“RAISING THE BAR” ON MODEL VALIDATION

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- **Do not** discuss what you or other entities plan to do in a particular geographic or product markets or with particular customers.
- **Do not** speak on behalf of the SOA or any of its committees unless specifically authorized to do so.
- **Do** leave a meeting where any anticompetitive pricing or market allocation discussion occurs.
- **Do** alert SOA staff and/or legal counsel to any concerning discussions
- **Do** consult with legal counsel before raising any matter or making a statement that may involve competitively sensitive information.

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Agenda

- What’s changed?
- Model validation techniques
- Case studies
- Best practices
What’s changed?
# US GAAP LDTI - summary

## Areas impacted by GAAP LDTI

<table>
<thead>
<tr>
<th>DAC</th>
<th>Traditional liabilities</th>
<th>Market risk benefits</th>
<th>Disclosures</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Straight-line”</td>
<td>Unlocking</td>
<td>All other-than-nominal market risks that provide protection to contract holder measured at fair value</td>
<td>DAC and liability roll-forwards</td>
</tr>
<tr>
<td>No longer tested for impairment</td>
<td>Best estimate assumptions</td>
<td>Instrument specific credit risk to OCI</td>
<td>Assumptions updates and judgements</td>
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<tr>
<td>No shadow OCI</td>
<td>Market bond yield discount rates&lt;sup&gt;1&lt;/sup&gt;</td>
<td></td>
<td>LRT/np cap details</td>
</tr>
<tr>
<td>Similar changes to “DAC-like” balances</td>
<td>Interest rate risk to OCI</td>
<td></td>
<td>And more...</td>
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</table>

<sup>1</sup>Cash flows are discounted using upper-medium grade (low credit risk) fixed-income instrument yields.
Areas impacted by PBR

**VM-20: Life products**
- VM-20 reserve = 3 components
  - NPR = mostly prescribed assumptions, minimum floor
  - DR = Assumptions based on company experience where credible, single deterministic scenario
  - SR = Same liability assumptions as DR, scenarios based on ESG
- Deterministic Exclusion Testing
- Stochastic Exclusion Testing

**VM-21: Annuity products**
- VM-21 maintains much of AG43
- Aggregate reserve = Max (Standard Scenario amount, CTE amount)
  - Standard Scenario reserve similar to VM-20 DR
  - CTE 70 reserve similar to VM-20 SR

**Other requirements**
- VM-31 = reporting and documentation
- VM-50 = Experience reporting requirements
- VM-G = Corporate governance (Board, senior management, qualified actuary requirements)
**ASOP 56 – modeling standards**

### Development and use
- Separate production and sandbox environments
- Change controls
- Input and output management
- Documentation

### Validation
- An ongoing & independent verification activity
- Ensures that model calculations are performing as expected and used consistently with intended purpose

### Oversight
- Governance framework including roles, responsibilities, and standards
- Model inventory and risk assessment

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**ASOP 56**
Professional standards and guidance when “designing, developing, selecting, modifying, using, reviewing, or evaluating models.”
Opportunities for model validation

**Input**
- Modernize data architecture and processes to extract, transform, and load
- Refine assumptions and align with other projection bases

**Calculations**
- Enhance model functionality, remove simplifications, and adopt new software features
- Review modeling standards and methodology decisions

**Output**
- Streamline reporting and minimize downstream processing
- Build strategic analytics to enhance business decisions
Model validation techniques
## Risk-based approach to model validation

<table>
<thead>
<tr>
<th>Step</th>
<th>Activity</th>
<th>Potential Risk</th>
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<tbody>
<tr>
<td>1</td>
<td>Model identification</td>
<td>High</td>
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<tr>
<td>2</td>
<td>Model risk assessment</td>
<td>Low</td>
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<tr>
<td>3</td>
<td>Data collection</td>
<td>Medium</td>
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<td>4</td>
<td>Testing and quantifications</td>
<td>High</td>
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<tr>
<td>5</td>
<td>Documentation and communication</td>
<td>Low</td>
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<tr>
<td>6</td>
<td>Remediation</td>
<td>High</td>
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### Model validation techniques

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<th>Degree of rigor</th>
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The degree of rigor in a model validation should align with the risk of the model component.
Case studies
## Model validation techniques

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What key risks are presented and what are their possible solutions?
Case study #1 – input validation

You are validating the data input process for the new LDTI model in the testing environment. You confirmed the accuracy of the inputs and notified IT to move the data to the Production environment. Controls are in place to reconcile data between testing and Production.

**Risk**

- Input data may be lost after model run
- Improper mapping of inputs
- Manual data process and controls may introduce error

**Solution**

- Establish streamlined and automated control process to verify inputs and outputs
- Spot checking of material inputs and assumptions
- Time zero static validation
- Periodically review controls
# Model validation techniques

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Case study #2 – model simplifications

Your company converted to a new modeling software as part of LDTI implementation. Certain immaterial product features are modeled using a simplified approach. Your actuarial student has compiled informal documentation of the simplifications and quantified financial impacts in a spreadsheet.

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**Risk**

- Simplifications could have unintended consequences to other parts of the models
- Inconsistency in reported reserves
- Simplification may be too aggressive, impact may increase over time
- Key person risk

**Solution**

- Framework for monitoring and assessing simplifications
- Formal documentation of key methodologies
- Sensitivity testing / quantifying financial impacts regularly
- Policy level testing and reconciliation to model output
Case study #3 – model software update

The software vendor just performed a formula database upgrade to fix a bug affecting the calculation of VM-20 seriatim level profits in the post-level term period. You reviewed the correction in the new version, performed a unit testing on one policy and confirmed the new software version is good for use.

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- Version upgrades may also involve other bug fixes and enhancements
- Model methodology and calculation may be compromised for other blocks of policies
- New bugs may be introduced as part of the upgrade

- Establish policy-level validation tools that test a more robust sample
- Periodically determine model versions to be used
- Perform regression testing
- Review vendor’s bug and enhancement reports during upgrades
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Degree of rigor

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2. Medium
3. Low
Your model development team completed the new traditional life GAAP model. They also performed unit testing, stress testing, and single policy testing. They conclude the results are reasonable and move the model to production. The Valuation team relies on the development team’s testing.

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### Risk
- Rigor of model validation techniques are insufficient for the associated model
- Key modeling errors may not be detected due to lack of separation of duty
- Modeled results may lead to inaccurate financials

### Solution
- Secure buy-in of testing plan from key stakeholders
- Clearly define roles and responsibilities of model governance process, and review periodically
Best practices
A robust model development cycle can result in infrastructure that is easier to maintain.
A well-designed data input process will require less upkeep

- Coordination between business areas to define complete requirements
- No transformations between extract and model
- Clearly defined data and system ownership and roles
- External suppliers must attest to effectiveness of their controls
- Validation to ultimate source (e.g., contracts, policy administration records)
- Periodic sampling and testing
- Single repository of master data and definitions
- Production data stored with read-only access
- A well-designed data input process will require less upkeep
The rigor of validation techniques will be fully aligned to their associated risks
Reporting and communication of results will be streamlined with analytics tools and controls

<table>
<thead>
<tr>
<th>Automate and streamline</th>
<th>Ledger controls</th>
<th>Analytics and KPIs</th>
<th>Segregation of duties</th>
<th>Proactive Communication</th>
<th>Documentation</th>
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<tr>
<td>Reduce risk by automating processes and reducing hand-off steps and manual processes</td>
<td>Validate model results to ledger values and have tracking system for outside-of-model adjustments</td>
<td>Develop standard analytics packages with appropriate review guidelines</td>
<td>Clearly define owners throughout process for proper accountability</td>
<td>Proactively communicate between upstream and downstream owners and with internal and external audit</td>
<td>Illustratively document all process inputs, outputs, and accounting bases</td>
</tr>
</tbody>
</table>