MODEL RISK: A VIEW FROM THE THIRD LINE

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MODEL RISK – AN EXPERIMENT
MODEL RISK: A VIEW FROM THE THIRD LINE

- Model Risk in perspective
- Regulatory context
- Legal & General Internal Audit Approach
- People
- Future developments

MODEL RISK IN GOOGLE BOOKS LIBRARY

Google Ngram viewer shows references to “model risk” increased five times between 1995 and 2005
MODEL RISK IN RESEARCH

20% of spreadsheets used in scientific papers in field of Genomics contained errors

Errors increasing at 15% vs 4% growth in papers

Source: “Gene name errors are now widespread in the scientific literature”, Ziemann, Eren and El-Osta, 2016

MODEL RISK IN BUSINESS

<table>
<thead>
<tr>
<th>Name</th>
<th>When</th>
<th>What Happened</th>
</tr>
</thead>
<tbody>
<tr>
<td>West Coast Mainline bid (HM Treasury)</td>
<td>2011</td>
<td>Model used to assess rival bids inconsistent and incorrect conclusion drawn</td>
</tr>
<tr>
<td>JP Morgan (London Whale)</td>
<td>2012</td>
<td>Ignored control warnings, changed how VaR measured</td>
</tr>
<tr>
<td>US Federal Reserve</td>
<td>2010</td>
<td>Spreadsheet error in Fed’s Consumer Credit Calculations</td>
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</tbody>
</table>
THE LEGAL & GENERAL GROUP INTERNAL AUDIT VISION

"To be recognised as a leading edge global audit team, which provides robust assurance and value creating insight and challenge through the excellence of our people and processes."

MODEL RISK 3rd LINE ASSURANCE

- Corporate Governance Code
- IIA Financial Services Code
- Supervisory Guidance on model risk management
- Review of quality assurance of Government analytical models
BOARD GOVERNANCE REQUIREMENTS

Section C: Accountability

The board is responsible for determining the nature and extent of the principal risks it is willing to take in achieving its strategic objectives.

The board should maintain sound risk management and internal control systems.

MODEL RISK ASSURANCE

“Internal Audit should focus on the areas where it considers risk to be higher.”
MODEL RISK ASSURANCE

IIA Financial Services Code: Key focus areas

a) Internal governance
b) The information presented to the Board and Executive Management for strategic and operational decision making
c) The setting of, and adherence to, risk appetite
d) The risk and control culture of the organisation
e) Risks of poor customer treatment, giving rise to conduct or reputational risk
f) Capital and liquidity risks
g) Key corporate events
h) Outcomes of processes

FEDERAL RESERVE – MODEL RISK

Internal audit to cover:
• Inventory
• Usage
• Lifecycle
• Documentation
• Risk reporting
• Supporting systems and data

“The audit function will need to consider how it addresses the overall model risk framework as well as how this is applied on individual models.”
“the right skills, stature and incentives”

"Internal audit's role is not to duplicate model risk management activities. Instead, its role is to evaluate whether model risk management is comprehensive, rigorous, and effective.”
**HM TREASURY – MODEL QUALITY ASSURANCE**

100% Internal peer review

Internal audit now covers 30% of government models.

**MODEL RISK 3rd LINE ASSURANCE**

- Corporate Governance Code
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THE THREE LINES OF DEFENCE

<table>
<thead>
<tr>
<th>Board of Directors</th>
<th>1st line of defence</th>
<th>2nd line of defence</th>
<th>3rd line of defence</th>
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</thead>
<tbody>
<tr>
<td>Divisional executive management</td>
<td>Group Risk Committee</td>
<td>Executive Risk Committee</td>
<td>Audit Committee</td>
</tr>
<tr>
<td>Risk &amp; Compliance Committee</td>
<td>Business management</td>
<td>Group and divisional risk teams</td>
<td>Group Internal Audit</td>
</tr>
</tbody>
</table>

- Design and implement appropriate controls
- Document processes
- Monitor and control the effectiveness of controls
- Correct deficiencies

- Support the business in control design / implementation
- Evaluate the appropriateness of the control framework and the effectiveness of its operation
- Oversee compliance with regulatory standards
- Assess and report on material deficiencies
- Verify control confirmation and challenge if necessary

TOP DOWN ASSESSMENT

- Oversight and Reporting
- Model Inventory
- Risk Appetite MI

- Model Life Cycle
- Model Quality Assurance Cycle
- Model Realisation

- Risk Culture and Training
- Group Policies and Standards
- Group Model Risk Appetite Statement
### MODEL RISK - UNIVERSE

<table>
<thead>
<tr>
<th>Division / product</th>
<th>Pricing / front office</th>
<th>Business Planning</th>
<th>Financial Reporting</th>
<th>SII capital</th>
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</thead>
<tbody>
<tr>
<td>Bulk Annuities</td>
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<tr>
<td>Retail Protection</td>
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<tr>
<td>Group Protection</td>
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<td>e.t.c.</td>
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### MODEL RISK - AUDIT PLAN

<table>
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<th>SII capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audit planning</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>• Assessment of inherent risk</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>• Assessment of controls / residual risk</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>• Previous assurance / other assurance</td>
<td></td>
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<tr>
<td>• Model risk plan – a lens</td>
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INDIVIDUAL MODELS – AUDIT SCOPE

- Lifecycle: Assurance over controls framework for model development and change
- QA: Assurance over robustness and independence of Model validation
- Realise: Assurance over controls framework for model operation

INDIVIDUAL MODELS – EXAMPLE 1

- Lifecycle: Scope → Build → Test → Deliver → Change
- QA: Evaluate concept
- Realise: Analyse output
- 3P
INDIVIDUAL MODELS – EXAMPLE 2

Life cycle

QA

Realise

Realisation Environment

Data
Assumptions

Code
Output

Use

Monitor

Analyse output

3P

RECORDING RESULTS

Aligned to group risk framework

Categorised by model area

Judgement required

Operate

Realisation Environment
MODEL USE

Source: Guy Carpenter, Managing Catastrophe Model Uncertainty (2011)

The "uncertainty band" around a typical PML curve paints a more realistic – and much less precise – picture of catastrophe model output.

RESULTS AGGREGATION – ROLLING 12m

- High
- Medium
- Low
ROOT CAUSE ANALYSIS: COSO SPLIT

Control Environment
- Standards of conduct
- Experienced independent oversight
- Reporting structure
- Staff capability
- Accountability

Control Activities
- Control activities
- General Technology Controls
- Policies and Procedures

Information and Communication
- Control information
- Internal communication
- External communication

Monitoring Activities
- Independent Evaluations (e.g. QA)
- Communication and follow up

ASSESSING SPREADSHEET RISK

Controls vs Complexity

Formality of control should increase with materiality and complexity
FEDERAL RESERVE – PEOPLE

“the right skills, stature and incentives”

“Staff need to possess sufficient expertise in relevant modelling concepts and how they are used.”

ACTUARIAL SKILLS IN UK INTERNAL AUDIT

Overall c.310 staff in internal audit across 6 large UK life offices

22 qualified and 6 part qualified actuaries directly employed.

Permanent roles the norm, some use of secondments.

Co-source around 5-20% of work
ACTUARIAL SKILLS IN UK INTERNAL AUDIT

30% of functions: actuaries > 10 years
The remainder between 1 and 5 years
6 to 15% have an actuarial qualification
50% of those functions expect this ratio to increase and 50% to stay the same

AREAS OF WORK

Areas of work performed by Actuaries in internal audit.

- Solvency II (Pillar 1,2,3)
- New business pricing
- Customer service
- Systems
- Strategy / planning
- IFRS
- M&A / Other

Number of companies
CONCLUSION

- MODEL RISK IS A MAJOR RISK FOR MOST INSURERS
- COMPANIES NEED TO BUILD STRONG MODEL RISK FRAMEWORKS
- INTERNAL AUDIT FUNCTIONS MUST DEVELOP A ROBUST RESPONSE TO SUPPORT CHANGE
- STAFF SKILLS ARE CRITICAL – THE ACTUARIAL SKILL SET IS VITAL FOR SUCCESS