

The Actuarial Profession Risk and Investment Conference



Model risk and governance

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Risk Management
- Brighton 19 June 2013

Introduction



Vijay Krishnaswamy has 15 years of relevant and varied experience spanning the banking industry, consulting and regulation.

- Not an actuary!
- Head of Enterprise Risk practice at Hymans Robertson.
- Member of the Steering Committee of PRMIA.
- FSA
 - Developed more robust model governance and stress testing/ capital models, tools and reviewed firms' stress testing models. He also sat on the FSA's IRB model challenge panels.
- Standard Chartered Bank.
- Financial Risk practice of KPMG.
- Financial Risk Manager (FRM) certification from GARP.
- Co-author of a chapter on model risk in "Managing Illiquid Assets" (<http://riskbooks.com/managing-illiquid-assets>).

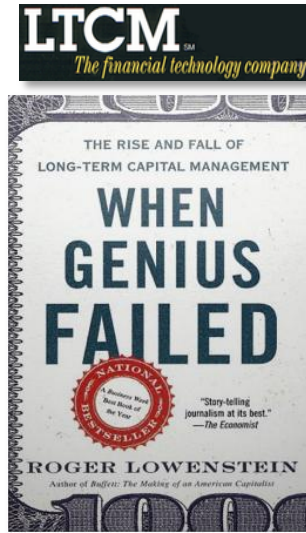


Topics

- Motivation and basics
- Sources of model risk
- Managing model risk
- Examples
- 3 Take-aways

Caveat: Although some of what I say is based on my model governance experience at the FSA, nothing that I say should be construed as necessarily representing the FSA/ PRA/ FCA's views.

Model risk disasters



May 20, 2008 11:36 pm

Moody's error gave top ratings to debt products

By Sam Jones, Gillian Tett and Paul J Davies in London

Moody's awarded incorrect triple-A ratings to billions of dollars worth of a type of complex debt product due to a bug in its computer models, a Financial Times investigation has discovered.

REY

Department for
Transport



What is a “model”?



Simplified version of reality; tool for a purpose

Which is the “model”?

☐ Conceptual: Black-Scholes model for option prices?

VS.

☐ Physical: Spreadsheet adding up your monthly expenses?

VS.

☐ Black-Scholes implemented in a spreadsheet?

Each is subject to different risks

What is a “model”?

Form

“Compound”

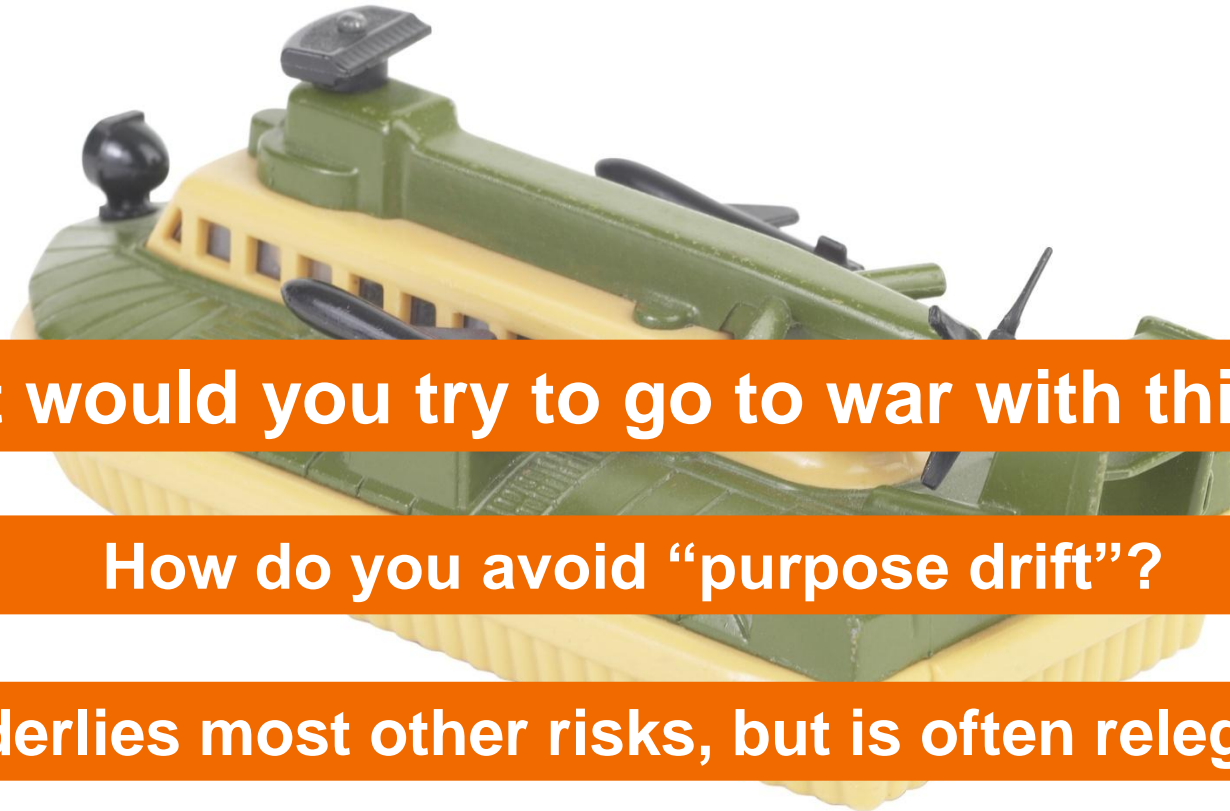
Simplified version of reality; tool for a purpose

Intricacy

>Regulated



What is “model risk”?



But would you try to go to war with this...?

How do you avoid “purpose drift”?

Underlies most other risks, but is often relegated

Hard to eliminate but no explicit capital requirements



What is “model risk”?

- ✓ Assumptions that may not hold

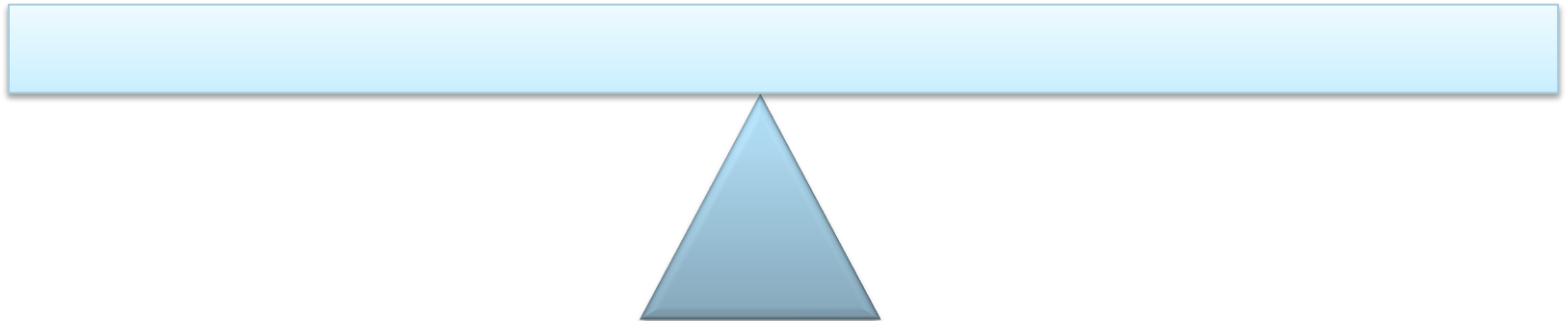
- ✓ Mistakes in underlying data/ information

- ✓ Formula errors

etc... that contribute to an actual or economic loss



Sources



Sources

(Simplifying) Choices along
the modelling lifecycle



Calibration

“Method”

Data

Interpreta-
tion & use

Implement-
ation

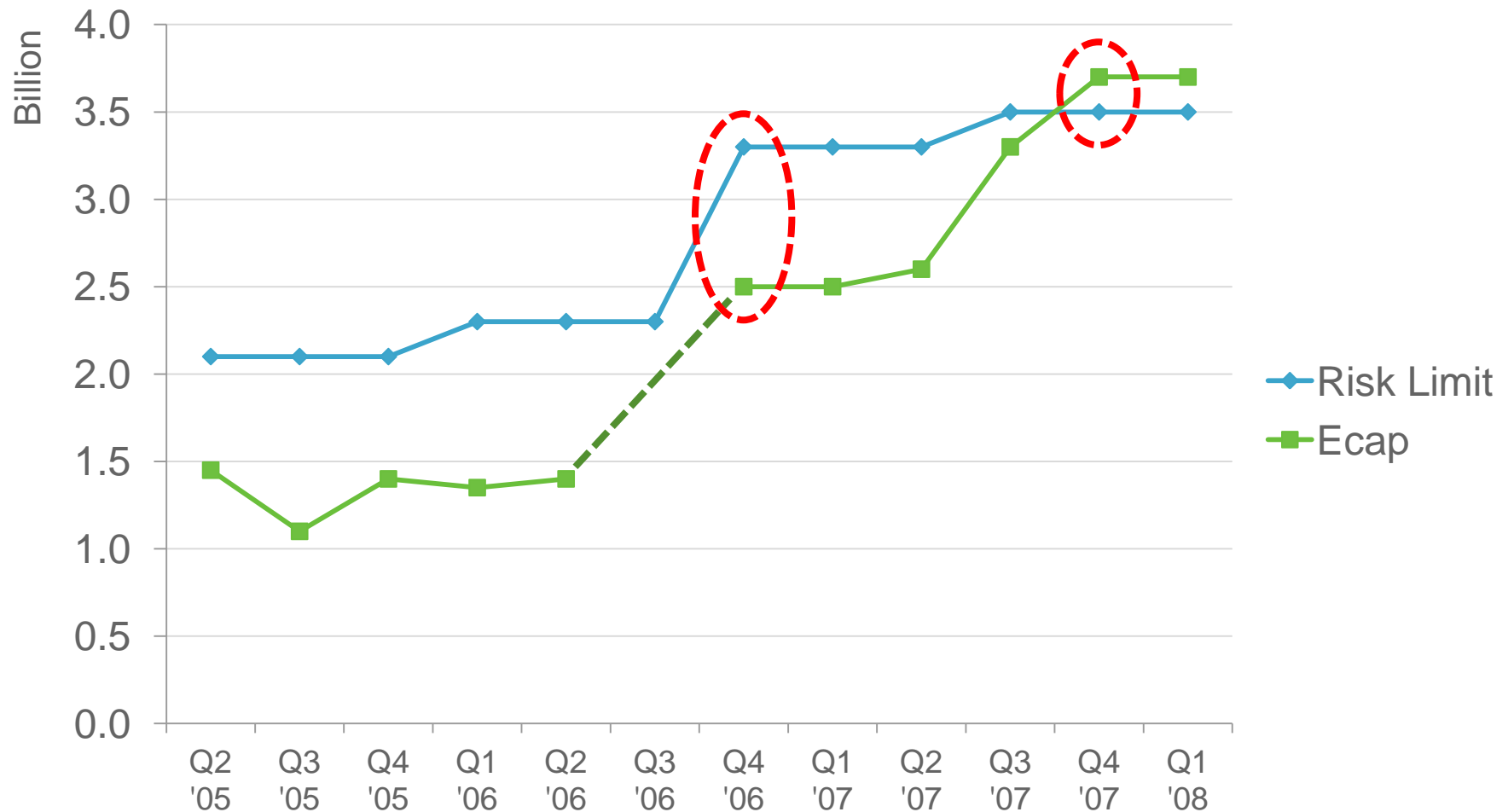
Historical Scenario Analysis

- ◆ We simulate our current portfolio of positions thru a variety of scenarios (11 different ones) that we model based on actual events of the past, including 1987 stock market crash, 1998 EMG crisis, 2002 High Yield Debt crisis, among others
- ◆ The historical scenario with the worst outcome based on our March 31 portfolio of positions resulted in a trading revenue loss of approximately \$2B

Hypothetical Scenario Analysis

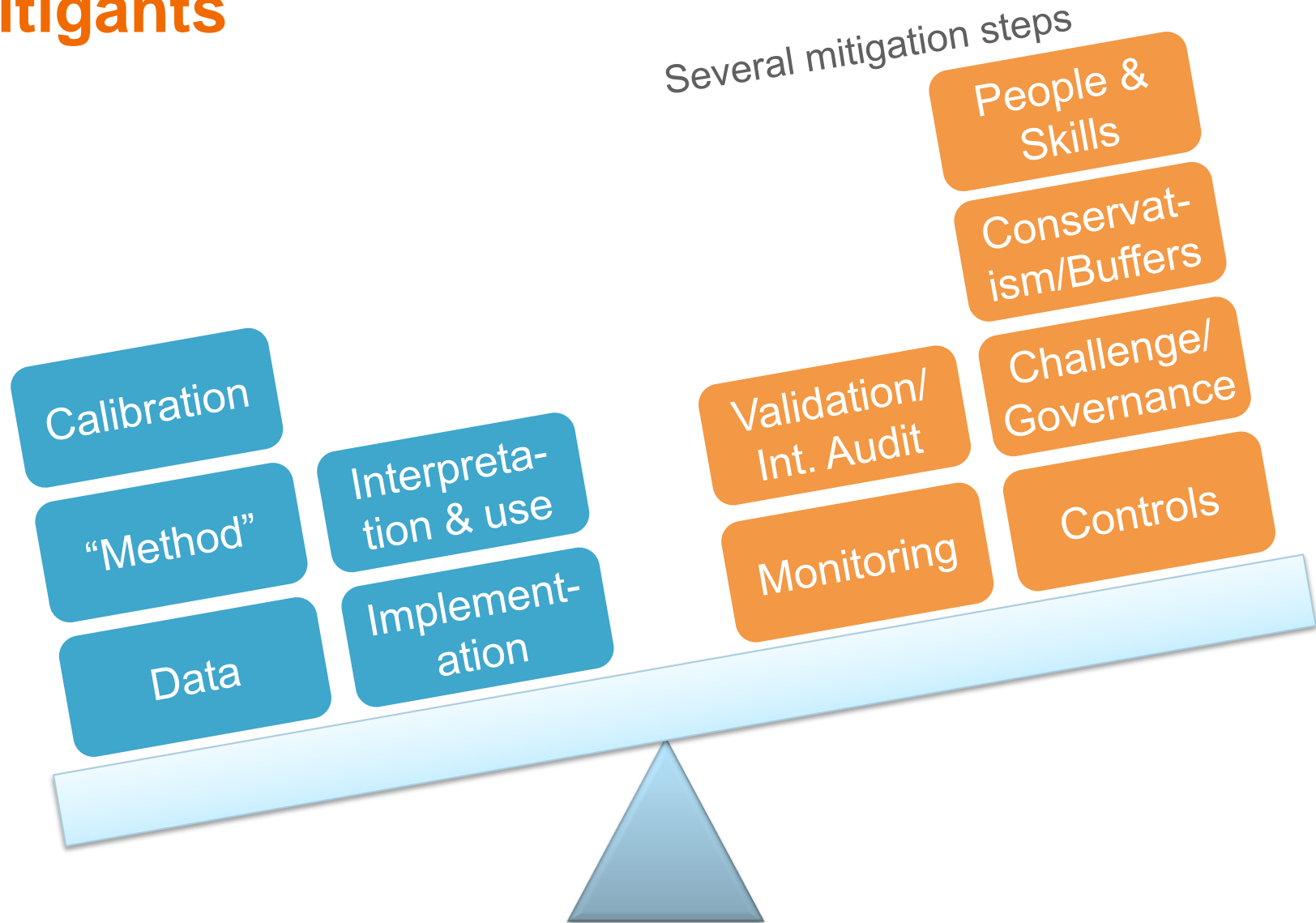
- ◆ We also simulate our current portfolio thru 4 scenarios that are even more penalizing than those that have actually happened during historical crises (e.g., if credit crisis of 2007 also had a simultaneous significant equity market downturn)
- ◆ The hypothetical scenario with the worst outcome based on our March 31 portfolio of positions resulted in a trading revenue loss of approximately \$3B
- ◆ Scenario analyses are for trading positions only, and do not include real estate owned and private equity positions
- ◆ Scenario losses do not consider client related revenues that we would expect to earn even in a period of high stress
- ◆ The worst scenario losses do not exceed one quarter's worth of expected revenue

Use in risk appetite: Lehman Brothers

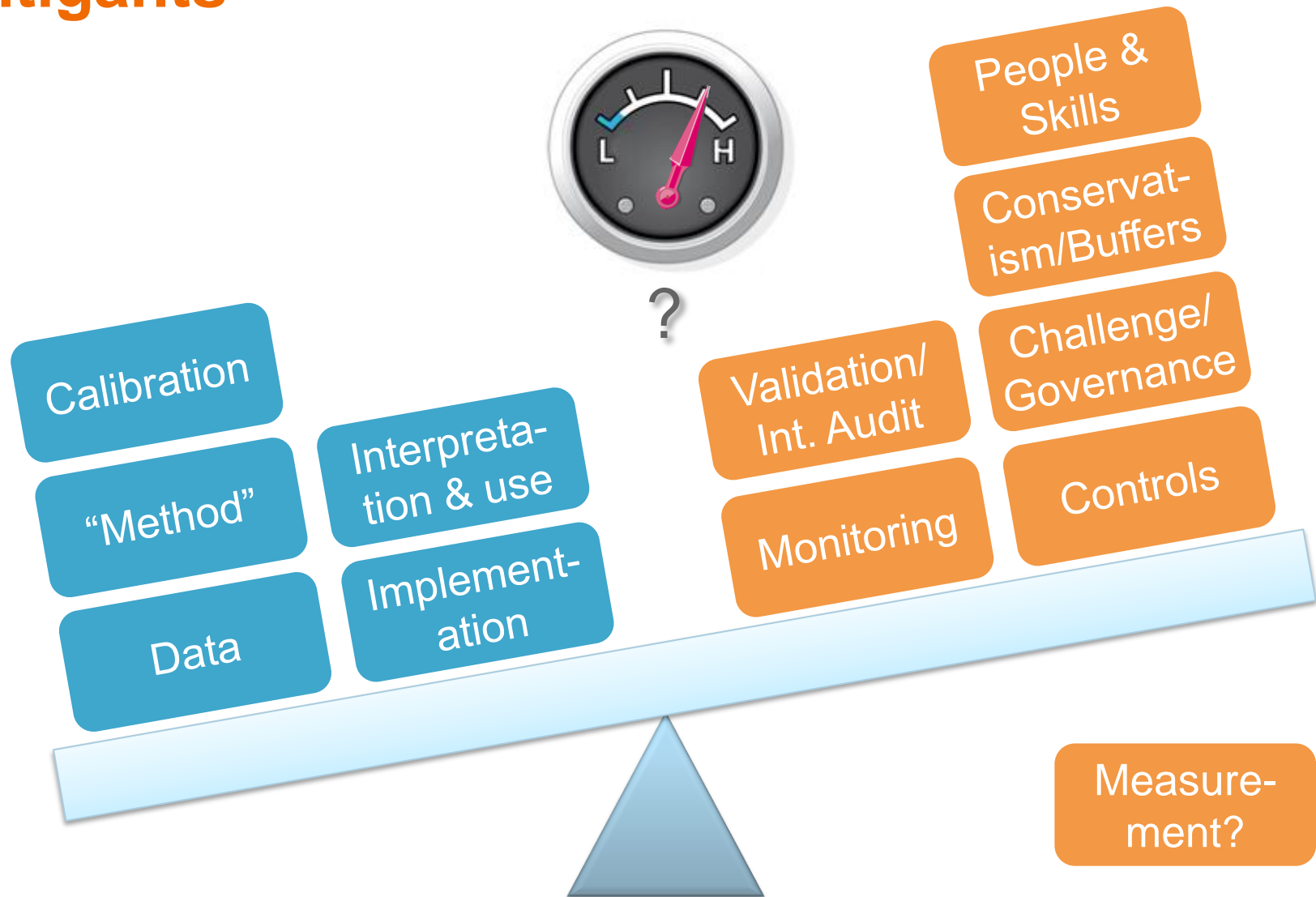


Source: Valukas report

Mitigants



Mitigants



For more details, refer to chapter 10 in (Dieleman and Krishnaswamy) "Managing Illiquid Assets"

Delivering constructive challenge is not easy



- Model owners and users
- Group risk/validation/governance
- Internal audit + external validation

Overcoming group-think requires fresh thinking and “cultural translation”

Range of outcomes	Alternative models / schemes / views	Sensitivities
Assumptions expressed as business scenarios	Scenarios	Reverse stress testing
Pictures and interpretation	“Measurement”	Operating limits

For more detail, refer to chapter 10, “Managing Illiquid Assets”, Dieleman and Krishnaswamy

“Cultural translation”...

Manuel, there
is too much
butter “on
those trays”



No, no, senior
Fawlty, it is
“Uno, dos,
tres!”

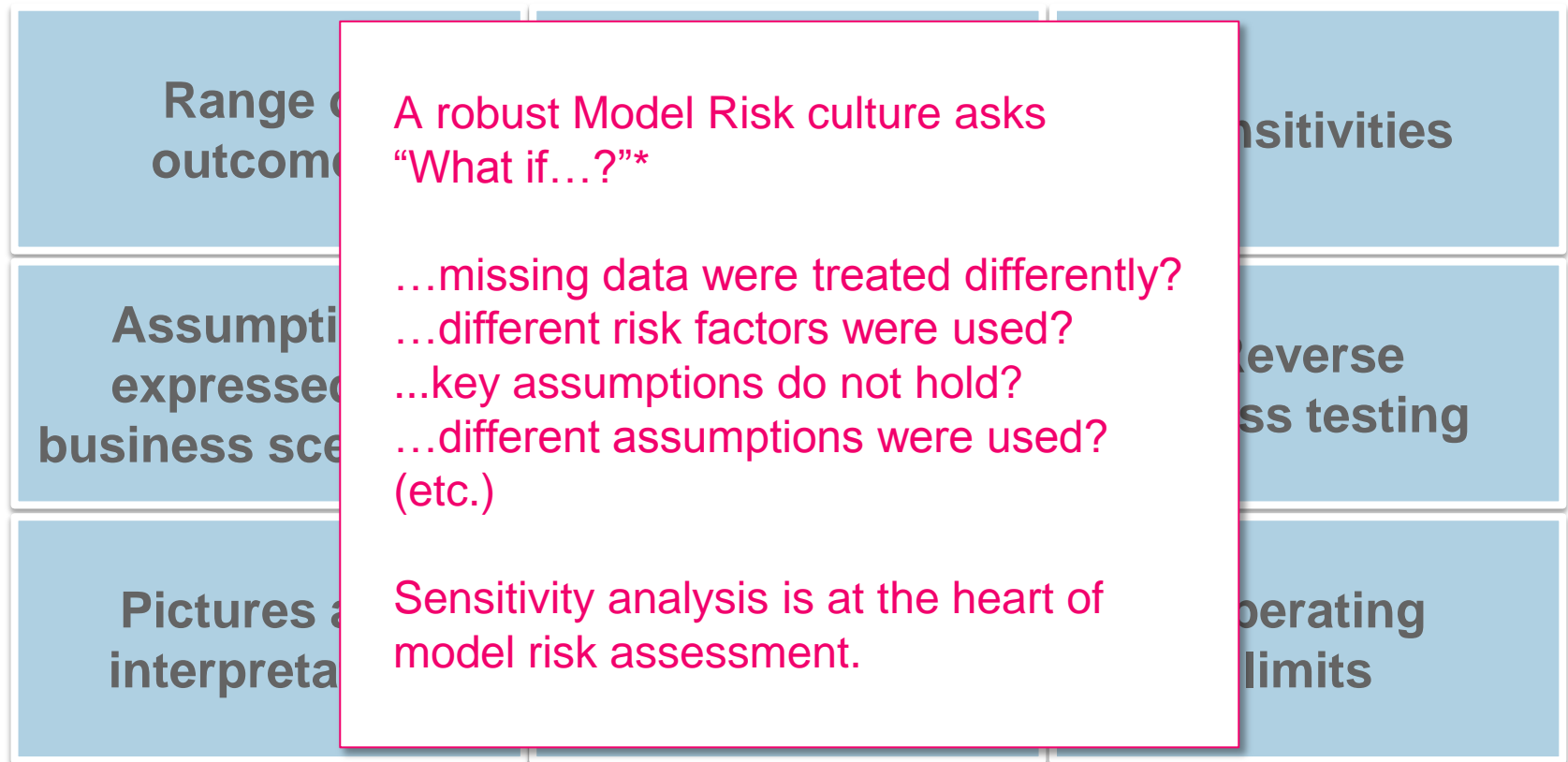
Source: Fawlty Towers, British Comedy series

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Overcoming group-think requires fresh thinking and “cultural translation”



* Quote based on Alan Forrest (2012, talk at the IFA)

Financial example 1

VaR Model at LTCM*

- August losses = USD 1.7 Bn
- Expected frequency = once in 800 trillion years
(assuming normal distribution)
- Ex-ante outcome: “our risk is low enough”

- Challenge: Test using an alternative - what if:
- a Student's t was used instead: once in 8 years

* Source: Jorion (2000)

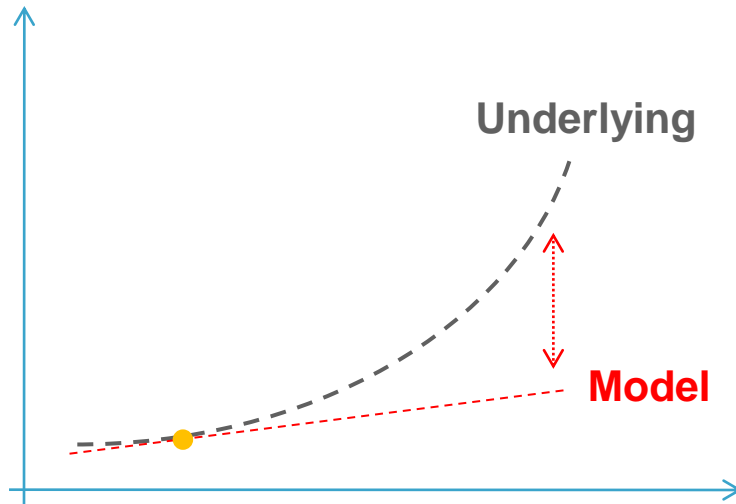
Financial example 2

Assumption

“We assume that the [NAV] change from a [1] bp change in interest rates can be applied to a [200] bp shock by multiplying by [200]”

➤ How do you challenge this?

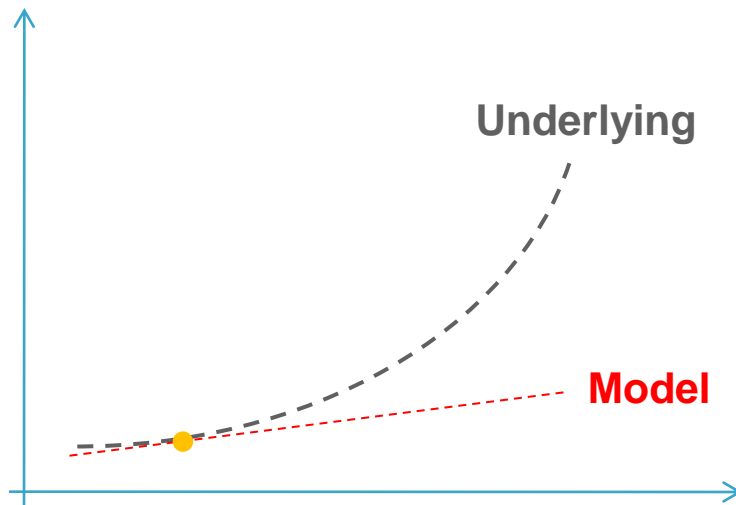
Financial example 2



▶ “Linear Extrapolation risk”

- ▼
1. Materiality?
 2. Scenarios?
 3. Risk appetite?

Financial example 2



▶ “Linear Extrapolation risk”

1. Materiality?
2. Scenarios?
3. Risk appetite?

Outcomes (example)

Fit-for-purpose*
upto [5] bps
shocks but no
further

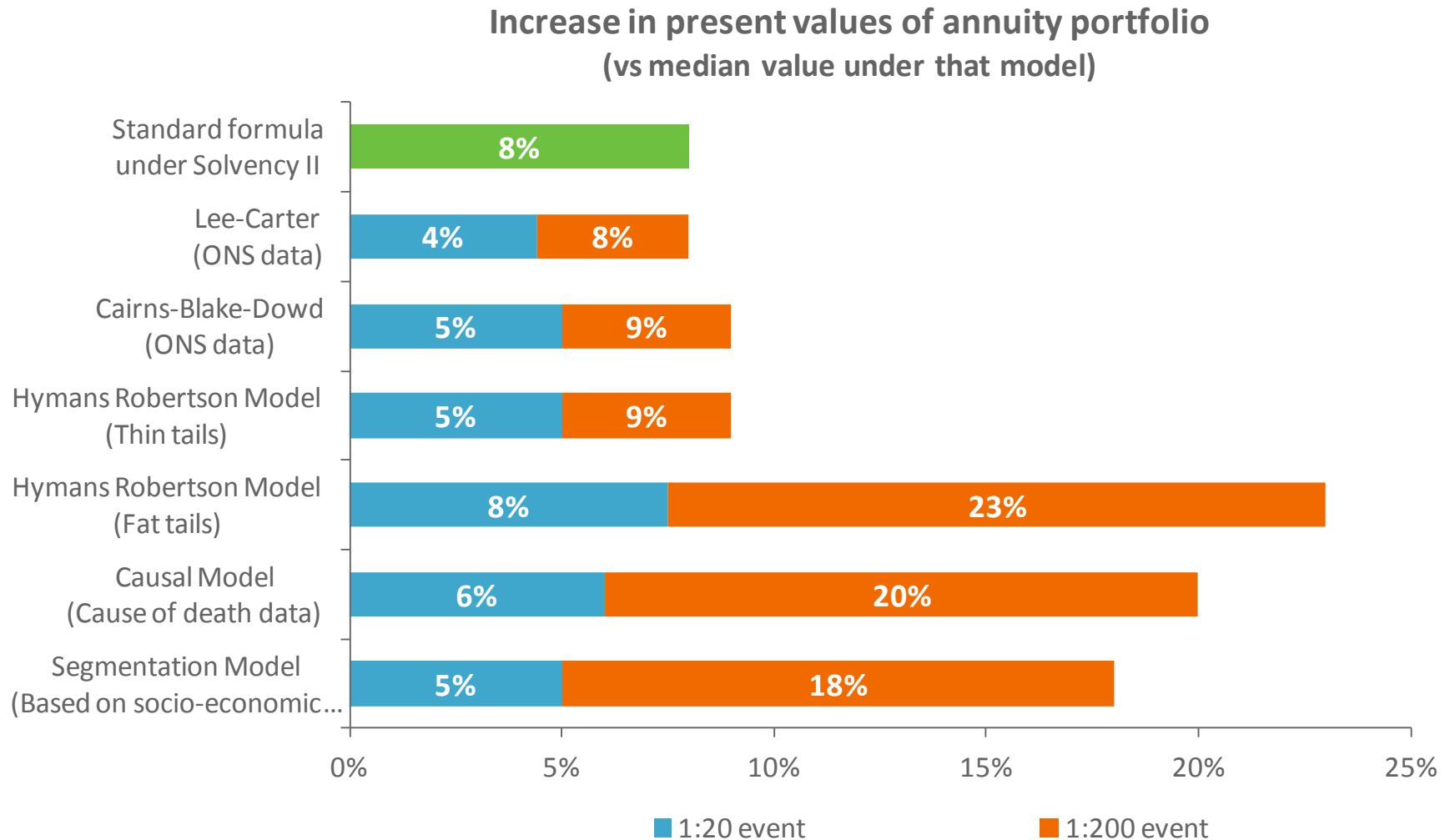
... and can be
used beyond that
only with
prominent caveats

Not fit-for-purpose
and a new model
needs to be built

* i.e. the model can only be used if the limit and conditions are satisfied

Financial example 3:

Alternative models: Just how big is the longevity tail?



Financial example 4

PD model at a Bank

- Source of risk: Model was calibrated to an average default rate based on relatively few data points

➤ Challenge:

- Quantify: develop an upper confidence interval
- Result: capital increase of 15%; considered material
- Outcome: include this conservatism as an overlay until sufficient data points are built up

Recap: What is “model risk”?

- ✓ Assumptions that may not hold
- ✓ Mistakes in underlying data/ information
- ✓ Formula errors

Etc...

Take-away #1:

Framework for assessing assumptions

Assumption* ► 1. What's the risk?



2. How material is it? Quantify?



3. Under what scenarios can the risk arise?



4. Does it fit with your risk appetite? Acceptable?



5. Are there better assumptions?



Outcome/ actions

- Find more evidence
- Accept and monitor
- Set limits
- Add conservatism etc.



* not all assumptions are obvious ex-ante

Take-away #2:

Which of these tools do you use in your model validation/ governance framework?

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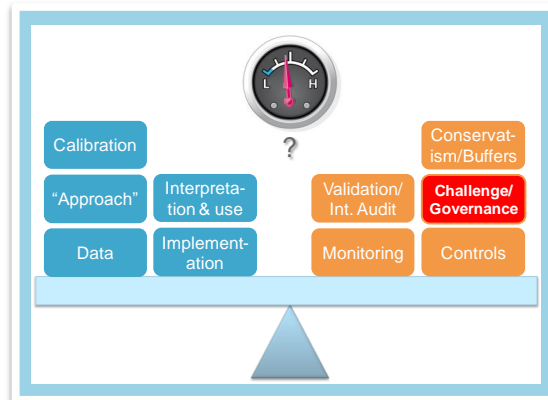
For more detail, refer to chapter 10, “Managing Illiquid Assets”, Dieleman and Krishnaswamy

Take-away #3:

Two additional questions that your model governance committee should ask (but don't)

- “Will the model be fit for purpose not only in the immediate future, but also in the longer run and under stress?”
“Is it clear to us under what circumstances the model is **not** fit for purpose? How bad can it get? What controls are needed?”
- “Is the result acceptable/ within our risk appetite?”

Recap



Range of outcomes	Alternative models / schemes / views	Sensitivities
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Appendix: About us

A bit about us ...

Quick facts:

 **91** years

 **60** partners,
600+ staff

 **300** experienced
consultants

 **Independent**
UK partnership

 **Actuarial and risk**
management focus

 **Dedicated** financial
modelling team

A bit about us ...

A selection of our financial sector clients:

LLOYDS
BANKING
GROUP



HSBC 

 Newcastle Building Society

 money

GIB
بنك الخليج الدولي

 nab


PRUDENTIAL

 BAILLIE GIFFORD

 OLD MUTUAL
INSURANCE • INVESTMENT • SAVINGS • BANKING

PRINCIPALITY
BUILDING SOCIETY

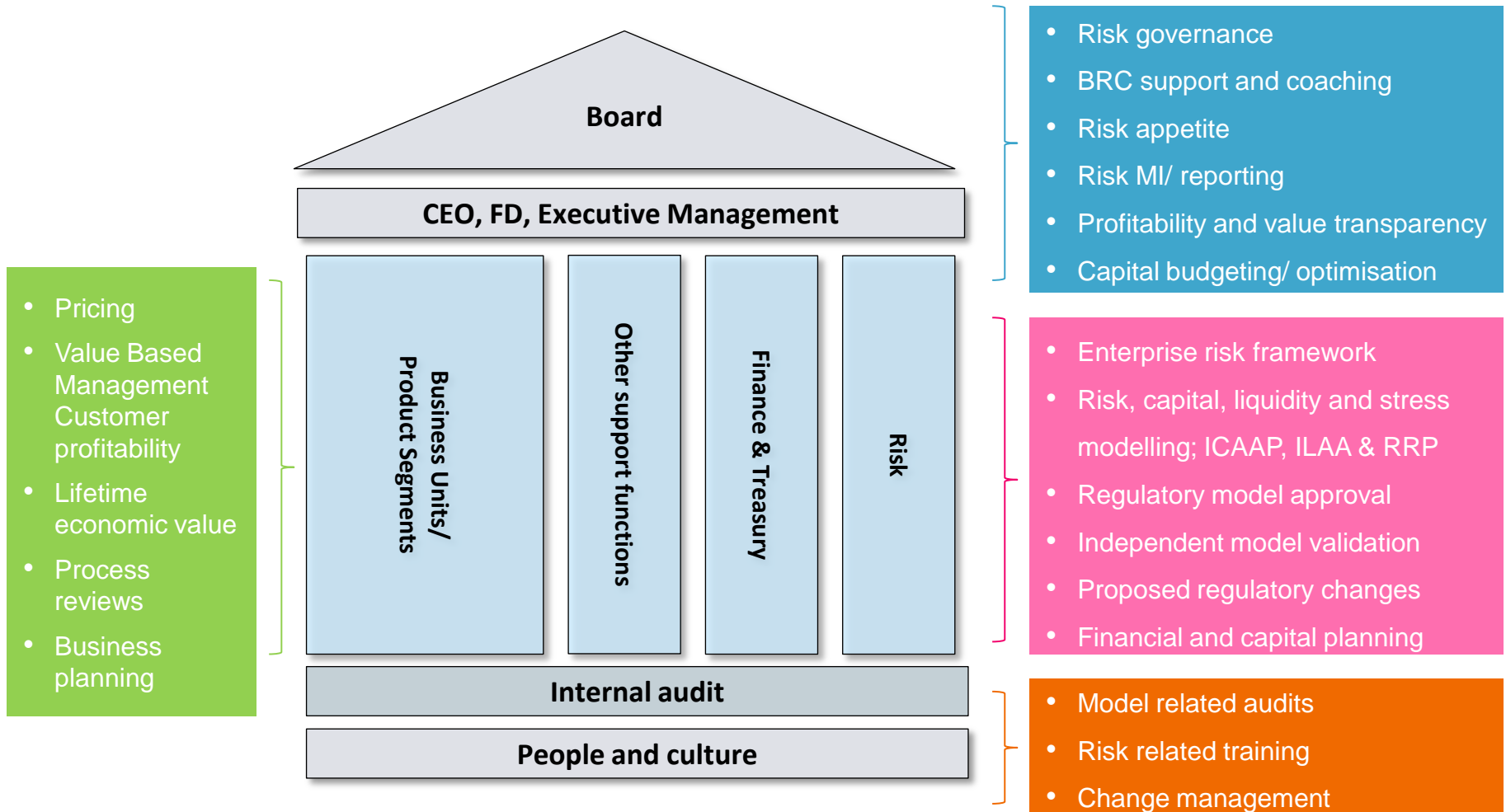
 STANDARD LIFE

OneSavings Bank plc


AVIVA

 Sun
Life Financial

Potential topics where we work



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