

# MODEL RISK: A VIEW FROM THE THIRD LINE

Tom Bryant  
March 2016

EVERY  
DAY  
MATTERS®



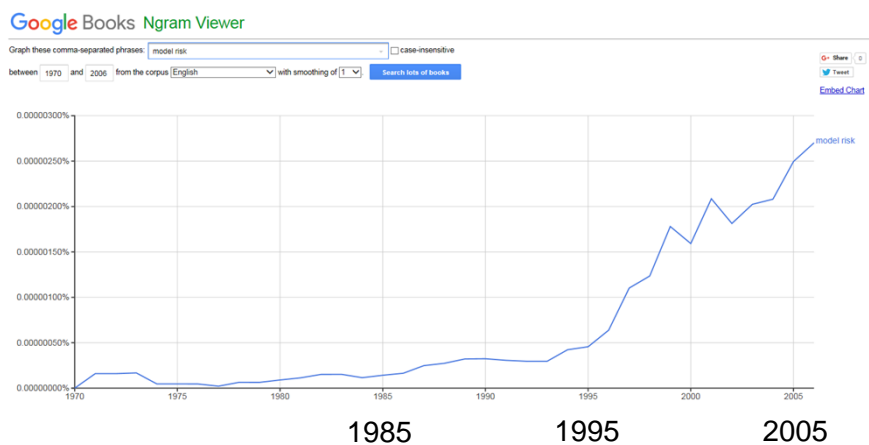
## MODEL RISK - AN EXPERIMENT



## MODEL RISK: A VIEW FROM THE THIRD LINE

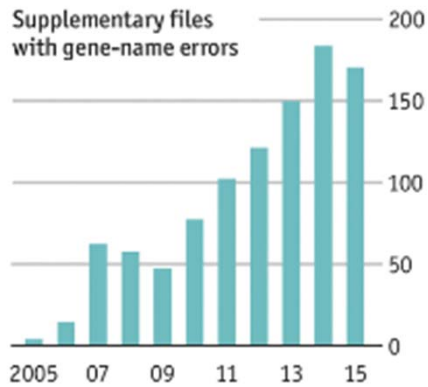
- Model Risk in perspective
- Regulatory context
- Legal & General Internal Audit Approach
- People
- Future developments

## 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

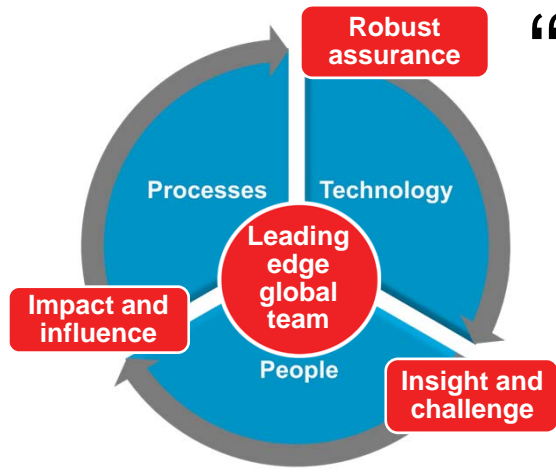
Errors increasing at 15% vs 4% growth in papers

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

## MODEL RISK IN BUSINESS

Name	When	What Happened
West Coast Mainline bid (HM Treasury)	2011	Model used to assess rival bids inconsistent and incorrect conclusion drawn
JP Morgan (London Whale)	2012	Ignored control warnings, changed how VaR measured
US Federal Reserve	2010	Spreadsheet error in Fed's Consumer Credit Calculations

# 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 3<sup>rd</sup> LINE ASSURANCE



Corporate Governance Code



IIA Financial Services Code

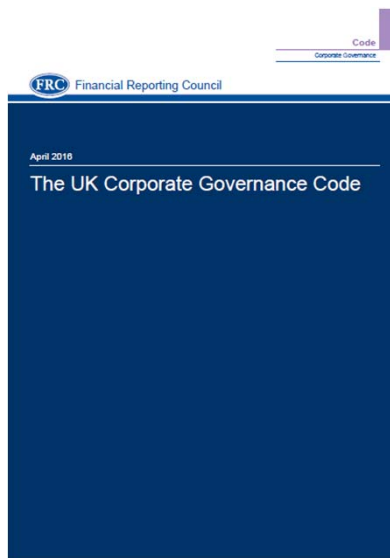


Supervisory Guidance on model risk management



Review of quality assurance of Government analytical models

## BOARD GOVERNANCE REQUIREMENTS



### Section C: Accountability

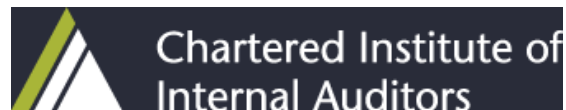
The board is responsible for determining the **nature and extent of the principal risks** it is willing to take in achieving its strategic objectives.

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

## MODEL RISK ASSURANCE



BANK OF ENGLAND  
PRUDENTIAL REGULATION  
AUTHORITY



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

## MODEL RISK ASSURANCE



BANK OF ENGLAND  
PRUDENTIAL REGULATION  
AUTHORITY



FCA  
FINANCIAL CONDUCT AUTHORITY



Chartered Institute of  
Internal Auditors

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.”*

## FEDERAL RESERVE – MODEL RISK



“the right skills, stature and incentives”

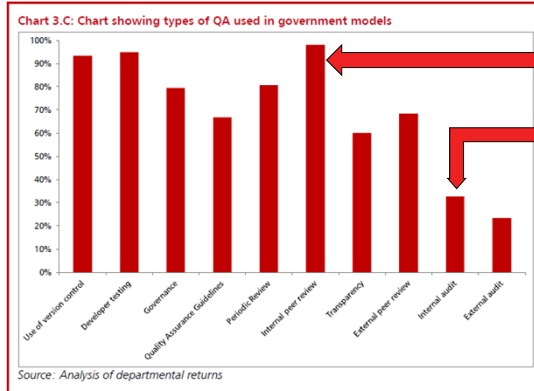
## FEDERAL RESERVE – MODEL RISK



*“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.



**HM TREASURY**

**Review of quality assurance of Government analytical models**

## MODEL RISK 3<sup>rd</sup> LINE ASSURANCE



Corporate Governance Code



IIA Financial Services Code



Supervisory Guidance on model risk management



**HM TREASURY**

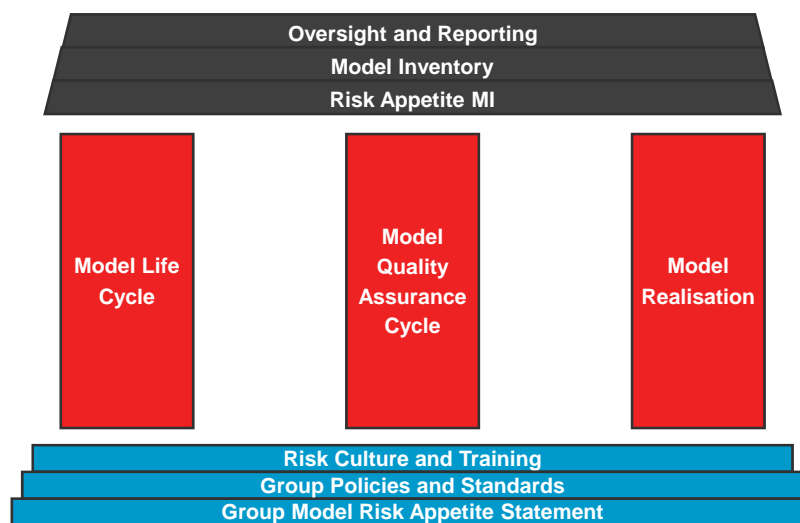
**Review of quality assurance of Government analytical models**



## THE THREE LINES OF DEFENCE

Board of Directors		
1 <sup>st</sup> line of defence	2 <sup>nd</sup> line of defence	3 <sup>rd</sup> line of defence
Divisional executive management Risk & Compliance Committee	Group Risk Committee Executive Risk Committee	Audit Committee
Business management	Group and divisional risk teams	Group Internal Audit
<ul style="list-style-type: none"> <li>Design and implement appropriate controls</li> <li>Document processes</li> <li>Monitor and confirm the effectiveness of controls</li> <li>Correct deficiencies</li> </ul>	<ul style="list-style-type: none"> <li>Support the business in control design / implementation</li> <li>Evaluate the appropriateness of the control framework and the effectiveness of its operation</li> <li>Oversee compliance with regulatory standards</li> <li>Assess and report on material deficiencies</li> <li>Verify control confirmation and challenge if necessary</li> </ul>	<ul style="list-style-type: none"> <li>Provide assurance over the adequacy and effectiveness of the Group's governance, risk management and internal control processes on behalf of the Board</li> </ul>

## TOP DOWN ASSESSMENT



## MODEL RISK - UNIVERSE

		Model use			
		Pricing / front office	Business Planning	Financial Reporting	SII capital
Division / product	Bulk Annuities				
	Retail Protection				
	Group Protection				
	e.t.c.				

## MODEL RISK - AUDIT PLAN

		Model use			
		Pricing / front office	Business Planning	Financial Reporting	SII capital
Division / product	Bulk Annuities				
	Retail Protection				
	Group Protection				
	e.t.c.				

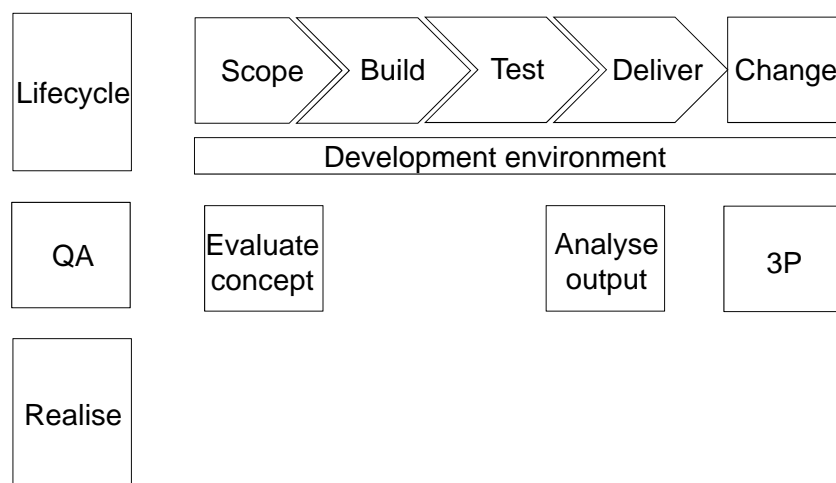
**Audit planning**

- Assessment of inherent risk
- Assessment of controls / residual risk
- Previous assurance / other assurance
- Model risk plan – a lens

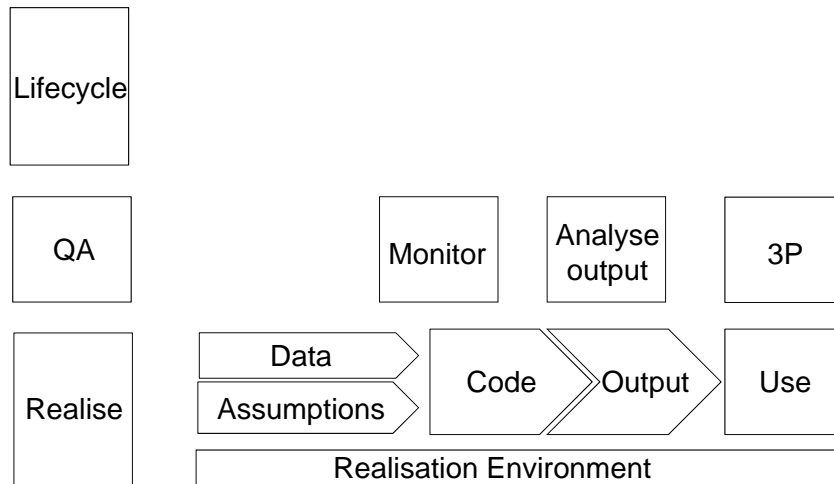
## INDIVIDUAL MODELS – AUDIT SCOPE

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



## INDIVIDUAL MODELS - EXAMPLE 2

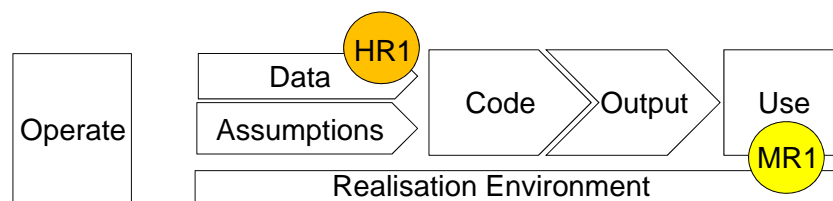


## RECORDING RESULTS

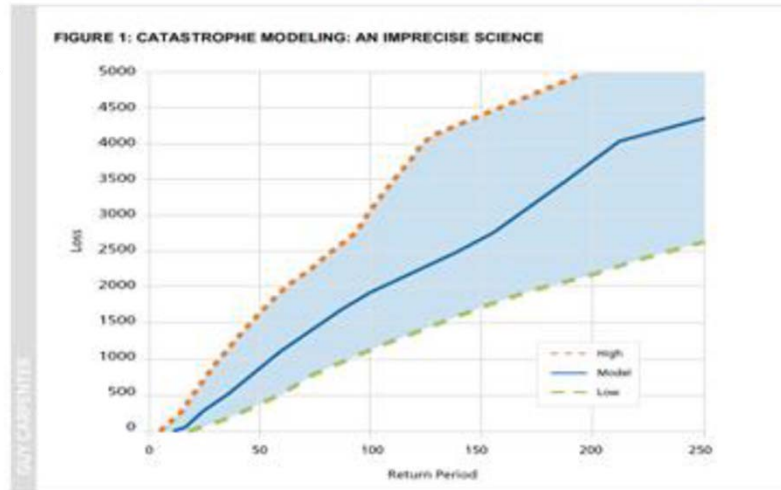
Aligned to group risk framework

Categorised by model area

Judgement required



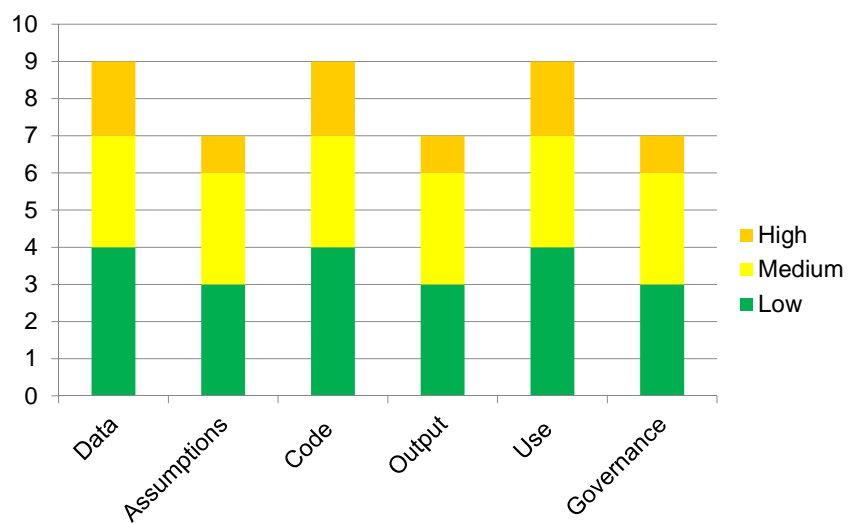
## MODEL USE



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

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

## RESULTS AGGREGATION - ROLLING 12m

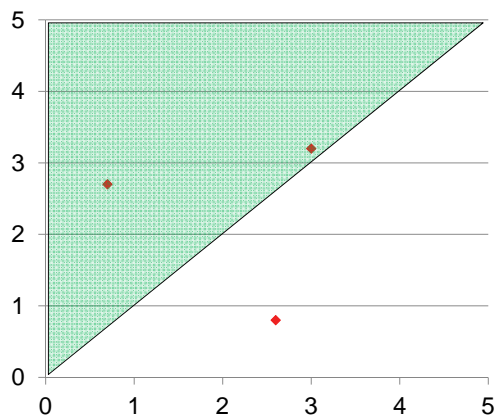


## ROOT CAUSE ANALYSIS: COSO SPLIT

<b>Control Environment</b>	<b>Control Activities</b>
Standards of conduct	Control activities
Experienced independent oversight	General Technology Controls
Reporting structure	Policies and Procedures
Staff capability	<b>Information and Communication</b>
Accountability	Control information
<b>Risk Assessment</b>	Internal communication
Clear objectives	External communication
Risk identification	<b>Monitoring Activities</b>
Fraud	Independent Evaluations (e.g. QA)
Change	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

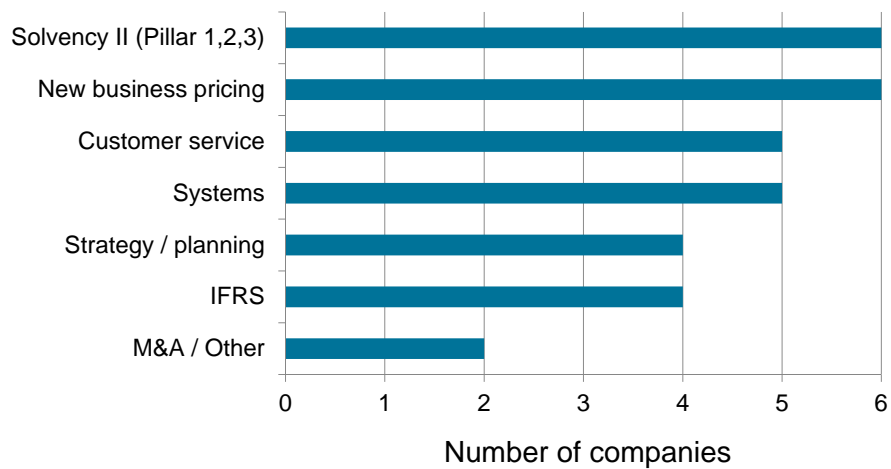
The remainder between 1 and 5 years

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.





## 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