



AMERICAN ACADEMY *of* ACTUARIES

Objective. Independent. Effective.™

US Life Insurer Stress Testing

Presentation to the Office of Financial Research

June 12, 2015

Nancy Bennett, MAAA, FSA, CERA

John MacBain, MAAA, FSA

Tom Campbell, MAAA, FSA, CERA



Agenda

- **Stress Testing**
 - A Definition
 - The Evolution of Stress Testing by US Life Insurers
- **Overview of the Uses of Stress Testing by Life Insurers**
- **Overview of the Uses of Stress Testing by US Regulators**
 - Current
 - Own Risk Solvency Assessment (ORSA)
 - In Implementation or Development Phase
- **US Regulatory Requirements for Statutory Reserves & Capital**
 - Methodology, Assumptions, Models
 - Asset Adequacy Analysis
 - Principle-Based Approaches
 - Professional Requirements
- **Concluding Thoughts**



Stress Testing Definition

- Stress testing is a process for measuring the impact of adverse changes in one or relatively few factors affecting an organization's financial position.*
- Types of stress tests
 - Reverse Stress Tests—reverse engineer a scenario that creates a specific event
 - Deterministic Stress Tests—design a scenario to challenge the insurer in specific ways based on its unique exposures
 - Combination of Stress Tests—design a scenario where multiple events that were tested in other scenarios happen simultaneously or sequentially
 - Combinations of Events—design a scenario that combines multiple events and their interactions

* Per Actuarial Standards of Practice 46 & 47

Stress Testing Definition (cont.)

■ Examples

- How much would interest rates have to decrease for capital to decrease 15%?
- What if interest rates spiked 150bp? Equity returns dropped 30%?
- What if mortality rates increased 10%?



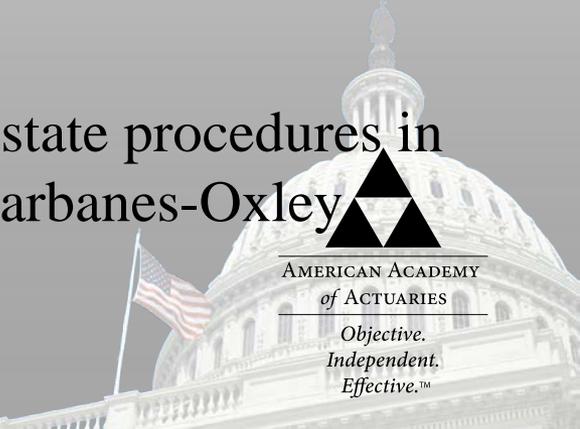
Scenario Testing Definition

- Scenario Testing is a process for assessing the impact of one possible event or several simultaneously or sequentially occurring possible events on an organization's financial position.*
 - Historical scenarios (e.g., 1970 Japan interest rates, 1918 influenza epidemic)
 - Plausible future simulations of one variable (e.g., financial projections over 500 future interest rate paths)
 - Monte Carlo simulations where an assumption is projected by a random process (e.g., US Treasury rates)
- Some insurance reserve and capital calculations utilize stochastic processes, where the results of scenario testing forms the basis for the final reserve or capital amount reported.

* Per Actuarial Standards of Practice 46 & 47

The Evolution of Stress Testing in the US Life Insurance Industry

- Regulatory stress testing of life insurance reserves started in late eighties with the addition of asset adequacy requirements in response to very high interest rates.
- Risk-based capital requirements were introduced in mid-'90s
 - RBC formulas have been refined many times
 - Scenario modeling for interest rate and equity risks added in the 2000s
- Risk-focused examinations introduced in some states in mid-2000s, added to NAIC Financial Condition Examiners Handbook in 2007
- Model Audit Rule added to NAIC Handbook and state procedures in 2010 incorporating many of the requirements in Sarbanes-Oxley



AMERICAN ACADEMY
of ACTUARIES

*Objective.
Independent.
Effective.™*

Increased Emphasis on ERM after 2008 Financial Crisis

- By Insurers, Rating Agencies, and Regulators
- NAIC launched a Solvency Modernization Initiative:
 - Involved an extensive review of financial reporting, solvency, group supervision, and corporate governance regulations
 - Consideration was given to international developments and possible inclusion in US insurance regulation
 - Resulted in changes to solvency requirements (RBC), corporate governance regulations, ERM reviews via ORSA, and group supervision
 - Resulted in individual state requirements directed at specific risks (e.g., liquidity, ERM)

Stress Testing by US Life Insurers



Uses of Stress Testing by Insurers

- Degree of stress testing performed varies by company risk profile
 - Liability risks assumed (mortality, lapse, secondary product guarantees, guaranteed minimum death and living benefits, etc.)
 - Asset risks assumed (credit risk, default risk, etc.)
 - Asset/liability mismatch risk (interest sensitive products, indexed products → hedging)



Uses of Stress Testing By Insurers (Cont'd)

- Leading edge stress testing practices developed and used by insurers have in many cases shaped laws/regulations
- Specific areas of insurer operations where stress testing is used:
 - Pricing—insurers have for many years used deterministic and stochastic models as a basis for pricing; these have been used to model the sensitivity of premium levels and emerging financial results to stresses on the risks assumed (mortality, lapse, investment returns, etc.)
 - Management of Individual Risks—use stress testing activities in ALM models to ensure adequacy of reserves under moderately adverse stresses to risks assumed; also used to measure the effectiveness of hedging strategies under varying economic scenarios

Uses of Stress Testing by Insurers (Cont'd)

- Mergers and Acquisitions—used to value companies/blocks of business for buyer/seller under varying future risk scenarios
- Enterprise Risk Management—used to develop a company’s “risk appetite,” or risk limits, and impact of breaches in risk limits on capital; used to measure “true” or Economic Capital levels and impact on economic capital of risk factor changes
- Strategic Analysis—used to measure anticipated future statutory and GAAP profit flows and capital requirements for growth and impact on these from deviations in risk factors

Regulatory Uses of Stress Testing: current

- Life insurance and annuity reserve adequacy via the Actuarial Opinion and Memorandum Regulation (AOMR)
 - AOMR requires actuary to opine that: “...methods, considerations, and analyses...conform to the appropriate ASOPs*...”
 - ASOP 22–Actuary must ensure reserve adequacy under “moderately adverse conditions” [ASOP 22 Section 3.4.2]
 - ASOP 7–“sensitivity of the model to the effect of variations in key assumptions” [ASOP 7 Section 3.10.2]
- RBC for non-variable annuities (C3, Phase I) and variable annuities (C3, Phase II)

*ASOP refers to Actuarial Standards of Practice

Regulatory Uses of Stress Testing: current

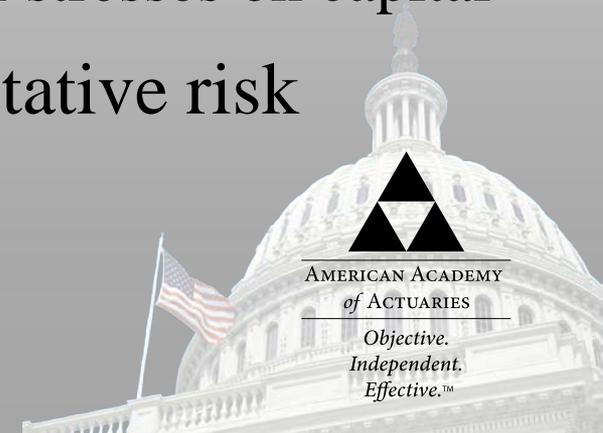
- Variable annuity reserve valuation
 - Conform to requirements of Actuarial Guideline 43 (AG43)
 - Part of NAIC's Accounting Practice and Procedures Manual (APPM) and Examiners Handbook
 - Conditional Tail Expectation (CTE) amount requires cash flow projections under numerous scenarios
- Some states (e.g., NY) require additional stress testing requirements for companies operating in their state
 - As part of insurer's annual statement filing (e.g., "125 bps net yield pickup" test)
 - Periodic ad hoc requirement (e.g., "self support" test for product filings)
- ORSA (effective 1/1/2017)
 - Own Risk and Solvency Assessment
 - "Quantitative...assessments of risk exposure in both normal and stressed environments..." [Page 7 NAIC ORSA Guidance Manual]

Own Risk and Solvency Assessment (ORSA)

- Confidential internal assessment of the material and relevant risks associated with an insurer or insurance group's current business plan, and the sufficiency of capital resources to support those risks
 - Appropriate to the nature of the risk
 - NAIC Model Regulation contains requirements for maintaining a risk management framework, and completing an ORSA, including filing an ORSA Summary Report
- The ORSA Summary Report should discuss three major areas, which will be referred to as the following sections:
 - Section 1–Description of the Insurer's Risk Management Framework
 - Section 2–Insurer's Assessment of Risk Exposure
 - Section 3–Group Assessment of Risk Capital and Prospective Solvency Assessment
- ORSA is less prescriptive, more principle-based

Own Risk and Solvency Assessment (ORSA)

- Section 2 provides a summary of the assessments of risk exposure for each material risk
 - Both normal and stressed environments
 - Range of outcomes using appropriate risk assessment techniques
 - Assessments can be quantitative and/or qualitative
 - Simple stress tests or more complex stochastic analyses
 - Consistent with the way the business is managed
 - Assessment should consider the impact of stresses on capital
- Include material quantitative and qualitative risk tolerance limits



Own Risk and Solvency Assessment (ORSA)

- Relevant comments in the NAIC ORSA Guidance Manual
 - “US insurance regulators do not believe there is a standard set of stress conditions that each insurer should test” [ORSA Guidance Manual page 7]
 - Commissioner may provide input regarding the level of stress for each risk
 - By identifying risk categories independently and reporting results in both normal and stressed conditions, insurer and commissioner can better evaluate certain risk combinations that could cause an insurer to fail
 - History can provide some empirical evidence of relationships, but the future is not always best estimated by history



Regulatory Uses of Stress Testing: In Implementation or Development

- Valuation of life insurance under Principle-Based Reserve (PBR) approach (contingent on states' adoption activities, a 1/1/2017 effective date for life insurance appears likely)
- A Principle-Based Approach is being considered for determining the capital requirements for life insurance business (C-3 Phase III)
 - Replace the current factor based approach with a modeling approach, more consistent with the reserve requirements.
 - Such an approach is likely to apply to inforce and new business
- Redefine Solvency Standards using Stress Testing
 - Specific charge is to evaluate RBC in light of PBR
 - The Subgroup is considering a total balance sheet approach that includes stress scenarios as a new method for establishing regulatory minimum capital.

US Regulatory Requirements for Statutory Reserves & Capital



AMERICAN ACADEMY
of ACTUARIES

*Objective.
Independent.
Effective.™*

Statutory Reserve Requirements

- Reserves are mostly formula driven
 - Subject to an Actuarial Opinion supported by Asset Adequacy Analysis
- Principle-Based Reserves (PBR) are currently required for all Variable Annuity contracts
- A PBR implementation plan is being developed for life insurance
 - Expected to apply to new business issued on or after 1/1/2017
 - Current approach will still apply to inforce life policies issued prior
 - Small company exemption is available
- PBR is also being pursued for fixed annuities (new business only)
 - Targeted completion date is 1/1/2017
- PBR reserves will still be subject to an Actuarial Opinion



Risk-Based Capital (RBC) Requirements

- Mostly factor driven
 - RBC covers the risks: investment, pricing inadequacy due to claims experience, A/L mismatch risk, general business risks (e.g., operational risk)
- Ratio of Total Adjusted Capital to RBC determines regulatory action
- Principle-Based Approaches apply to all annuity contracts
 - C-3 Phase I applies to non-variable annuities
 - C-3 Phase II applies to variable annuities



Actuarial Opinion and Asset Adequacy Analysis

- Required by the Standard Valuation Law and the Actuarial Opinion and Memorandum Regulation
 - “Every life insurance company ... shall annually submit the opinion of a qualified actuary as to whether the reserves and related actuarial items held in support of the policies and contracts ...are computed appropriately, are based on assumptions that satisfy contractual provisions, are consistent with prior reported amounts and comply with applicable laws of this state”
- Opinion is based on asset adequacy analysis
 - Generally requires analysis of asset and liability cash flows under moderately adverse scenarios (cash flow testing)
 - Opinion and analysis reviewed by regulators. Must be acceptable to the commissioner

Asset Adequacy Analysis using Cash Flow Testing

- Most common form of analysis used
- Usually performed over a broad range of deterministic and/or stochastic interest rate and equity performance scenarios
 - “Base” assumptions (mortality, lapses, etc.) usually based on best estimate of future experience; some insurers (not all) include a margin in addition to the base assumption
 - Sensitivity tests of assumptions are also considered
- Projection of asset and liability cash flows over the life of the block of business whose reserves are being analyzed—e.g., 30+ years for Universal Life (UL)
 - Starting assets equal the reserve
 - For each scenario tested, the analysis measures the excess or shortfall of assets to cover liability cash flows
- Actuary should consider whether the reserves and other liabilities being tested are adequate under moderately adverse conditions



AMERICAN ACADEMY
of ACTUARIES

Objective.
Independent.
Effective.™

Actuarial Opinion and Asset Adequacy Analysis

- Allows the appointed actuary to utilize professional judgment in performing the analysis, subject to standards of practice
 - No specific tests are required (although NY 7 scenarios are common)
- Analysis shall conform to Actuarial Standards of Practice, including *ASOP 7, Analysis of Life, Health, or Property/Casualty Insurer Cash Flows*
 - Sensitivity Testing—The actuary should consider and appropriately address the sensitivity of the model to the effect of variations in key assumptions
 - The actuary should consider the intended purpose and use of the analysis and whether the results reflect a reasonable range of variation in the key assumptions, consistent with that intended purpose and use [ASOP 7 Section 3.10.2]

Principle-Based Approaches

- Standard Valuation Law, RBC Instructions, and Valuation Manual (VM)
- A Principle-Based Approach
 - Captures the material risks, benefits and guarantees associated with the contracts, including the tail risk
 - Uses risk analysis and risk management techniques to quantify the risks
 - Permits the use of company-specific experience, based on the availability of relevant and credible experience
- Reserve/RBC based on greater of modeled component or formulaic component
 - VM-20 (PBR for life insurance) includes a deterministic reserve component



Principle-Based Approaches

- Modeled component
 - Similarities to cash-flow testing
 - Broad range of stochastically generated scenarios
 - Starting assets equal approximate statutory reserve
 - Projection of asset and liability cash flows
 - Greatest present value of accumulated deficiencies determines the results for each scenario
 - CTE 70 (reserves) or CTE 90 (variable annuity RBC)—i.e., average of worst results
- Assumptions
 - Company generated scenarios must meet calibration criteria
 - Each assumption must include a margin



Principle-Based Approaches

- PBA include a requirement to perform sensitivity testing of key assumptions

- e.g., AG 43 (PBR for variable annuities) states:

“The impact of behavior can vary by product, time period, etc. Sensitivity testing of assumptions is required and shall be more complex than e.g., base lapse assumption minus 1% across all contracts. A more appropriate sensitivity test in this example might be to devise parameters in a dynamic lapse formula to reflect more out-of-the-money contracts lapsing and/or more holders of in-the-money contracts persisting and eventually utilizing the guarantee. The actuary should apply more caution in setting assumptions for behaviors where testing suggests that stochastic modeling results are sensitive to small changes in such assumptions. For such sensitive behaviors, the actuary shall use higher margins when the underlying experience is less than fully relevant and credible.”



AMERICAN ACADEMY
of ACTUARIES

*Objective.
Independent.
Effective.™*

Professional Standards

- Actuarial Standards of Practice (ASOPs) that govern stress testing
 - ASOP 46, *Risk Evaluation in Enterprise Risk Management*
 - ASOP 47, *Risk Treatment in Enterprise Risk Management*
 - Discussion draft on Capital Adequacy Assessment



Chartered Enterprise Risk Analyst

- The Chartered Enterprise Risk Analyst (CERA) is a credential that a number of international educational societies, including the SOA, offer to those who have satisfied the requisite education and training requirements set out in the CERA Global Treaty. This credential focuses on enterprise risk management.



Concluding Points



Key Considerations in Stress Testing Life Insurers

- A wide variety of products is offered in the insurance market, resulting in significant variations in the risk profiles of individual insurers due to different investment, business, and risk management strategies.
- The risks managed by insurers are complex, creating significant challenges in the testing and management of risks.
 - The insurance business model includes promises made to policyholders for 50+ years
 - A life insurer's assets and product liabilities are integrated
- Uniform, mandated, one-size-fits-all risk analysis can produce misleading results, leading to incorrect conclusions about an insurer's exposure to risk. Stress testing based on uniform scenarios can identify outliers, leading to more in-depth discussions between regulators and insurers.
- Fundamentally, the life insurance business is a business of managing risks. Regulation can not totally eliminate risk; regulation can however provide regulators with better information to oversee insurers.

Final Thoughts

- Stress Testing is a fundamental analytical tool used by actuaries for many purposes.
- Stress Testing has been gradually introduced into the regulation of US life insurers for the last 30 years.
- As expectations for more sophisticated risk analysis increase, stress testing will take on greater importance for life insurer management and Boards, rating agencies, and regulators.



Questions?



AMERICAN ACADEMY
of ACTUARIES

Objective.
Independent.
Effective.™

For More Information

Nancy Bennett, Senior Life Fellow

American Academy of Actuaries

1850 M Street, NW Suite 300

Washington, DC 20036

202-223-8196

bennett@actuary.org

