



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***



Institute
and Faculty
of Actuaries

07 June 2017

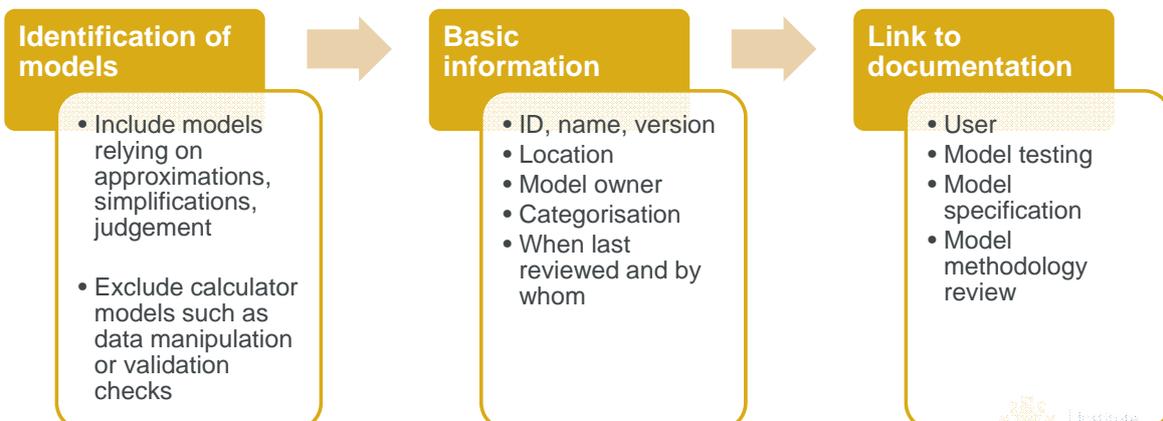
Today's Agenda

- **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



07 June 2017

Central Inventory of Core Models



07 June 2017

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"> inventories Gaining agreement on Model Owners
Model user	Model being used appropriately and only using the model after approval by the Model Approver	<ul style="list-style-type: none"> Training, governance Reducing key person dependencies
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"> Ensuring models in inventory are accurate and up-to-date. Needs sufficient authority / seniority
Model reviewer	Performing independent validation and reviews of models	<ul style="list-style-type: none"> Technical competence Access to key staff
Model approver	Reviewing residual risk assessments and approving the use (or limited use) of the model	<ul style="list-style-type: none"> Managing if models are at various stages of change. Difficulty in not approving a model for use
Internal auditor	Checking due process has been followed when using models	<ul style="list-style-type: none"> Timely, recording of audit Ensuring audit trails
External auditor	Independent review of process, methodology, assumptions, limitations, results	<ul style="list-style-type: none"> As for internal. Focus on exceptions and deviation from process

07 June 2017

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

07 June 2017

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

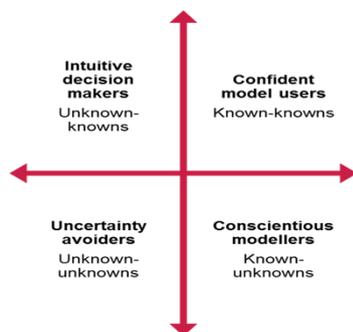


07 June 2017

The Culture Challenge

Daring to Open the Black Box

- Successful governance requires reflection of the different cultures of modeluser



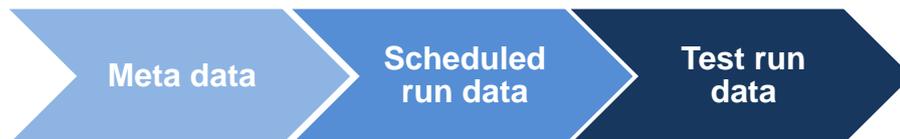
Illuminating the Black Box

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



07 June 2017

Model Risk Assessment / Quantification



Increased triage accuracy but increased effort



Institute
and Faculty
of Actuaries

07 June 2017

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



Institute
and Faculty
of Actuaries

07 June 2017

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



07 June 2017

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” !



07 June 2017

Software Development

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



07 June 2017

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



07 June 2017

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



07 June 2017

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



07 June 2017

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



07 June 2017

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



07 June 2017

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



07 June 2017

Questions

Comments

The views expressed in this [publication/presentation] are those of invited contributors and not necessarily those of the IFoA. The IFoA do not endorse any of the views stated, nor any claims or representations made in this [publication/presentation] and accept no responsibility or liability to any person for loss or damage suffered as a consequence of their placing reliance upon any view, claim or representation made in this [publication/presentation].

The information and expressions of opinion contained in this publication are not intended to be a comprehensive study, nor to provide actuarial advice or advice of any nature and should not be treated as a substitute for specific advice concerning individual situations. On no account may any part of this [publication/presentation] be reproduced without the written permission of the IFoA [or authors, in the case of non-IFoA research].



07 June 2017