



CARIBBEAN ACTUARIAL ASSOCIATION



Accredited as a Full Member  
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# 2015 Conference "Strength in Numbers"

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# Technology Risks and Opportunity

## Model Risk

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# Model Risk...

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- Defining it
- Wrong models
- Model governance
- Validation
- Data quality
- Managers and models

# “Model” Definition

## per ASB Exposure Draft ASOP on Modeling

- Model—A representation of relationships among variables, entities or events using statistical, financial, economic, mathematical or scientific concepts and equations
- Models are used to help explain a system, to study the effects of different components, and to derive estimates and guide decisions. A model consists of:
  - 1) A specification
  - 2) An implementation
  - 3) And one or more model runs



# “Model Risk” Definition

per ASB Exposure Draft ASOP on Modeling

- Model Risk—The risk of adverse consequences from decisions made as a result of a model that does not adequately represent that which is being modeled
- Typically this means three types of risks:
  - 1) Use the wrong model in the wrong way
  - 2) Misunderstand or misuse the output
  - 3) Model has fundamental errors



# Using the Wrong Model

- Variable Annuity \$ for \$ partial withdrawals: Assuming irrational behavior
- Universal Life gaming the system
- Missing drivers
- Wrong functional / statistical form



“Everything should be made as simple as possible, but not simpler”

Albert Einstein



# Misunderstanding or Misusing Output

Examples:

- Scale
- Currency
- Time frequency
- Time horizon
- Business covered
- Scenario
- Assumptions used
- Interpretation of data
- Out of date
- Risk mitigation
  - Documentation
  - Ownership



“All models are wrong, but  
some models are useful”

George E. P. Box



# Identifying What is Wrong

## What can be wrong?

- Input
- Assumptions
- Formulas
- Reports
- Scope

## How can it be wrong?

- Product mechanics
- Asset mechanics
- Reserving / cash value calculations
- Assumptions
  - Mortality and morbidity
  - Expenses
  - Policyholder behavior
  - Company behavior
  - Asset options

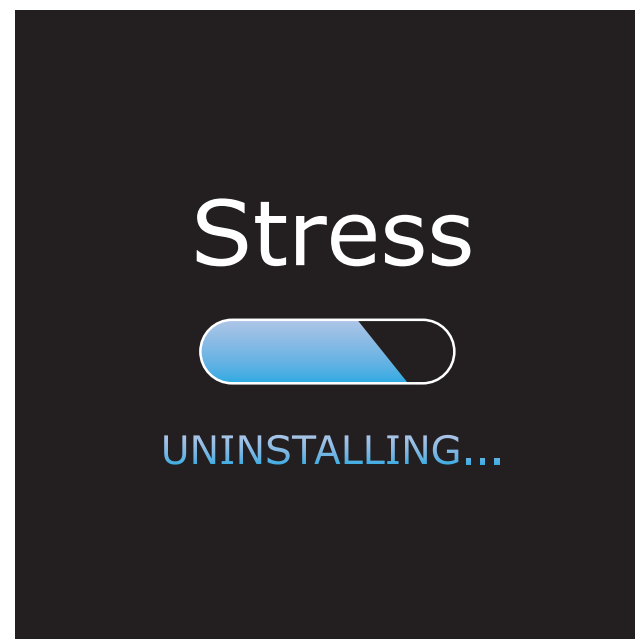
“It is better to be vaguely right than exactly wrong”

Carveth Read



# Validate or Refine?

- Fundamental problem with actuaries:  
Continuing to refine
- **One hour** spent on model validation and documentation beats ten hours on model refinement



# Model Governance and Controls

- Who can access the models?
- Separate development, test and production environments
- Separate validation and development teams
- Controlled procedures for making changes
- Standards for documentation
- Standards for testing
- Standards for validation
- Standards for peer review
- Reproducibility / backups

# Macro Reality Checks

- Management action needs validation
- The value of the Delphi method
- Tabular versus formulaic assumption specifications



# Knowing the Next Steps

- Change process
  - ❑ Definition of problem / need
  - ❑ Materiality estimation
  - ❑ Solution definition and documentation
  - ❑ Implementation
  - ❑ Documentation (as built)
  - ❑ Validation
  - ❑ Peer review
  - ❑ Results reasonableness
  - ❑ Ladder / waterfall
  - ❑ Production merge
  - ❑ Repeat validation
- Appropriate signoff at every stage
- Documentation at every stage
- Separate teams

# How to Validate

- Step changes
- Comparison against predictions
- Cell audits
- Subtotals / slices
- Internal consistency
- Stress tests
- Boundary conditions
- Static validation
- Dynamic validation
- Parallel models
  - ❑ Pricing versus forecast
  - ❑ Illustration versus pricing



# The Problem of Induction



# Data Quality

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The model is only as good as the data coming in:

- Consistency
- Roll forwards
- Sampling
- Control totals / subtotals / pivots
- Averages

# Managers Need to Understand Models

Trust



Key man risk



Misuse or  
misunderstand

Don't trust



Won't use or rely

“For every complex problem there is an answer that is clear, simple, and wrong.”

H.L. Mencken



# Suggested Further Reading

- “How Model Risk Devastated an Organization,” Segal, Sim, *The Actuary*, June/July 2013
- “Assessing Model Risk in Practice,” SIAS, *The Actuary*, February 2013
- Guszczka, Jim, FCAS, Casualty Actuarial Society, Annual Meeting, 2009
- Guidance on Model Risk Management  
[www.federalreserve.gov/bankinforeg/srletters/sr1107.htm](http://www.federalreserve.gov/bankinforeg/srletters/sr1107.htm)
- Second Exposure Draft of ASB ASOP on Modeling  
[www.actuarialstandardsboard.org/asops/modeling-second-exposure-draft/](http://www.actuarialstandardsboard.org/asops/modeling-second-exposure-draft/)

