group 1 for long rates and was originally populated by formula, with a value of 2.375 based on the lower and upper bounds of this group. This cell is used to weight the scenario paths between adjacent Interest Rate Groups, and one can either hard-code it to remain 2.375 or leave it as a formula, in which case its value will change depending on the change to cell F35. Either approach is reasonable, but the hard-coded value of 2.375 is modestly more consistent with the underlying analysis and will ensure consistency with prior results when the initial interest rate is higher. For his own modeling purposes, the author is planning to hard-code this cell to be 2.375. As of September 30, 2020, Scenario 11 (an increasing rate scenario) is the only scenario that differs under the two approaches, with only modest differences.*

Question 2: Do these spreadsheet errors imply that the MDS scenarios are invalid in the current rate environment?

Answer: *No. The underlying analysis does not rely on the lower bound of Interest Rate Group 1. If long rates at current levels had been present in the historical data, they would have been incorporated in Group 1, and the lower bound would have been set lower. They would have impacted the quantitative results, but not the qualitative nature of the analysis.*

It is important to note that the MDS scenarios are based on a retrospective analysis of historical rates. As such, they presume that historical interest rate patterns have predictive value. The fact that interest rates are outside of

historical ranges could lead one to question whether the historical data applies in the current environment. This is a question each appointed actuary should consider using his or her own professional judgment.

Question 3: The MDS calculator is generating negative interest rates in some scenarios. What should I make of that?

Answer: The MDS scenarios are based on projections of a short rate and a long rate, using a static interpolation algorithm to fill in the full yield curve. The MDS calculator was not calibrated to generate negative rate scenarios and will not project negative values for the short rate and long rate, but the interpolation algorithm may result in negative rates for some tenors. At September 30, 2020, the 2-year rate appears to experience the greatest frequency of negative rates in the MDS scenarios.

It is suggested that when an MDS scenario includes negative rates the user closely review the overall yield curve shape for reasonableness. Since the negative rates arise from a limitation in the MDS interpolation algorithm, it may be reasonable to apply a non-negative floor, particularly if one's model has not been tested for negative interest rates. If one's model has been tested and behaves appropriately under negative rates, it may also be appropriate to let the negative rates flow through.

Question 4: What changes have been made in the new version of the Appendix J file, 2017-modern-deterministic-scenarios-appendix-j-REV OCT2020.xlsx?

Answer: The revised file reflects the following changes:

1. The issue described in Question 1 has been corrected. For long rate Interest Rate Group 1, the lower bound has been reset to zero, and the midpoint has been hard-coded to 2.375.
2. A reference error has been corrected in the Scenario Output tab for the MDS13 and MDS14 scenarios. For these two scenarios, the cell references were previously shifted by two columns, so that the 0.25 and 0.5 year columns were blank, the 1-year column contained the 0.25 year rate, etc.
3. On the Initial Values tab, the formula to populate the initial 30-year rate has been updated to use the 20-year rate if there is no historical 30-year rate data on the valuation date. There was no 30-year data for the period 2/15/2002-2/08/2006 because issuance was suspended, resulting in errors at the 30-year point if one generated scenarios for those dates.
4. The Historical Treasuries tab has been updated to include values through 10/01/2020.
5. Cell B30 of the Inputs tab, an initializing parameter for the cyclical scenarios 13 and 14, has been updated from 8 to 11, to reflect three additional years in a flat portion of the interest rate cycle.
6. A correction was made to the description of the MDS14 on the Scen Dsc tab (no impact on calculations).

Question 4: Does the SOA have plans to refresh or update the MDS analysis and scenarios given the current environment?

Answer: The analysis underlying the MDS scenarios was based on U.S. interest rate data through 2015, supplemented with U.K. data prior to World War I, the period when the U.K. occupied the position of the world's leading economic power. Neither the SOA nor the author have current plans to update the MDS analysis and resulting scenario algorithms. It is expected that adding 4-5 more years of low rate U.S. data would tend to reduce rates in the low-rate scenarios, but that this effect would be modest.

The lack of treatment of negative rates may be viewed as a limitation of the MDS analysis and scenarios. A potential expansion of the research might involve the incorporation of data from countries other than the U.S. and U.K., including countries that have experienced negative rates. In addition to allowing for negative interest rates, such an expansion would significantly expand the data set, which might also improve the statistical validity of the analysis. However, the use of multi-country data would also complicate the analysis and would be a significant undertaking.

It is the author's opinion that, while an update to the MDS analysis could be valuable, the scenarios remain appropriate for their intended purpose.

About The Society of Actuaries

With roots dating back to 1889, the [Society of Actuaries](https://www.soa.org) (SOA) is the world's largest actuarial professional organization with more than 31,000 members. Through research and education, the SOA's mission is to advance actuarial knowledge and to enhance the ability of actuaries to provide expert advice and relevant solutions for financial, business and societal challenges. The SOA's vision is for actuaries to be the leading professionals in the measurement and management of risk.

The SOA supports actuaries and advances knowledge through research and education. As part of its work, the SOA seeks to inform public policy development and public understanding through research. The SOA aspires to be a trusted source of objective, data-driven research and analysis with an actuarial perspective for its members, industry, policymakers and the public. This distinct perspective comes from the SOA as an association of actuaries, who have a rigorous formal education and direct experience as practitioners as they perform applied research. The SOA also welcomes the opportunity to partner with other organizations in our work where appropriate.

The SOA has a history of working with public policymakers and regulators in developing historical experience studies and projection techniques as well as individual reports on health care, retirement and other topics. The SOA's research is intended to aid the work of policymakers and regulators and follow certain core principles:

Objectivity: The SOA's research informs and provides analysis that can be relied upon by other individuals or organizations involved in public policy discussions. The SOA does not take advocacy positions or lobby specific policy proposals.

Quality: The SOA aspires to the highest ethical and quality standards in all of its research and analysis. Our research process is overseen by experienced actuaries and nonactuaries from a range of industry sectors and organizations. A rigorous peer-review process ensures the quality and integrity of our work.

Relevance: The SOA provides timely research on public policy issues. Our research advances actuarial knowledge while providing critical insights on key policy issues, and thereby provides value to stakeholders and decision makers.

Quantification: The SOA leverages the diverse skill sets of actuaries to provide research and findings that are driven by the best available data and methods. Actuaries use detailed modeling to analyze financial risk and provide distinct insight and quantification. Further, actuarial standards require transparency and the disclosure of the assumptions and analytic approach underlying the work.

Society of Actuaries
475 N. Martingale Road, Suite 600
Schaumburg, Illinois 60173
www.SOA.org