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GIRO conference and exhibition 2010
Solvency II IMAP Working Party

Challenges for GI Actuaries

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Our brief

The internal model approval process for Solvency II presents a number of specific challenges for GI actuaries. For example, what level of documentation is sufficient for a third party actuary to gain comfort over the model? How are the requirements for risk ranking and calibration being interpreted in practice? And what level/extent of use are firms targeting?

In this update, we will cover

- the results of our research (esurvey, face-face interviews);
- possible approaches to key questions on calibration, expert judgement, risk ranking, profit and loss attribution, documentation and the use test

Agenda

Chair

Introduction

Key areas of research

- Calibration
- Expert Judgement
- Risk Ranking
- P&L Attribution
- Documentation

Close & Next Steps

Our focus
Bridging CEIOPS requirements and business/modelling reality

Questions

How are the requirements being interpreted by experienced modellers?

How is the industry approaching the tests?

Topics

- Calibration
- Expert Judgement
- Use Test
- Risk Ranking
- Profit & Loss Attribution
- Documentation

The ‘hurdle’ for each model test is likely to emerge over the next 2-3 years. Views expressed here are those of the working party members.

Business Reality – your plans for the use test
40+ firms responded to our esurvey

Top 5 – Uses

Top 5 - Influence

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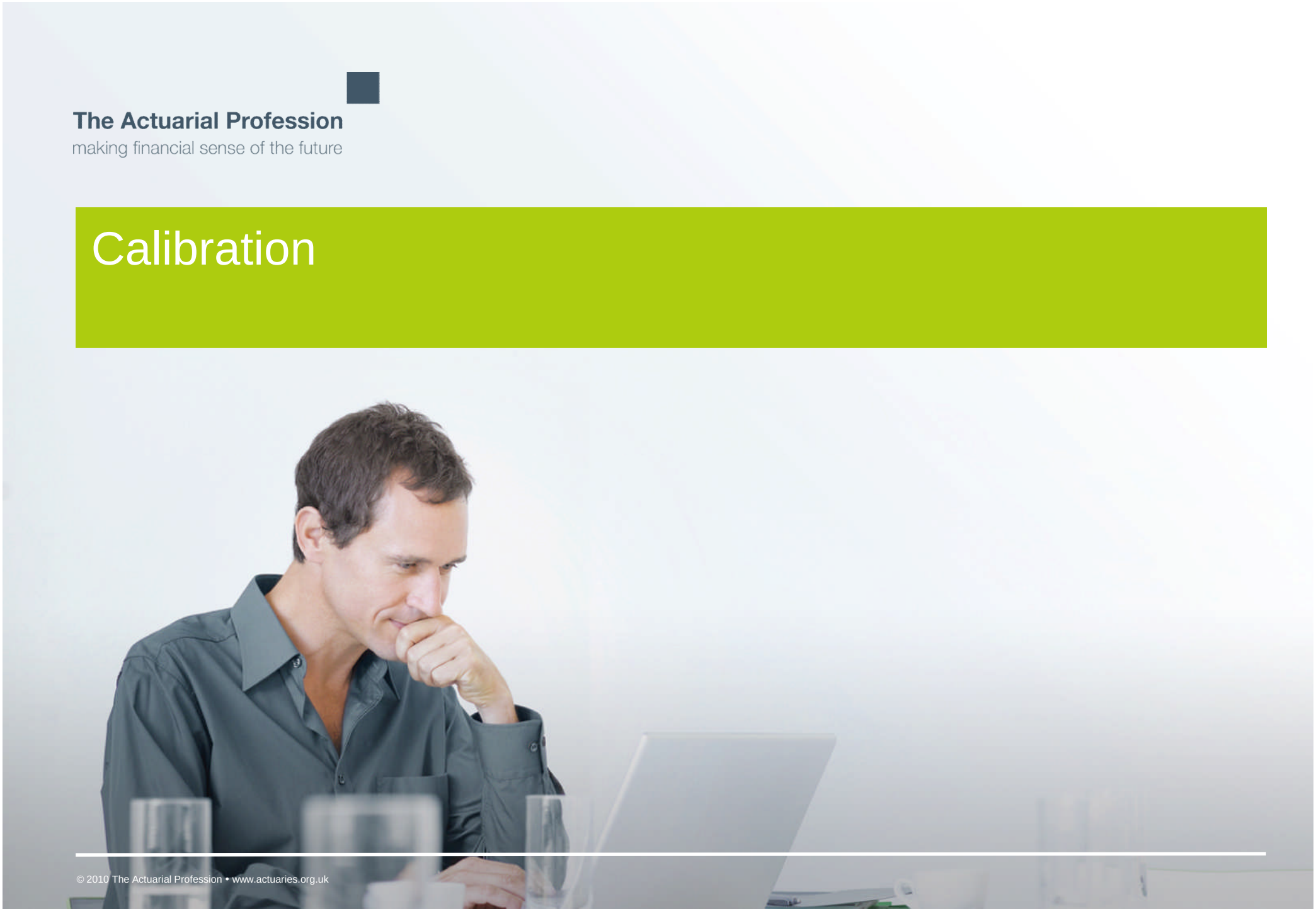
Calibration



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Approach to estimating 12 months capital still unclear – if much discussed !

"How do you plan to adjust your ICA model to calculate the SCR over a 1 year time horizon and VaR measure?
Are you considering using a different time period or risk measure, if so, why?"

How do you interpret the requirement?

- Almost all plan to produce SCR on S2 basis (99.5% VaR over 1 year time horizon, liabilities measured to ultimate)
- Most were plan to use an alternative measure for economic capital
- Few had developed prototype SCR calculations

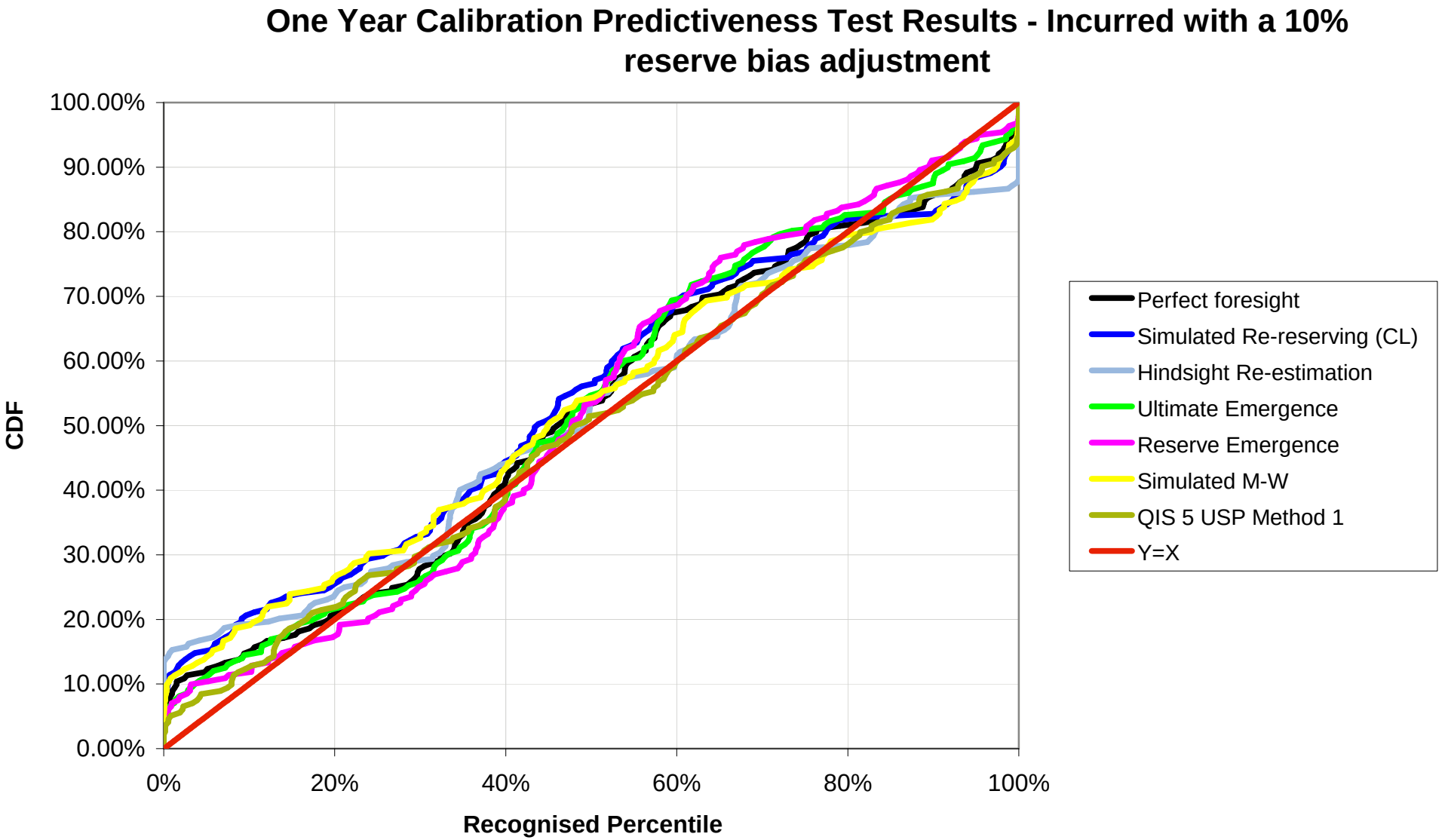
One year calibration methods identified

- Perfect foresight
- Simulated re-reserving
- Proportional emergence
- Merz-Wuthrich (simulated)
- Hindsight re-estimation
- QIS 5 USP Method 1

What did we do?

1. Extract triangles of incurred claims and booked ultimates from FSA Returns for 10 years, for multiple companies and classes
2. Adjust data and exclude latest diagonal i.e. FY 2009
3. Apply method to simulate distribution for one-year ultimate losses (all accident years) at FY 2009
4. Compare actual booked ultimate at FY2009 to simulated distribution
   We expect the company to book greater than the 50th %ile roughly half of the time, and less than the 50th half the time
5. Repeat for all companies

Results – Incurred with a 10% reserve bias adjustment



Results – Incurred with 10% bias adjustment
Overall, differences between methods were not pronounced

	Total Squared Error	χ^2 test statistic
Perfect foresight	39%	87
Simulated Re-reserving (CL)	93%	123
Hindsight re-estimation	66%	207
Ultimate emergence	45%	70
Reserve emergence	55%	73
Simulated MW	66%	110
QIS 5 USP Method 1	*15%*	*46*

Note that more tests were investigated (and are available on the web). The QIS 5 USP Method 1 did not perform best in all tests.

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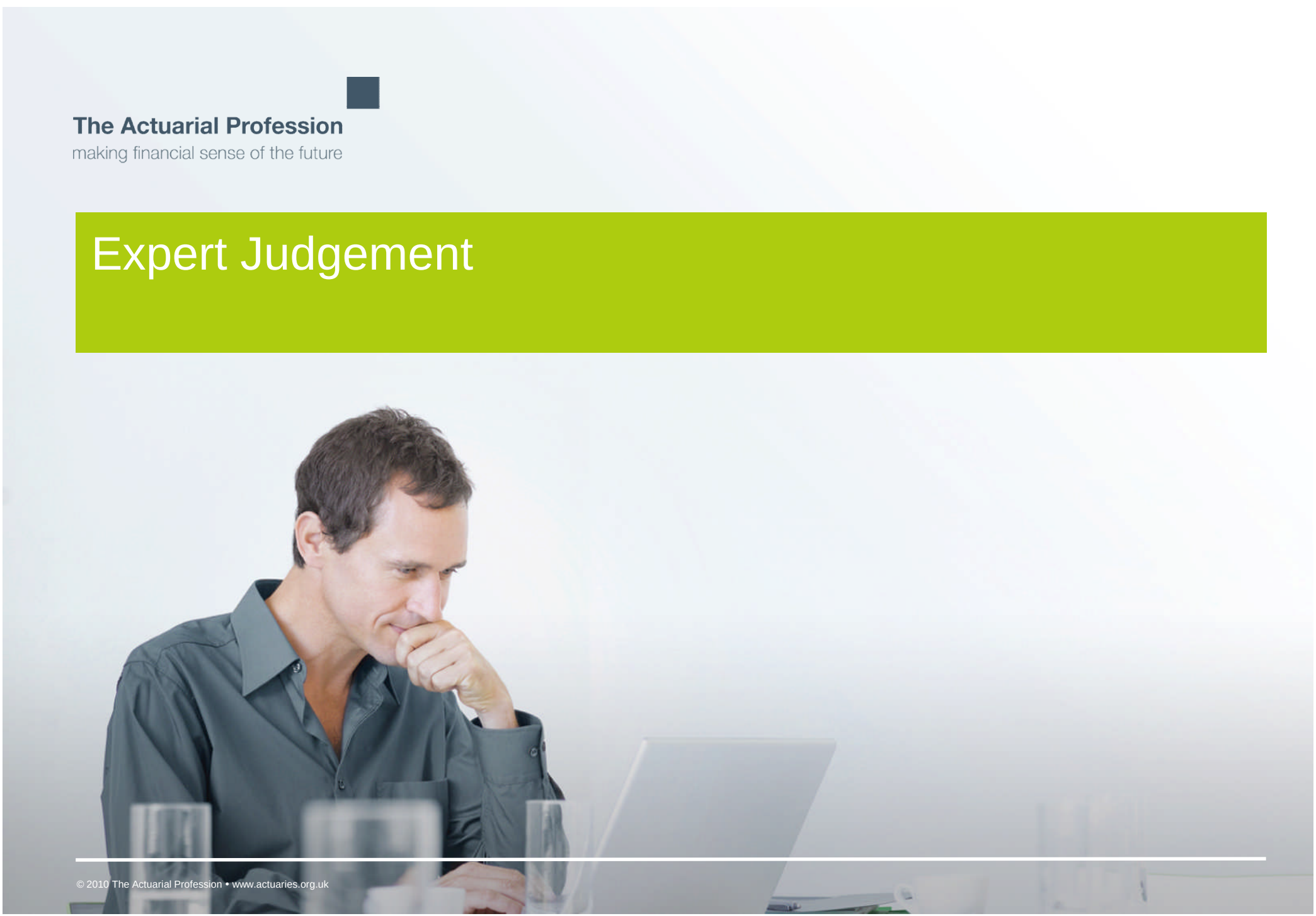
Expert Judgement



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Scope of Expert Judgement

CEIOPS view

Do the requirements apply to

- Data ...

or

- … all expert judgements?

Our view

It is sensible to include all expert judgements, but if we do

- Materiality and proportionality are key
- Where expert judgements are material, important to review and document thoroughly
- Less detail needed if expert judgement is less material

Expert Judgement

> “What processes do or will you use to justify the expert judgement, with respect to selection of data, methods, parameters, or other areas?”

How do you interpret the requirements?

- Independent review
  - internal
  - external
- Other forms of validation
  - Consideration of how well the assumption fits the data
  - Comparison to other sources
  - Back testing

Possible Process

1. Define problem or issue

2. Identify appropriate expert

3. Collect data

4. Analyse and consider data

5. Make judgement

6. Document

7. Review

8. Sign off judgement to be used in internal model

Key Issues

- When is a judgement material enough to document in detail?
- Should the expert be:
  - part of the risk management function?
  - business representative?
  - part of the modelling team?
  - external to the company?
- How can you demonstrate that someone is an expert?
- What happens if experts disagree?
- How do you allow for expert judgement within change policy?
- What are the implications if the expert judgement is not commissioned specifically for the insurer?
- How should you handle expert judgements that are "inherited" from external data or external models?
- How easy is it to create a track record of expert judgements?
- What should the governance arrangements around the use of expert judgement look like?

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Risk Ranking

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Risk Ranking ....

> "the ability of the internal model to rank risk shall be sufficient to ensure that it is widely used in and plays an important role ... their risk-management system and decision-making processes, and capital allocation" *Article 121*

How do you interpret the requirement?

- What are our key risks? What are interrelationships? Do we model these appropriately?
- What are our most material risks? Do these drive the tail?
- Does the model drive capital allocation?
- Does the model reflect structure and nature of risks?
- Needs to be a common sense and pragmatic solution

Demonstrating that the model ranks risk appropriately – possible approaches

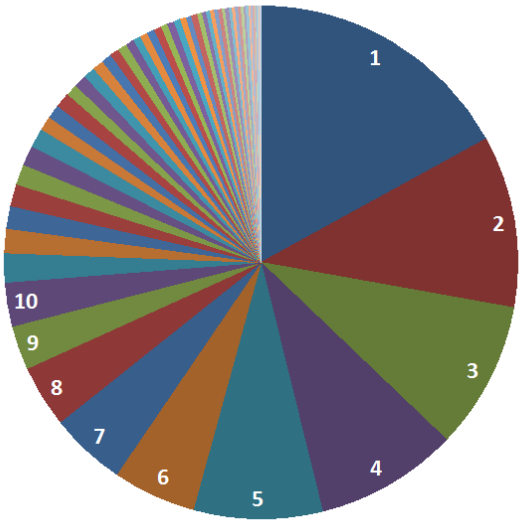
- Independent Actuarial Review
- Use of Results
- Analysis of Drivers
- Review by Management, Business or Operations
- Comparison to Risk Register
- Stress and Scenario Testing
- CoV, Return Period, Capital Allocation
- Risk Return Measures

A worked example – Operational Risk

Option	1	2	3	4	5
Rank	Mean	SD	CV	Var 97.5	Capital Alloc
1	UW Auth	RDS	RI	Del UW	Del UW
2	Staff Ret	Del UW	RDS	Claim systems	RDS
3	Emp Law Risk	Staff Ret	Phys Inv	Staff Ret	Staff Ret
4	Claim systems	UW Auth	Other	UW Auth	Claim systems
5	Del UW	Claim systems	Other	UW Review	UW Auth
6	IT	Phys Inv	Mkt Change	Emp Law Risk	Emp Law Risk
7	UW Review	Emp Law Risk	Other	Proj 1	Phys Inv
8	Fraud Claim	UW Review	Other	Syst Exploit	Mkt Change
9	Syst Exploit	Mkt Change	Other	Fraud Claim	UW Review
10	Dis Rec Plan	Systemic claims issue	Other	Dis Rec Plan	Systemic claims issue

Communication (1) – stacked plots in the tail
These charts identify how risks interact in the tail

Communication (2) – treemaps versus pie charts
Treemaps communicate relativities more effectively



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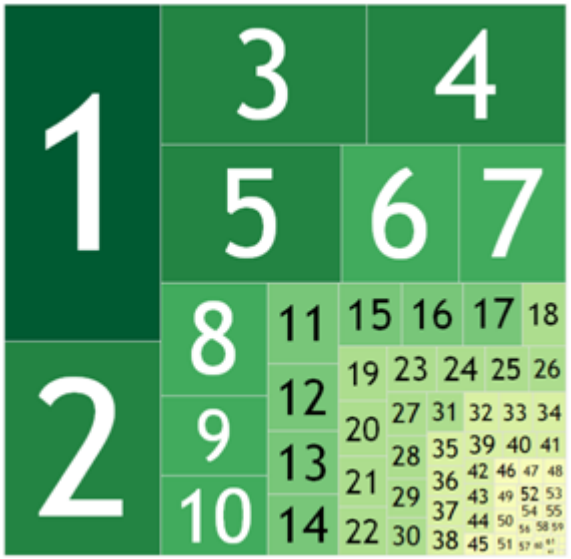
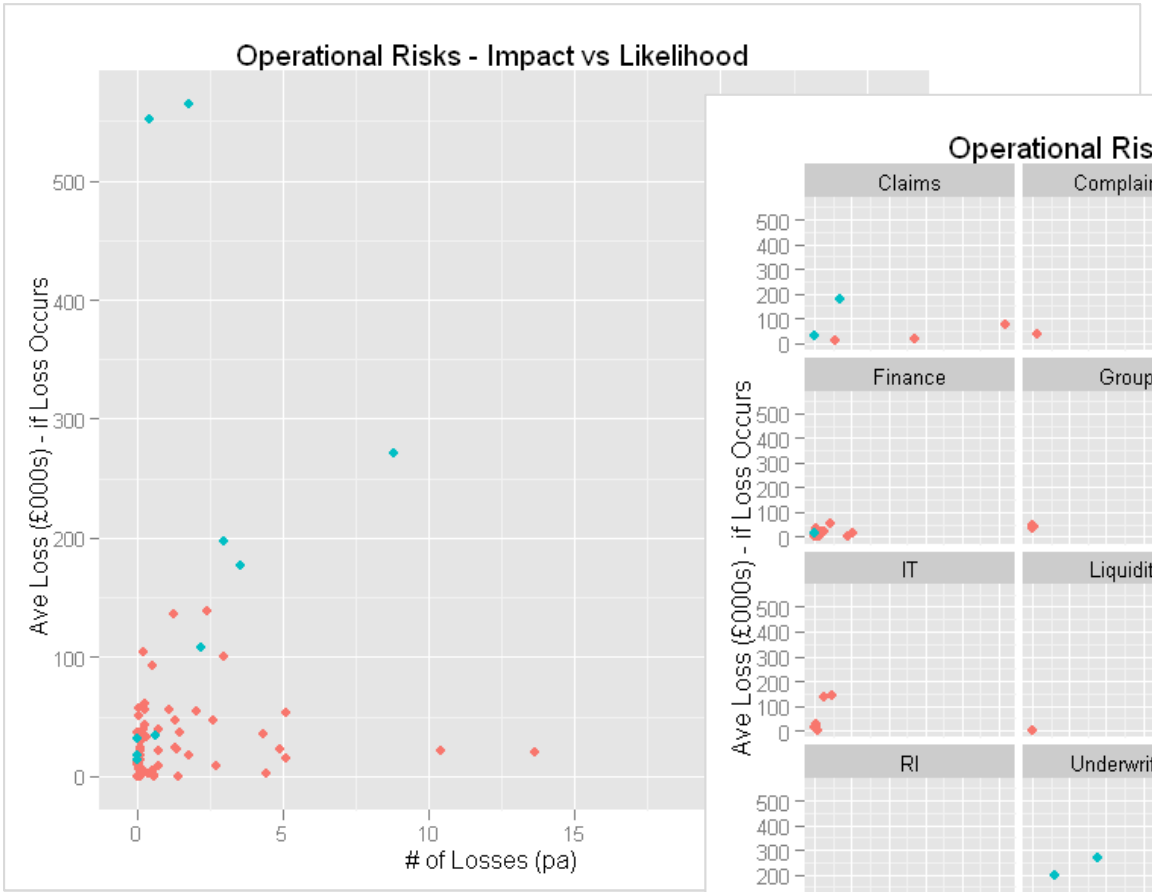
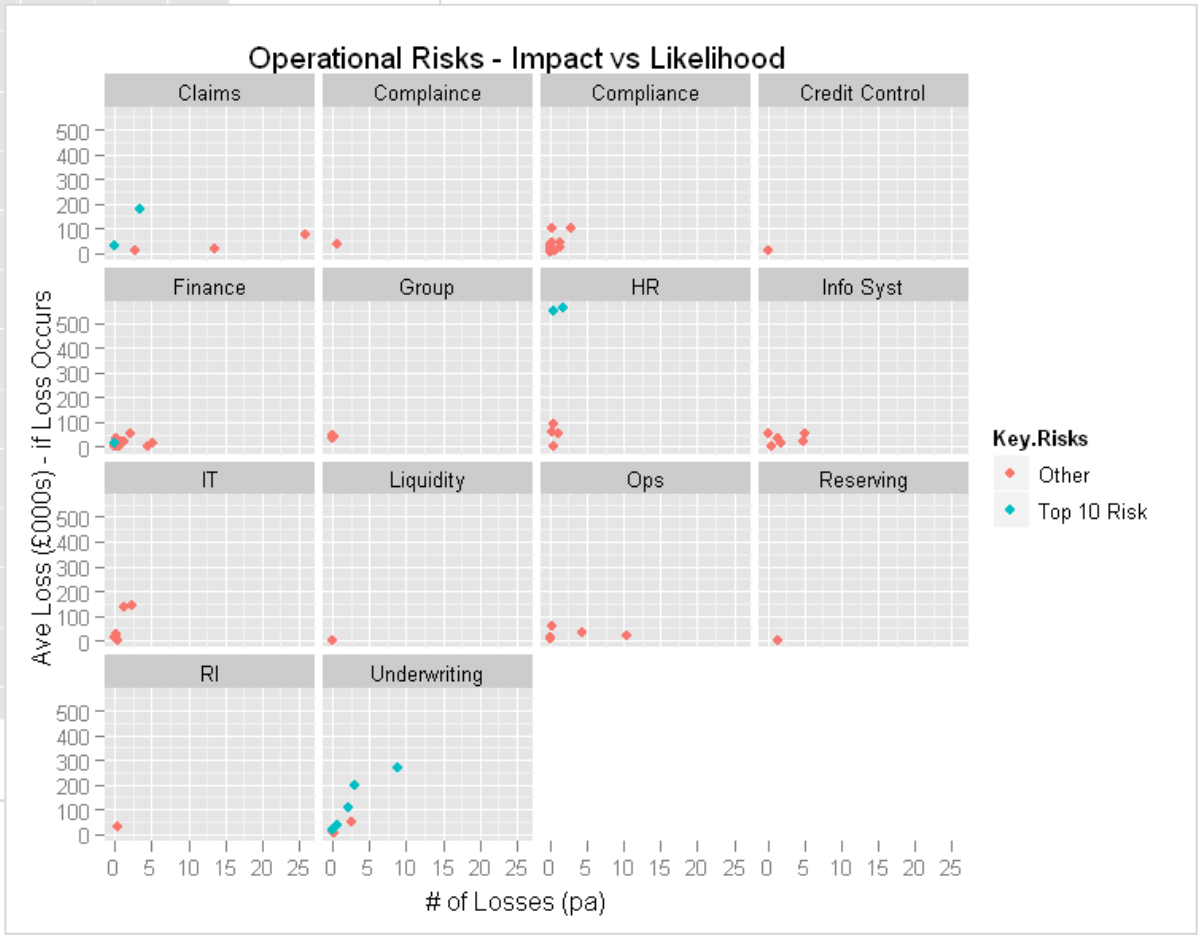


Note graphs show capital allocated by risk

Communication (3) – Frequency and Severity Plots
Drill down by function, or individual ...





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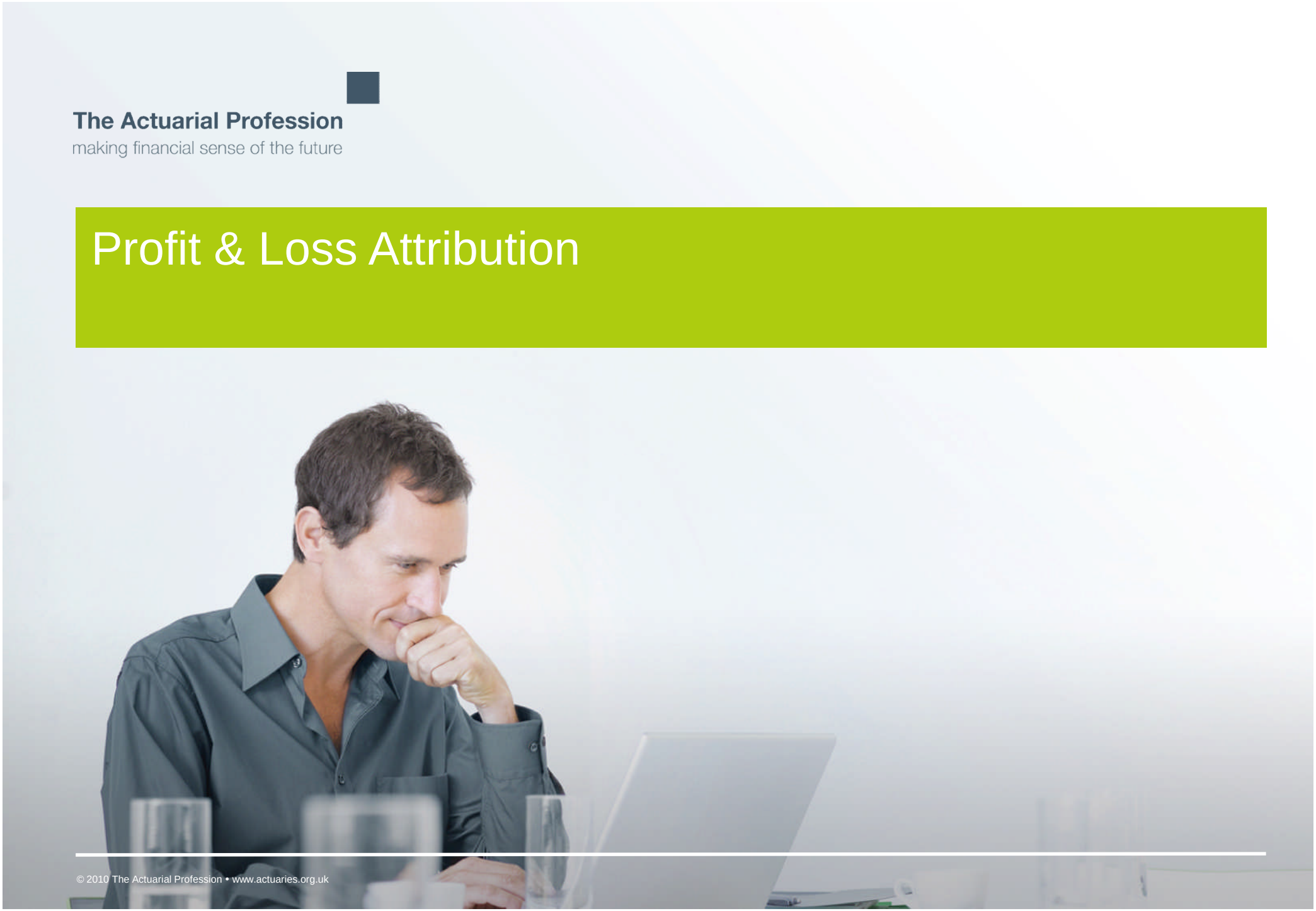
Profit & Loss Attribution



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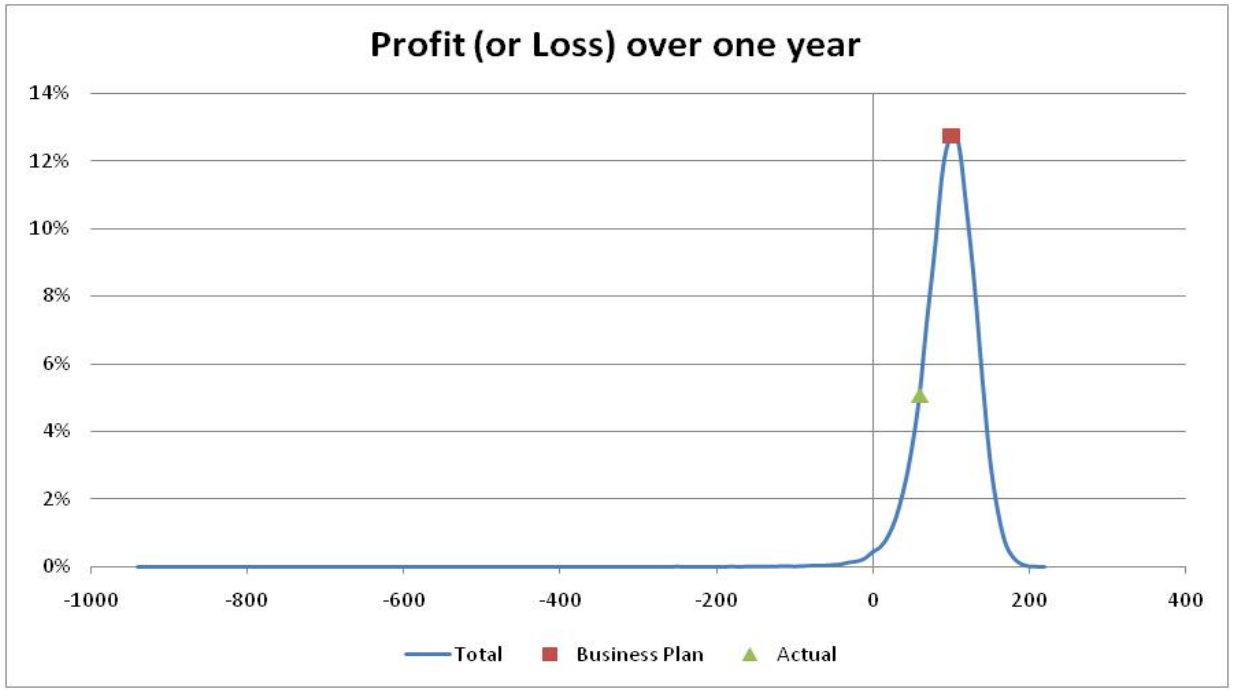
Profit and Loss Attribution ....

> Demonstrate how the categorisation of risk chosen in the internal model explains the causes and sources of profits and losses. The categorisation of risk and attribution of profits and losses shall reflect the risk profile of the insurance and reinsurance undertakings. *Article 123*

How do you interpret the requirement?

- "For each level of granularity, we will compare the actual profit or loss against the distribution of profit or losses projected by the model."
- "To support management in understanding the drivers of profitability"
- "To validate the assumptions in the model against emerging experience"

Graphical Display of Profitability



The variability in profit comes from a variety of **sources**:

- Lines of business (ie. property, motor etc)
- Risks (ie. non-life, market, operational etc.)
- Terms of trade & commission arrangements
- Business Strategy

And can be controlled by levers that **cause** profit variability:

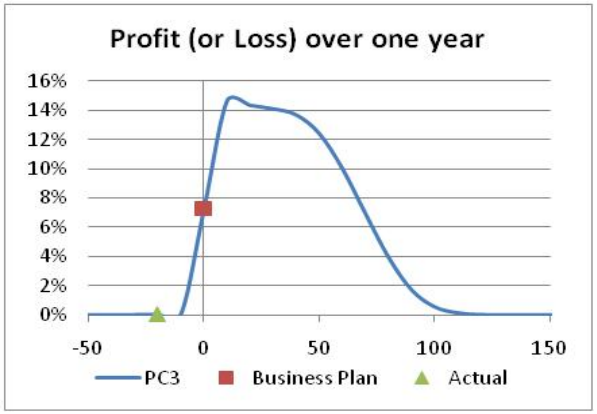
- Investment portfolio
- Reinsurance protection
- Pricing & underwriting
- Terms of trade & commission arrangements
- Business Strategy

Graphical Display of Profitability

Property business

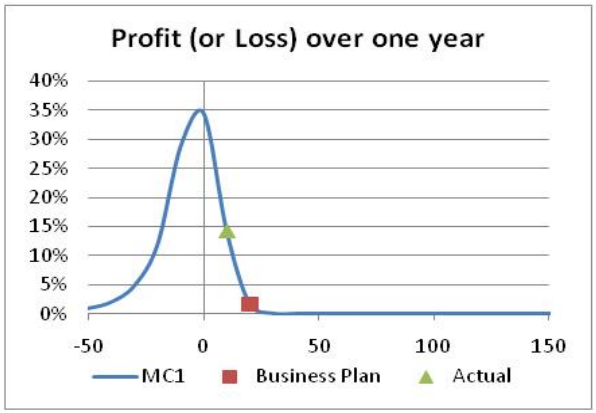
Channel 1

Channel 2

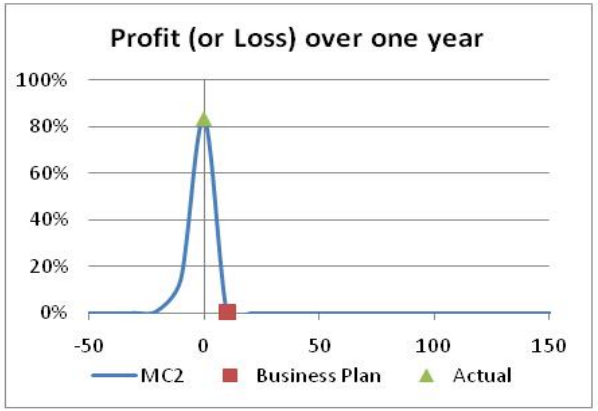


Channel 3

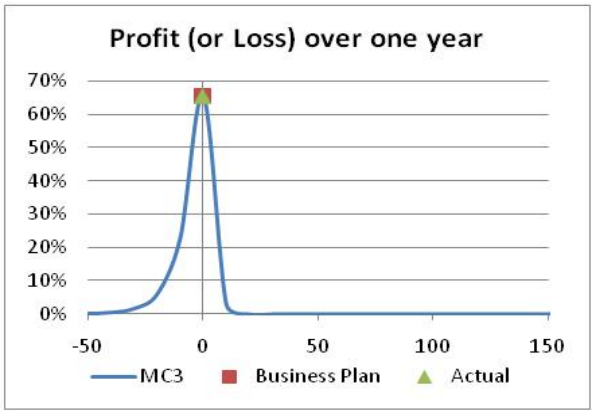
Motor business



Channel 1

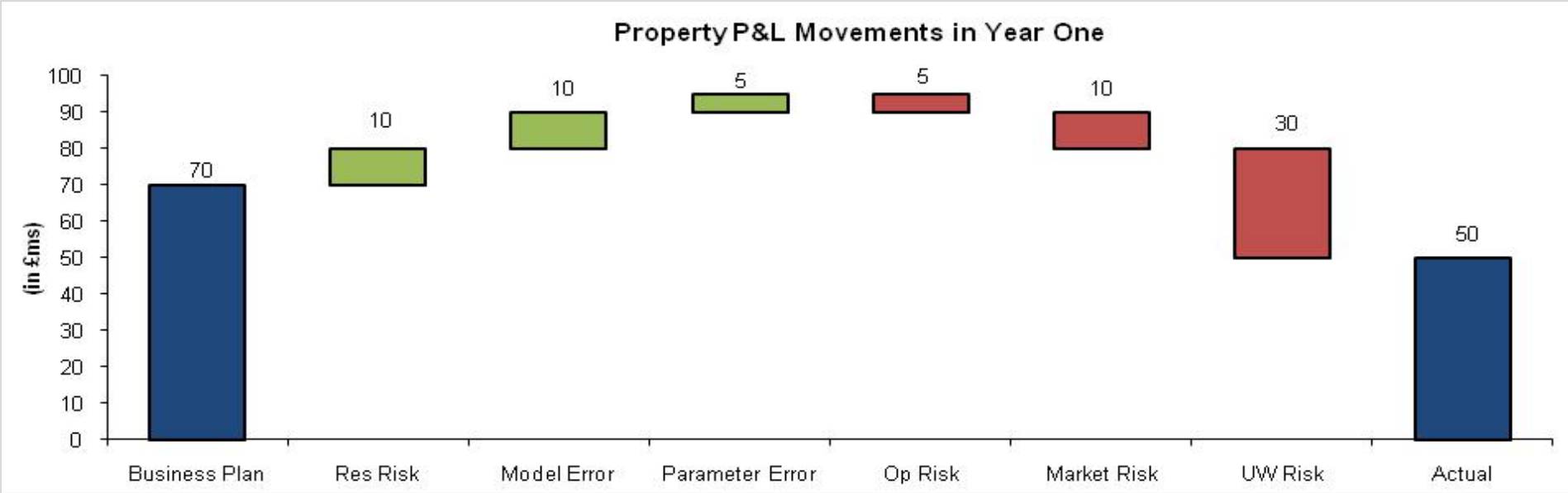


Channel 2



Channel 3

Profit & Loss Attribution – a waterfall chart helps to track the key movements in sources of profit from plan



This enables

- the business to understand the areas of the internal model where differences have arisen from what was expected
- the actuaries to backtest volatility assumptions in the model, by looking at year-on year deviations, or more importantly trends

Profit & Loss Attribution – different approaches to implementing the test

Definition of Profit

- Solvency II
- Accounting e.g. UK GAAP
- Management e.g. UW Year

Granularity

- By Entity, Division or LOB
- Insurance, Investment or operational results

Historical Data

- Current Year / Prior Years

Challenges

- Business Plan and Capital Assessment may not be joined up
- SII analysis may not be seen as value add by management
- Allocation of investment, expenses or reinsurance may be arbitrary
- Test increasingly spurious at lower levels of granularity
- What trigger levels? Trends or year on year deviations?

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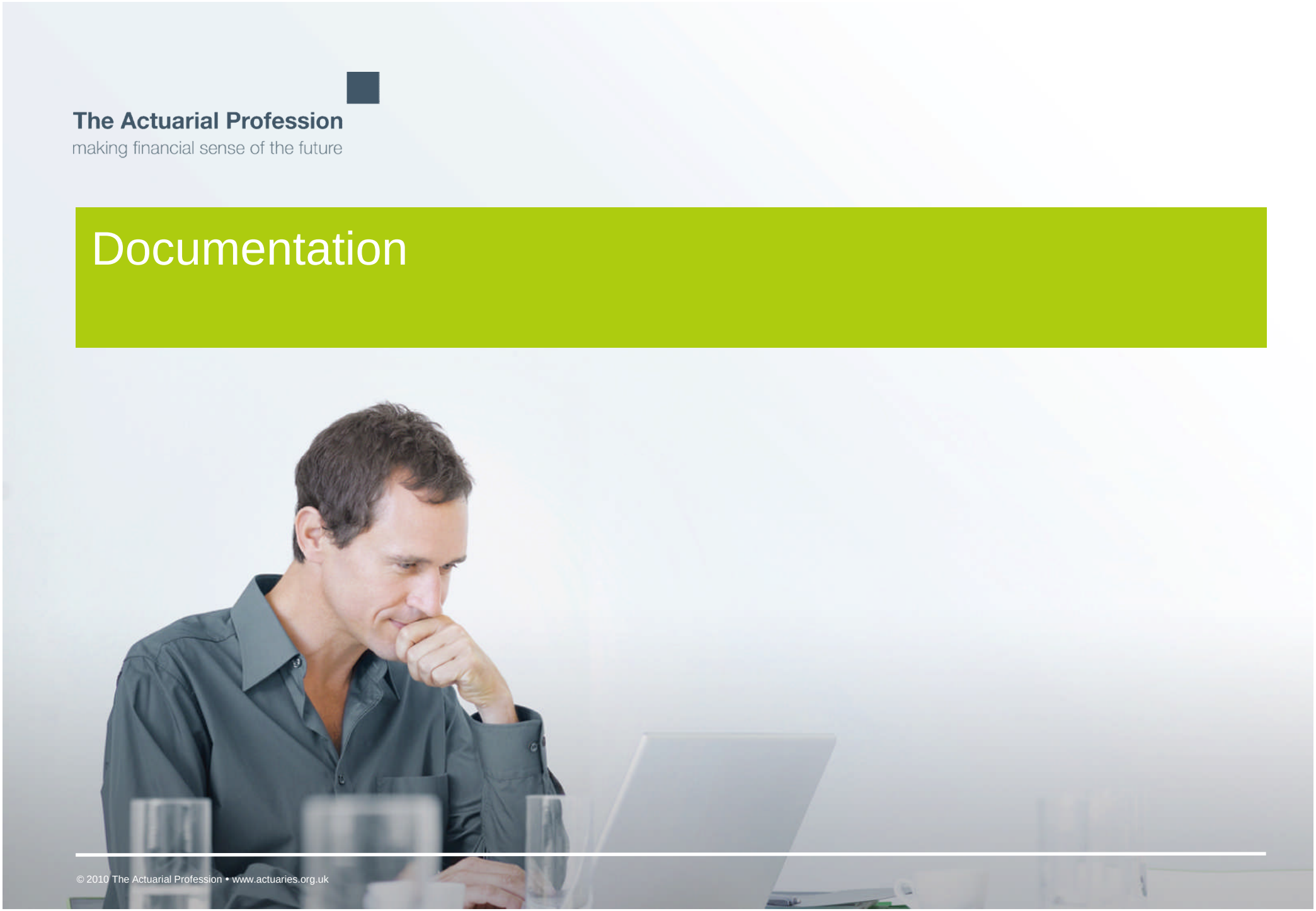
Documentation



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Documentation requirements ...

An independent, knowledgeable third party can :

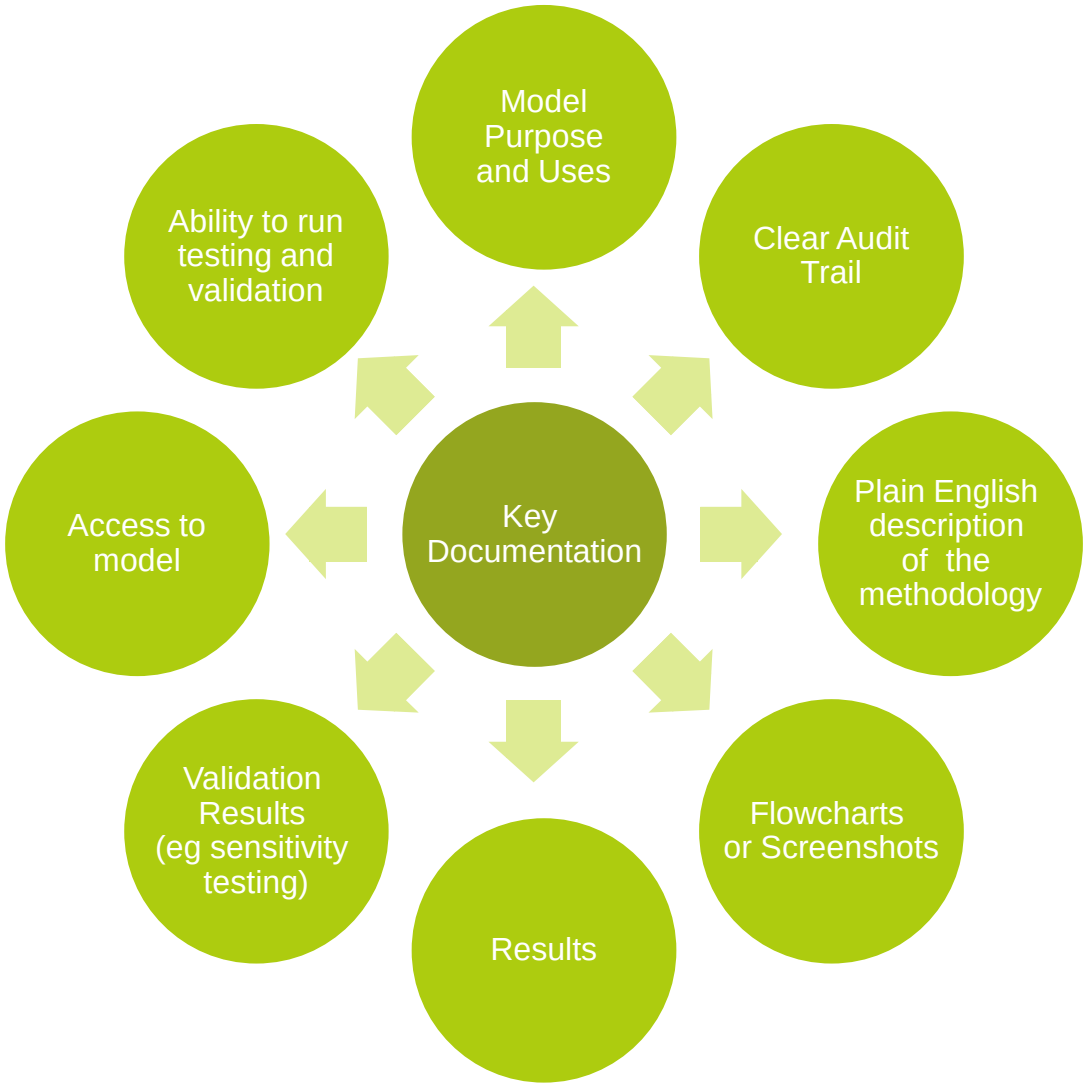
"form a sound judgment as to the reliability of the internal model ... and understand the reasoning and the underlying design and operational details of the internal model." Former CP56 9.53.

"understand the model framework, its methodology, the underlying assumptions, and the limits of applicability of the model" Former CP56 9.40

"use a different platform to build a consistent internal model within a reasonable time period." Former CP56 9.41

"in principle reproduce the model outputs if all the parameters and exposure data were available." Former CP56 9.40

Views from our survey
What do you need to form a sound judgement on the model?



Summary of CP requirements – Possible Documentation Framework

Data
- Data Management approach
- Clear data dictionaries
- Description and construction of the databases
- Data flow chart covering internal model
- Assumptions for Data
- Process and controls for data, data flows and data quality
- External and Internal data
- Etc.

Assumptions and Parameters
- Summary of methodologies and formulae to estimate parameters
- Sources of data backing assumptions
- Expert Judgement
- Etc.

Technological Specifications / Systems
- Description of the Information Technology platform used in the internal model
- Contingency plans, security policies and business recovery plans for the technological elements of the internal model
- User guide
- Source code
- Etc.

Calibration Standards
- Risk measures & time periods for different business units and justification of these
- Demonstrate consistency between SCR calculation and internal model
- If SCR cannot be directly derived from probability distribution then
  - How risk is rescaled and justify how bias is immaterial
  - Shortcuts used to reconcile outputs of internal model with distribution of Basic Own Funds
- Etc.

Calculation Kernel – (Methodology)
- Detailed outline of the theory, assumptions and mathematical and empirical basis underlying the internal model
- Technical Provisions – best estimate and risk margins
- Capital / Solvency Requirements
  - Risks in scope / Out of scope
  - Business Units In scope / Out of scope
  - MCR
  - SCR
  - Recognition of risk mitigation instruments
- Aggregation policy and methodology
- Overview of the historical development of the internal model
- Simplifications / Approximations
- Etc.

Use Test
- Evidence of Use Test i.e. integration of model within the business
- Senior management understanding of model
- Etc.

Internal Model Governance
- Policies & Standards
  - Validation Policy
  - Model Change Policy
  - Documentation Policy
  - Calibration Standards, Etc.
- Controls and Procedures
- Responsibilities and accountabilities
- Drawbacks and weaknesses
- Etc.

Profit and Loss attribution
- Profit and Loss Attribution Policy
- Results of Profit and Loss Attribution
- Material risks in the risk profile not represented by the internal model
- Etc.

External Models and Data
- Role and extent of use
- Decision / Rationale for choice of particular external model or data
- Demonstration of detailed understanding and knowledge of external models' and data's:
  - Methodological underpinnings
  - Basic construction
  - Capabilities
  - Limitations
- Demonstration of appropriateness in relation to:
  - Nature, scale and complexity of risks
  - Business objectives
  - Modelling methodologies
  - Availability of internal data
- Validation of External models and data
- Risks arising from use of external data and models e.g. strategic risk, contractual risk, etc.
- Etc.

Expert Judgement
- Description of where Expert Judgement is applied in the model
- Justification of use of Expert Judgement where used in the model
- Validation of Expert Judgement
- Etc.

Validation Policy
- Purpose and scope of validation
- Validation tools used
- Frequency of validation process
- Where, if anywhere, external review and systems are used
- Testing results against experience
- Analysis of Change
- Actual versus Expected
- Etc.

Documentation Policy
- List of all relevant documents and how these can be accessed
- Identify people responsible for maintaining documents
- Overview of historical development of the internal model including Methodologies, Assumptions and Data
- Version control process of internal model
- How requirements governed in Articles 120 to 124 have been taken into account and fulfilled
- Limitations in risk modelling
- Nature, degree and sources of uncertainty
- Deficiencies in input data
- Documentation Index
- Model Scope
- Etc.

Statistical Quality Standards
- Detailed description of Internal Model Methodologies and parameterisations
- Description of underlying assumptions
- Risk ranking and drivers of risk
- Etc.

Internal Model Output and Reporting
- Supervisory and external reporting
  - Report to Supervisor (RTS)
  - Solvency and Financial Condition Report (SFCR)
  - ORSA – Economic Capital
- Internal reporting
- Etc.

Model Change Policy
- Definition of a major and minor model change
- Etc.

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Bridging CEIOPS requirements and business/modelling reality

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How are the requirements being interpreted by experienced modellers?

How is the industry approaching the tests?

Topics

- Calibration
- Expert Judgement
- Use Test
- Risk Ranking
- Profit & Loss Attribution
- Documentation

The working party continues next year – volunteers welcome !

Questions or comments?

Expressions of individual views by members of The Actuarial Profession and its staff are encouraged.

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