Model Error Risk - Unravelling the model environment web

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• What is Model Risk?
• Putting a framework in place
• Helping to quantify the risk
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In the news and on the agenda …
Not all press is good press!

**Chief Economist admits errors in Brexit Forecasting**
The Guardian – Jan 2017

**JPMorgan loss stokes risk model fears**
$2bn trading hit gives boost to critics of Value-at-Risk
Financial Times – March 2013

**RBS admits error in stress test data**
BBC – Nov 2014

**Online Leading Platform admits it miscalculated investors’ annual returns**
Financial Times – May 2017

**Risk Management Breakdown at AXA Rosenberg**
Firms Agree to Pay More Than $240 Million to Settle SEC Charges in 2011 (for concealing coding error); articles published hypothesising too much trust placed on model managers
Stanford Closer – May 2013

**Bank of America Finds a Mistake: $4 Billion Less Capital**
Telegraph – April 2014
Importance to GI Insurers
Why and what to consider in a model risk assessment?

Governance
Risk Committee
Risk Scoring
Overarching policies
MI
Reserving
Key Models
Point Estimates
Limitations
Business Unit Adoption
Spreadsheets
Inventory
Local Application
General Insurance
Competency
OCC

FSB
SR11 Compliance
End to End Transformation
Legacy System

Business Critical
Aggregation
Life Insurance
Age of Models
Validation

Appetite
Capital
Model Definition
Solvency II
Tolerances
Policies and Standard
Enterprise Wide
Reconciliation
Internal Audit
Culture
Pricing v Reserving

Internal Model
Overarching policies
Validation
Reconciliation
Pricing v Reserving

Banking
Point Estimates

Point Estimates
Local Application

Risk Scoring
Model risk is being pushed higher up the agenda of Senior Management

Key Challenges

1. Model error risk managed but not consistently nor robustly
2. Model Landscape not fully understood
3. Errors undermine confidence
4. Lack of clarity over ownership of model risk
5. New models may be well governed but older models may contain hidden risks
6. Models cover end to end process and not just calculation engine

Market developments

- Develop an **Enterprise-wide** approach to managing model risk
- Ensure **consistency of application** across business units and geographies, where relevant
- Assess areas of **current good practice** and build on these, including developments as part of Solvency II
- Learn from historical errors and ensure controls are fit for purpose
- Apply **technology and analytical solutions** to cut through complexity and volume
- Define roles and responsibilities for **1st, 2nd and 3rd lines of defence**
- Bring model risk **within risk appetite**

Assessing model error risk needs to consider all areas of an organisation which have a role in developing, governing and using model results. As such any framework needs to reflect this enterprise wide scope in its approach and any assessment process should not underestimate the eventual reach and impact.
What is Model Risk?
Question Time

• Which number concerns you the most?
• Which model produces that number?
• How many models flow into the model which produces the number?
• How many individuals and teams work on the models which flow into the model which produces the number?

• What does that process look like?

• What is a model??
What do we mean by the term ‘model’?

An End to End Process recognising all the constituent parts from Data through to Business Use

Information component  Calculation processing component  Results reporting component  Use
What is Model Risk and where does it lie?

“The potential for adverse consequences from decisions based on incorrect or misused model outputs and reports”

EU Regulation (DIRECTIVE 2013/36/EU)

Model risk occurs primarily for two reasons:

1. The model may have fundamental errors and may produce inaccurate outputs when viewed against the design objective and intended business uses

2. The model may be used incorrectly or inappropriately or there may be a misunderstanding about its limitations and assumptions

US SR11-07, IFoA Model Risk Working Party
How does model risk arise?

To understand inherent risks that exist within your model lifecycle, the end to end process should be assessed, monitored and tested.
Dealing with the problem: Putting a framework in place
Where to begin….

1. Risk Appetite Statement:
   - Have you discussed model risk with your Board?
   - Do they understand the risks associated with your models?
   - What is their tolerance for errors, given the prohibitive cost of eliminating risks of errors?

2. Risk Limits:
   - Do you have them?
   - Can you differentiate between models?
   - How well do they support decision making and taking action?

3. Model Inventory:
   - Do you know how many models you have in the organisation?
   - Which of them are critical?
   - For the critical ones, where do the risks lie?

4. Policies & Standards:
   - Do you have them?
   - How good are they?
   - How well understood and followed are they?

5. Risk Measurement and Scoring:
   - Do you have a process to evaluate where risk lies in the process?
   - Can you measure the risk levels at each stage?
   - Is each key model process mapped and all moving parts well understood?

6. Controls:
   - How well are they working?
   - Do they align to where risk lies?
   - Are they consistently applied?

Through this approach identify the areas requiring in-depth validation and baselining.
Risk Measurement: Model Error Assessment

- Each component of the process should be assessed against a defined list of risks.
- Ranking of ‘riskiness’ enables clarity around higher risk areas.
- Risk rating should be linked to the wider Operational Risk Framework.
- Consistency of approach enables comparison across models.
- Clarity of the assessment process supports wider communication.

<table>
<thead>
<tr>
<th>Component</th>
<th>Governance</th>
<th>Inputs</th>
<th>Calculation</th>
<th>Results</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Define what ‘good’ looks like</td>
<td>Data Preparation</td>
<td>Source Data</td>
<td>Model Lifecycle</td>
<td>Results Production</td>
<td>External Reporting</td>
</tr>
<tr>
<td>Review each model process against the optimal state</td>
<td>Data Extraction</td>
<td>Model Point files</td>
<td>Development Model</td>
<td>Consolidation</td>
<td>Business Decisions</td>
</tr>
<tr>
<td>Peer review to ensure consistency</td>
<td>Transformation</td>
<td>Grouping</td>
<td>Production Model</td>
<td>Manual Adjustment</td>
<td>Internal MI</td>
</tr>
<tr>
<td>Report on each process stage</td>
<td>Cash-flow and Methodology</td>
<td>Product Documents</td>
<td>Results</td>
<td>Results</td>
<td>Other Model Inputs</td>
</tr>
<tr>
<td>Expert Judgement</td>
<td>Assumptions</td>
<td>Assumption Papers</td>
<td>Input Files</td>
<td></td>
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</tbody>
</table>
Risk Measurement: Drawing out the thematic issues

- The analysis of individual models produces local model risks and issues
- The identification of common thematic risks across the model portfolio may be a more productive way of addressing wider modelling concerns
A model error risk assessment provides an improved view as to where risk lies in the process.

The thematic view enables key control points to be established.

The assessment of current controls establishes the Gap to be filled.

Improved controls instigated.
Roles and Responsibilities

Model error risk is a key risk to the operations of a company which can have unexpected impact on reported results and balance sheet position. In this context, it is crucial for management to be clear on the controls framework that is in place and to take a view on its adequacy. Each of the three lines of defence has a role to play.

Establish a Model Governance and Controls Framework

- Establish framework of model controls
- Provide Oversight and Validation by checking

Provide Independent Assurance

1st Line - Own and Operate
2nd Line – Guide, Support, Challenge
3rd Line – Internal Audit
Dealing with the problem: Helping to quantify the risk
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Risk Appetite

We have very limited tolerance for model risk where inaccuracies would result in:

• Poor decision making,
• Material financial misstatement,
• Disruption or delay to disclosure of results,
• Widespread customer detriment,
• Reputational damage to the group.

However, we accept that we cannot completely eliminate the risk and are prepared to tolerate a degree of model error, provided it remains within pre-set operating ranges.

The Risk Appetite applies to **significant models**, which are defined to be those that could lead to one or more of the following:

• **Poor decision making** by the executive committee of a business unit, entity, or group; or that is used in providing MI at a group or business unit risk committee;
• **Material financial misstatement**;
• **Disruption or delay to disclosure** of entity results, or other milestone deemed critical by the Board of any entity;
• **Widespread customer detriment**; or
• **Damage to the reputation** of the group or a legal entity within the group, at a level likely to be reported to the Group Audit Committee.

Challenge: How to set acceptable ranges?
Risk Appetite : Possible Framework - Top Down

• Board:
  - Sets and approves Risk Appetite

• CRO:
  - May consider different tolerances depending on the model and its business use
  - Define risk limits and metrics to be monitored based on past experience, peer comparisons
  - Sets the prioritisation of models to be validated in accordance to usage level and materiality perhaps via reference to a number of questions designed to define ‘riskiness’

• Model Owner:
  - Updates inventory on number of models being used
  - Provide training to team
1. Discovery
   • Automated discovery of the entire spreadsheet estate.
   • The discovery phase identifies data flows and links between models to provide a picture of dependencies.
   • This linkage captures links from other software into the spreadsheet model.
   • Mechanically builds up a picture to illustrate the complexity of the underlying model environment
   • Model inventory populated

2. Risk Assessment
   • Automated identification of high-risk EUC models and spreadsheets.
   • ‘High-risk’ identification is based on standardised rules
   • Examples of high-risk values may be hard-coded numbers, hidden (and very hidden) data, data identified as personal/sensitive, complex formulae.
   • We can help to tailor these conditions to meet your materiality framework
Risk Appetite: Assessing individual risks with model
Revisiting the Model Error Risk Assessment

The key dimensions
in the end to end modelling environment

- Qualitative criteria for each element of the model under examination
- Can be translated to a score with associated weight to produce a quantitative score metric
- This can be aggregated for each model to compare risk levels between models
Risk Appetite: Assessing individual risks with model
Overlaying a stochastic lens on this approach

- Adding correlations to improve the robustness of risk score

- Listing potential error risk events, from the model error risk assessment conducted …with knowledge of their probabilities from risk scoring

- Severities can be added and correlations so that aggregated impacts can be calculated, while also allowing for diversification impacts

- …this helps to provide a range of risk score percentages for each model which help more easily define the risk limits and appetites
Case study
Developing a model error risk framework

There are five phases in developing the model risk framework. These cover all the major components of assessing the model environment and producing a business action plan to enhance the model risk framework and reduce residual model risk.

1. Phase 1: Model Risk Appetite
2. Phase 2: Model Standards
3. Phase 3: Model Error Risk Assessment
4. Phase 4: Controls Identification and Mapping
5. Phase 5: Business Action Plan
Final Thoughts
Model Error Risk – Some takeaways

01 Model Error Risk continues to be a growing area of Operational Risk for Firms and Regulators

02 Insurers should not rely on Solvency II to cover off model governance requirements

03 Models need to be considered in the context of an End to End process with a number of inputs, outputs & potentially moving parts

04 Integration with wider Risk Framework, Appetite & Limits is essential and all three Lines of Defence should be involved

05 Opportunity to learn from the Banking global management standard SR11-07 and what has been achieved with Solvency II

06 Don’t be lulled into a false sense of security... pre-empt the regulator interest and assess your model risk!
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