



Institute  
and Faculty  
of Actuaries

## Model Risk - Illuminating the black box

Model Risk Working Party

07 June 2017



### Model Risk – Illuminating the Black Box

Working Party paper due to be published and presented to the Institute and Faculty in Edinburgh on 29 June 2017.

Contents:

- Model Risk – Daring to Open the Black Box and Case Studies
- Model Risk Communication
- ***Practical Implementation of a Model Risk Management Framework***
- ***Model Risk – Lessons Learned from Other Industries***
- ***Practical Applications of Model Risk Management in Actuarial Fields***



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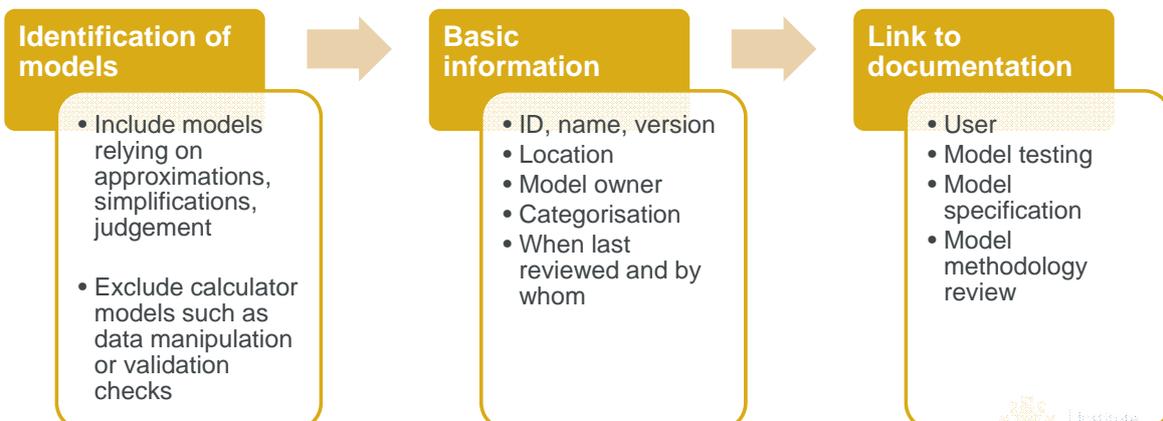
## Today's Agenda

- **Practical Implementation of a Model Risk Management Framework**
  - Central Inventory of Core Models
  - Assigning Key Model Roles
  - Third Party Model Software
  - Independent Review and Frequency
  - The Culture Challenge
  - Model Risk Assessment / Quantification
- Model Risk – Lessons Learned from Other Industries
- Practical Applications of Model Risk Management in Actuarial Fields



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## Central Inventory of Core Models



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## Assigning Key Model Roles

Role	Main responsibilities	Main risks / mitigating actions
Chief Risk Officers	Ensuring all models are identified and recorded in the model inventory, and have Key Model Roles assigned	<ul style="list-style-type: none"> <li>inventories</li> <li>Gaining agreement on Model Owners</li> </ul>
Model user	Model being used appropriately and only using the model after approval by the Model Approver	<ul style="list-style-type: none"> <li>Training, governance</li> <li>Reducing key person dependencies</li> </ul>
Model owner(s)	Maintenance of information in model inventory system, model risk prioritisation, compliance with model risk control standards, sign-off of model developments, model monitoring, liaising with the Model Reviewer and Auditors	<ul style="list-style-type: none"> <li>Ensuring models in inventory are accurate and up-to-date.</li> <li>Needs sufficient authority / seniority</li> </ul>
Model reviewer	Performing independent validation and reviews of models	<ul style="list-style-type: none"> <li>Technical competence</li> <li>Access to key staff</li> </ul>
Model approver	Reviewing residual risk assessments and approving the use (or limited use) of the model	<ul style="list-style-type: none"> <li>Managing if models are at various stages of change.</li> <li>Difficulty in not approving a model for use</li> </ul>
Internal auditor	Checking due process has been followed when using models	<ul style="list-style-type: none"> <li>Timely, recording of audit</li> <li>Ensuring audit trails</li> </ul>
External auditor	Independent review of process, methodology, assumptions, limitations, results	<ul style="list-style-type: none"> <li>As for internal.</li> <li>Focus on exceptions and deviation from process</li> </ul>

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## Third Party Model Software



- “Another team, in a separate room”
- Due diligence critical
- Include 3rd party models in your inventory
- Ensure suitably qualified personnel
- Keep your software up to date
- Test new versions
- Keep documentation up to date

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## Independent Review and Frequency

- Independent review – defined as validation by people who have no involvement in the design and operations of the model being validated
- Evidence and record review

### Review contents:

- Model review date; the model and version being reviewed
- Is purpose clear and has it been used for that purpose?
- Review of documentation; could it be followed by a technically competent third party?
- Evidence of requirements, testing documentation and recent model sign off
- Action points and agreed completion dates

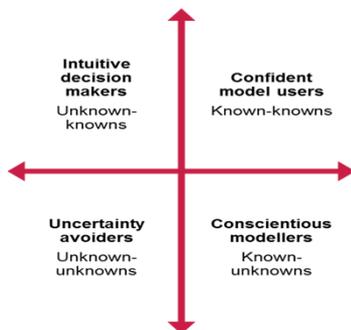


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## The Culture Challenge

### Daring to Open the Black Box

- Successful governance requires reflection of the different cultures of modeluser



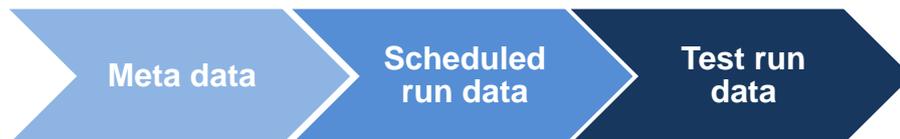
### Illuminating the Black Box

- Opening up the model
- Social pressures
- Balancing model change and innovation



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## Model Risk Assessment / Quantification



Increased triage accuracy but increased effort



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## Today's Agenda

- Practical Implementation of a Model Risk Management Framework
- **Model Risk – Lessons Learned from Other Industries**
  - Weather Forecasting
  - Aerospace
  - Software development
  - Auditors
- Practical Applications of Model Risk Management in Actuarial Fields



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## Weather Forecasting

- Errors noticeable – “Michael Fish” moments
- Making progress
  - RMS error statistic forecast vs naïve forecast
  - Numerical Weather Prediction Index
- Monitoring progress
  - User satisfaction measures
- Considerations for actuarial Models
  - Could we better assess and communicate progress in our forecasting skill?
  - Box ticking vs true progress



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## Aerospace

Consequences of Model risk materialising may be extremely serious

Areas considered:

- Computational fluid dynamics
- Flight control systems
- Incident investigation by independent investigators

Considerations for actuarial Models

- It is useful to understand what caused Models to go “wrong” !



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## Software Development

- Conceptual Model vs Software Implementation
- Test Driven Design (TDD) vs Behaviour Driven Design (BDD)
- The use of Meta Data in Software development



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## Auditors

- Third line of defence
  - Supplement “first line” – day to day users and “second line” – risk function
- Internal and external
- Highlight importance of
  - Controls and process completed in real time and evidenced
  - Clear lineage from initial model specification, test plans, test evidence, and model sign-off
  - Ability to evidence checks and process with documentation



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## Today's Agenda

- Practical Implementation of a Model Risk Management Framework
- Model Risk – Lessons Learned from Other Industries
- **Practical Applications of Model Risk Management in Actuarial Fields**
  - Life Office
  - Banking
  - Pensions
  - Links to TAS-100



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## Life Office

- Overview of Model risk mitigation techniques:
  - Central inventory
  - Model development process
    - Change controls – central and local
    - Practicalities – prioritisation
  - Training and controls
  - Automation improves efficiency – eg with VBA
  - Inline code comments
  - Model simplification and removal where justifiable
  - Robust organised filing system



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## Banking

- PRA outlined expectations in area of Model Risk November 2015
  - Board must understand 5 key areas
- “Models” vary from simple checks to complex Models driving the business
- Models are risk rated and more significant / complex fall under framework
- Independent review required at regular intervals
- Regulatory review required in some cases
- Performance monitoring of KPIs usually conducted quarterly
- Senior management reporting



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## Pensions

- High reliance on model results
- Regulatory environment
  - Requirement for reporting of key numbers
  - Introduction of IORP II
- Key stakeholders: scheme actuary, trustees, employers, regulator
- Model uses: valuation, risk transfers, longevity projections
- Considerations for actuarial models
  - Increased focus on risk management expected moving forwards
  - Long term nature of the business presents challenges



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## Links to TAS-100

- New technical actuarial standard in force from 1 July 2017
- Aim to promote high quality actuarial work
- Key principles for Models include:
  - Models must be fit for purpose and this documented along with the model calculations
  - Controls and tests must be documented
  - Communications shall include methods, measures, rationale, changes, and limitations
- Framework set out by Model Risk Working Party consistent with TAS-100



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**Questions**

**Comments**

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