



SOCIETY OF ACTUARIES

**Life 2008 Spring Meeting  
June 16-18, 2008**

**Session 59, Internal Models for Insurer Risk and  
Capital Management**

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## Society Of Actuaries Life Spring Meeting– Solvency II and Internal Models

June 2008  
Andy Cope

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## Solvency II

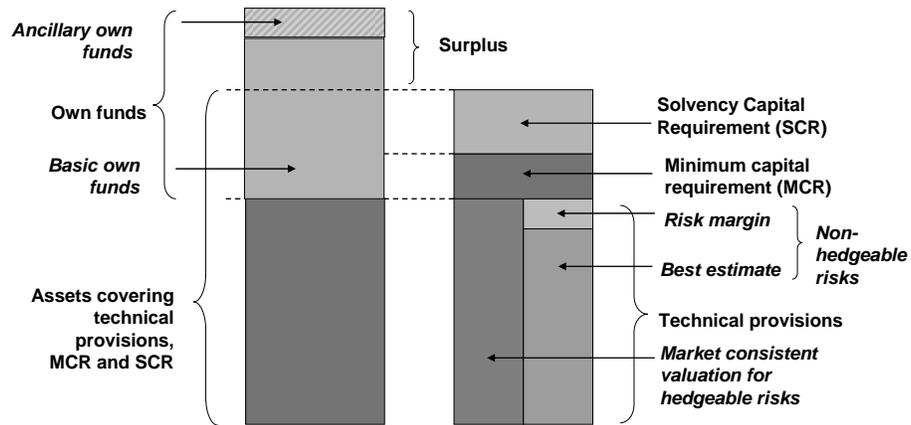
- Overhaul of European supervisory structure
- Unified prudential regulation of insurers and reinsurers
- Capital requirements more closely aligned to risks
- Focus on risk management framework
- Better consumer protection
- Non-zero failure regime
- Three pillar structure, based on Basel II and CRD
- Link to IFRS Phase II



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# Overview of the Solvency II Balance Sheet

Building blocks of the new regime



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## Accreditation and Validation of Internal Models

## Internal models

- Article 110 of the Framework Directive allows companies to calculate their SCR using an internal model “as approved by the supervisory authorities.”
- This can be a full or partial model.
- Make use of existing models?
- However the FSA (UK) has indicated it does not believe any existing models used to calculate ICA's are good enough to be used as internal models.



## What is an Internal model?

- International Association of Insurance Supervisors (October 2007) guidance paper on the use of internal models for risk and capital management by insurers
- “a risk management system developed by an insurer to analyse the overall risk position, to quantify risks and to determine the economic capital required to meet those risks”
- “an internal model may also be used to determine the insurer's regulatory capital requirements on the basis of the insurer's specific risk profile and the defined level of safety of the solvency regime”



## Reasons for developing an internal model

- The standardised approach will most likely be calibrated conservatively.
  - This suggests that internal models will produce lower capital requirements.
- The additional insights provided by internal models should give those firms which use them a competitive advantage.
- Rating agencies increasingly focussed on companies' internal models and their risk management framework.

## Approval of Internal Models

### **The Framework Directive (Feb 2008) does give some indication of what the process will entail**

- Use test (article 118)
- Statistical quality standards (article 119)
- Calibration standards (article 120)
- Profit and loss attribution (article 121)
- Validation standards (article 122)
- Documentation standards (article 123)

## Use test

- Internal model widely used and important role in
  - System of governance
  - Risk management and decision-making
  - Capital assessment and allocation
- Built in to control loops
- Fit within operational and organisational structure



## Statistical quality standards

- Sound actuarial and statistical techniques
- Based upon up to date, credible information and realistic assumptions
- Accurate and appropriate data
- Covers all material risks
- Diversification allowed as long as justified
- Risk mitigation allowed as long as resultant risks modelled
- Accurate assessment of options and guarantees
- Future management actions allowed as long as consistent with expectations



## Calibration standards

- SCR Value-at-Risk measure at a confidence level of 99.5% over a one-year period.
- Internal measures vs. regulatory capital
- Approximations can be used in SCR calculation provided equivalent to required standard
- Regulator requirements – benchmark portfolios and assumptions to verify calibration



## Profit and loss attribution

- Annual analysis of the profits and losses of each business unit.
- The risk model must be able to explain the cause and source of each profit / loss.
  - Must be linked to the risk profile of the company
  - More granular assessment compared to current models



## Validation standards

- Regular cycle of model validation
  - Monitoring performance
  - Ongoing review
  - Back-testing
- Demonstrate statistical validity to regulators
- Must be valid for historical **and** new data
- Analysis of model stability including sensitivity testing for key parameters
- Data integrity analysis



## Documentation standards

- Design and methodology
- Processes
- Compliance checklists
- Shortcomings
- Change control





## Accreditation and Validation of Internal Models – UK developments

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### Requirements of Internal Models:

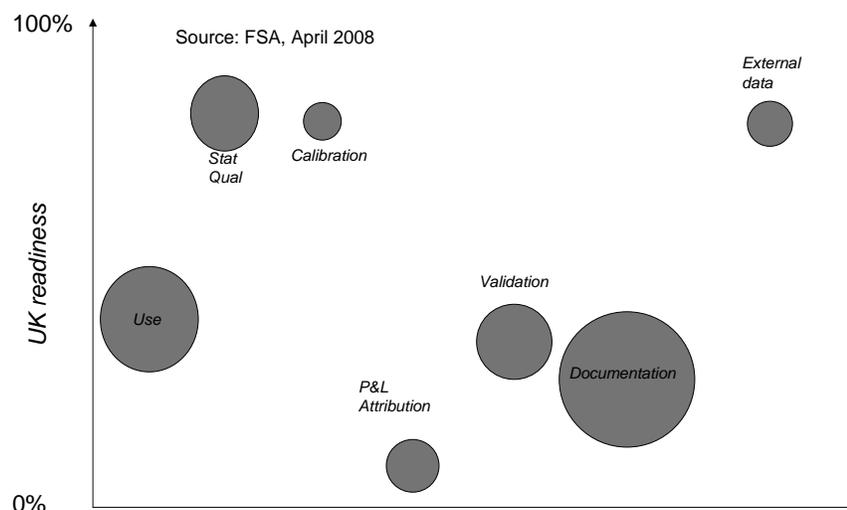
- Internal model does not need to be a fully stochastic model
- Should cover all risks to which a capital value can be assigned
- Complex models may be run infrequently, updating parts of it more frequently where necessary
- Detailed disclosure requirements for each parameter within the model
  - Distribution, variability
  - Underlying data, calibration
  - Appropriateness and fit of model



## Requirements of Internal Models (2):

- Alignment of pricing and capital models but not granularity
- Emphasis on proportionality
- Back-testing
  - Rework using historic experience and compare to actual
  - Level of granularity explains results?
  - Assess whether historic experience within agreed tolerance levels
  - Trends

## UK Firms readiness for Internal Models



## “State of Play” of current models

CURRENT MODELS	SOLVENCY II MODELS
<ul style="list-style-type: none"> <li>• Different models used for               <ul style="list-style-type: none"> <li>- Pricing, Pillar 1, Pillar 2, Economic Capital, Management Information</li> <li>- In different business units</li> </ul> </li> <li>• Predefined risk measures for some risks</li> <li>• Only key factors affecting risk modelled</li> <li>• Analysis of Surplus on key lines               <ul style="list-style-type: none"> <li>- Large unexplained items not uncommon</li> </ul> </li> <li>• Documentation of key processes of model</li> <li>• Reliance on external providers, e.g. ESGs, stochastic models</li> </ul>	<ul style="list-style-type: none"> <li>• One model (or at least models that are consistent) used throughout the business to run the company!</li> <li>• Ability to look at various risk measures and levels of confidence</li> <li>• Detailed granular assessment of risk</li> <li>• Review causes of profit and loss for each major business unit and demonstrate how categorisation of risk explains causes of profit and loss</li> <li>• Documentation of model covering theory, design, operational, compliance and shortcomings of model</li> <li>• No black boxes</li> </ul>

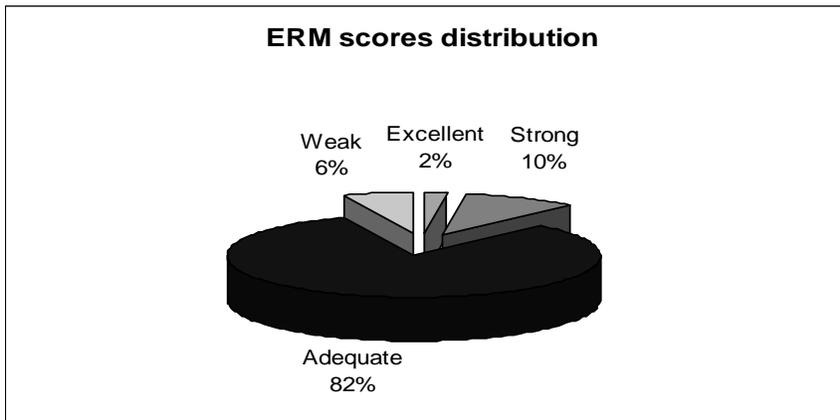


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## S&P’s view of European Insurers’ Enterprise Risk Management Frameworks

Source: Standard & Poor’s, as at December 2007



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## A Practical Compromise?



- **Improvements are required**

- Consistent models used in pricing, determining and allocating capital
- Link to risk management framework
- More granular assessment of risk (no significant levels of unexplained profits/losses)
- All material risks captured
- Model kept up to date in all areas
- Better governance and documentation

- **Benefits should outweigh costs!**



## Further information on Solvency II

- European Commission  
[http://ec.europa.eu/internal\\_market/insurance/solvency/index\\_en.htm](http://ec.europa.eu/internal_market/insurance/solvency/index_en.htm)
- European Insurance Federation (CEA)  
<http://www.cea.assur.org/index.php?page=solvency-ii>
- CEIOPS <http://www.ceiops.org/>
- ABI, CRO Forum, FSA (UK regulator)





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# Internal Models - Work of the IAA

Allan Brender

Session 59  
Quebec

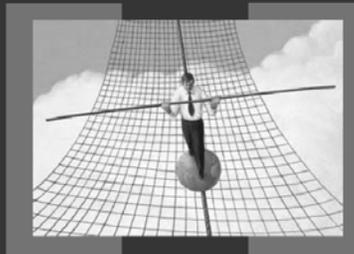
SoA/CIA/IAA Meeting  
June 17, 2008



OSFI  
BSIF

Canada

## A Global Framework for Insurer Solvency Assessment



OSFI  
BSIF



Research Report of the Insurer Solvency Assessment Working Party  
INTERNATIONAL ACTUARIAL ASSOCIATION  
ASSOCIATION ACTUARIELLE INTERNATIONALE

## Advanced Approaches to Capital Requirements - Internal Models

- **For technically sophisticated firms**
- **Requires supervisory approval**
- **Requires extensive risk management program**
- **“use test ”**



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## Internal Models

- **“use test” implies a broader application of internal models**
  - Economic capital
  - ALM
  - Reserving
  - Pricing
  - Product design
  - Risk management
  - .....



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## IAIS Solvency Sub-committee

- **Guidance Paper and Standard on the use of internal models for regulatory capital purposes**
- **Internal models are seen as having an application to both Pillar I and Pillar II requirements**
- **IAIS asked the IAA Solvency Sub-committee for technical help**



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## IAA Internal Models Paper

***Guidance paper on the use of internal models for risk and capital management purposes by insurers***

- **In progress for three years**
- **Expect completion by September, 2008**
- **Work has been done in close cooperation with the IAIS**



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# IAA Internal Models Paper

- 1. Introduction**
- 2. Model Fundamentals**
- 3. Design Considerations**
- 4. Construction of Model**
- 5. Controls**
- 6. Governance**
- 7. Communication**
- 8. Supervisory Approvals**



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## 2. Model Fundamentals

- **Financial Model**
- **Modelling Process**
- **Proportionality**
- **Risk assessment framework**
- **Real World versus Risk Neutral Probabilities**
- **Managing Models**
- **Types of Model**



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### 3. Design Considerations

- **Results**
- **Order of Calculation**
- **Control over Assumptions**
- **Reproducibility**
- **Flexibility**



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### 4. Construction of Model

- **Time Granularity**
- **Population of the Model**
- **Product Descriptions**
- **In-force Data**
- **Assets**
- **Insurance Experience Assumptions**
- **Insurance Assumptions for Projections**
- **Assumptions Concerning the Insurer**
- **Algorithms**
- **On the Use of Random Numbers**
- **The Number of Scenarios in a Stochastic Model**
- **Extreme Values**
- **Documentation**



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## 5. Controls

- **Sufficiency Test**
- **Calibration Test**
- **Use Test**
- **Change Test**



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## 6. Governance

- **Approvals, Policies, Expertise, Tools, and Resources**
- **Risk Management Policy**
- **Audit**
- **Review**
- **Documentation**
- **Compliance**



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## 7. Communication

- **Fundamentals**
- **Identify Stakeholders of the use of the Model**
- **Identify the Communication Requirements of each Stakeholder**
- **Internal Management Communication Needs**
- **Examiner Communication Needs**
- **Public Communication Needs**



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## 8. Supervisory Approvals

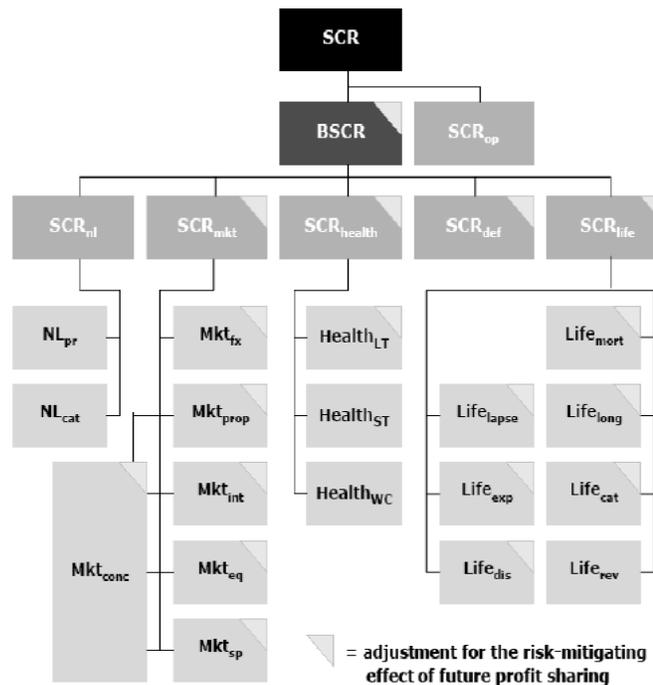
- **Role of the Board of Directors and Senior Management**
- **Risk Management Infrastructure**
- **Corporate and Operational Limits**
- **Model Integration**
- **Stress Testing**
- **Documented Policies**
- **Internal Audit**
- **Quantitative Model Standards**
- **Modifications to Capital Models**



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# Issues

- **Diversification**



# Issues

- **Diversification**
- **Limits to the use of and reliance on models**
- **Scenarios and stress testing**



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Questions and Discussion



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