Momentum conference 2010
Solvency II IMAP Working Party

Challenges for GI Actuaries

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

<table>
<thead>
<tr>
<th>Top 5 – Uses</th>
<th>Top 5 - Influence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital management</td>
<td>Capital management</td>
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<tr>
<td>Business planning/strategy</td>
<td>Business planning/strategy</td>
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<tr>
<td>Measurement of material risks</td>
<td>Reinsurance</td>
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<td>Reinsurance</td>
<td>Developing and monitoring of risk appetite</td>
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<tr>
<td>Development and monitoring of risk appetite</td>
<td>Efficient use of capital/performance measurement</td>
</tr>
<tr>
<td>94%</td>
<td>93%</td>
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<tr>
<td>90%</td>
<td>83%</td>
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<td>90%</td>
<td>80%</td>
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<tr>
<td>87%</td>
<td>77%</td>
</tr>
<tr>
<td>81%</td>
<td>73%</td>
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</table>

Calibration
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 planning 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

<table>
<thead>
<tr>
<th>Method</th>
<th>Total Squared Error</th>
<th>$\chi^2$ test statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perfect foresight</td>
<td>39%</td>
<td>87</td>
</tr>
<tr>
<td>Simulated Re-reserving (CL)</td>
<td>93%</td>
<td>123</td>
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<tr>
<td>Hindsight re-estimation</td>
<td>66%</td>
<td>207</td>
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<tr>
<td>Ultimate emergence</td>
<td>45%</td>
<td>70</td>
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<tr>
<td>Reserve emergence</td>
<td>55%</td>
<td>73</td>
</tr>
<tr>
<td>Simulated MW</td>
<td>66%</td>
<td>110</td>
</tr>
<tr>
<td>QIS 5 USP Method 1</td>
<td>15%</td>
<td>46</td>
</tr>
</tbody>
</table>

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.
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?
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

<table>
<thead>
<tr>
<th>Option</th>
<th>Rank</th>
<th>1 Mean</th>
<th>2 SD</th>
<th>3 CV</th>
<th>4 Var 97.5</th>
<th>5 Capital Alloc</th>
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<tbody>
<tr>
<td>1 UW Auth</td>
<td>RDS</td>
<td>Del UW</td>
<td>Del UW</td>
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<tr>
<td>2 Staff Ret</td>
<td>Del UW</td>
<td>RDS</td>
<td>Claim systems</td>
<td>RDS</td>
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<tr>
<td>3 Emp Law Risk</td>
<td>Staff Ret</td>
<td>Phys Inv</td>
<td>Staff Ret</td>
<td>Staff Ret</td>
<td></td>
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<tr>
<td>4 Claim systems</td>
<td>UW Auth</td>
<td>Other</td>
<td>UW Auth</td>
<td>Claim systems</td>
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<tr>
<td>5 Del UW</td>
<td>Claim systems</td>
<td>Other</td>
<td>UW Review</td>
<td>UW Auth</td>
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<tr>
<td>6 IT</td>
<td>Phys Inv</td>
<td>Mkt Change</td>
<td>Emp Law Risk</td>
<td>Emp Law Risk</td>
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<tr>
<td>7 UW Review</td>
<td>Emp Law Risk</td>
<td>Other</td>
<td>Proj 1</td>
<td>Phys Inv</td>
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<tr>
<td>8 Fraud Claim</td>
<td>UW Review</td>
<td>Other</td>
<td>Syst Exploit</td>
<td>Mkt Change</td>
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<td>9 Syst Exploit</td>
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<td>Fraud Claim</td>
<td>UW Review</td>
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<tr>
<td>10 Dis Rec Plan</td>
<td>Systemic claims issue</td>
<td>Other</td>
<td>Dis Rec Plan</td>
<td>Systemic claims issue</td>
<td></td>
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</tr>
</tbody>
</table>
Communication (1) – stacked plots in the tail
These charts identify how risks interact in the tail

Many competing risks
Clear away noise, and three risks are of interest

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

Note graphs show capital allocated by risk
Communication (3) – Frequency and Severity Plots
Drill down by function, or individual ...

Profit & 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

![Graphs showing profitability for different channels.]

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?

Documentation
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?

- Key Documentation
- Plain English description of the methodology
- Flowcharts or screenshots
- Results
- Validation Results (eg sensitivity testing)
- Access model
- Ability to run testing and validation
- Model Purpose and Uses
- Clear Audit Trail
Summary of CP requirements – Possible Documentation Framework

- Data & IT management approach
- Churn data between sources
- Data quality and completeness
- Data quality and and sourcing internal model
- Data quality and validation model
- Data quality and validation process

- Questions
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The working party continues next year – volunteers welcome!

Our focus
Bridging CEIOPS requirements and business/modelling reality
Questions or comments?

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

The views expressed in this presentation are those of the presenters.