Modelling and Management of Tail Risk in Insurance

IMF conference on operationalising systemic risk monitoring

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Systemic risk and capital requirements

FSB/IMF/BIS criteria for systemic risk
- Size
- Interconnectedness
- Substitutability
- Timing (added by IAIS)

Geneva association study on systemic risk in insurance (2010) based on above criteria
- Risk activities and their relative size, not institutions as such, determine systemic relevance
- Core (re)insurance activities are no source of systemic risk based on above criteria
- Identified systemic relevant activities:
  - (monoline) financial guarantee insurance
  - derivatives trading on non-insurance B/S
  - mismanagement of short-term funding

Traditional mitigation of systemic risk
Reduction of propensity to fail for institutions carrying out systemically relevant activities to avoid
- capital shortages in the event of very large losses
- liquidity shortages in meeting obligations as they arise during a very large event
- respective knock-on effects

However, regulations are based on different capital requirement frameworks depending on industry and geographic region

In principle a reasonable response, but . . .
. . . inconsistent and fragmented approaches allow regulatory arbitrage and inhibit aggregation
A (re)insurers’ balance sheet reflects its business model

Reinsurance industry, 9 months 2009  (Based on a sample of 27 leading reinsurance companies, excl. Berkshire Hathaway)

Premises paid by policyholders, . . .

. . . a loss event triggers the setting up of reserves . . .

. . . but typically claim payments are time deferred

Example: World Trade Centre

Assets matched to liabilities, and to a large extent held to maturity

Core (re)insurance business does not rely on short-term funding of investments and thus provides time to react to a severe loss event

Source: Swiss Re, Economic Research & Consulting
Capital and liquidity risk management are key if large loss events occur

Four key control requirements for insurers …

- **Ensure asset liquidity**
  Hold enough liquid assets to meet expected and unexpected liquidity requirements

- **Control diversification**
  Pool large number of sufficiently independent risks, to make aggregate claims more predictable

- **Ensure capital adequacy**
  Use risk capital to absorb unexpected losses

- **Control ALM risk**
  Investing premiums and capital to match market risk of liabilities

… give rise to two key questions

- **Capital**
  - Sufficient capital to absorb unexpected losses?
  - Capital adequacy framework

- **Liquidity**
  - Sufficient spot liquidity and liquidity generation capabilities under stressed conditions?
  - Liquidity stress testing framework consistent with capital view
Risk tolerance
Actively used by senior management for risk steering and limit setting

Swiss Re’s risk tolerance:
“To be able to continue to operate following an extreme loss event.”

The amount of risk we are willing to accept within the constraints imposed by capital resources, strategy and risk appetite, and the regulatory and rating agency environment

“Extreme loss event”: >100 year annual aggregate Group loss

Do we hold enough capital (survival)?

Can we meet all our obligations as they fall due (operation)?

Regulatory capital
Rating capital
Internal capital

Capital adequacy requirements

Liquidity stress test
Related liquidity requirements
Liquidity risk measured comparing stressed requirements and sources
Measured under normal and stressed conditions

Measuring funding liquidity risk

(Illustrative example)

- Net funding liquidity
  Defined as the difference between sources of cash and collateral and required cash and collateral

- Funding liquidity ratio
  Defined as the ratio of sources to required cash and collateral

- These measures are determined
  - both in normal and stressed operating conditions, and
  - over predetermined future time intervals (90 days, one year)
  - for key legal entity groupings within which funds are freely transferable
Funding liquidity scenarios driven by stress events from risk modelling

Swiss Re considers a number of different scenarios and key assumptions

<table>
<thead>
<tr>
<th>Assumption</th>
<th>Insurance loss</th>
<th>Credit crisis</th>
<th>Extreme loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Event description</td>
<td>insurance loss event</td>
<td>market crash and banking crisis</td>
<td>combined insurance and financial market loss</td>
</tr>
<tr>
<td>Time horizon</td>
<td>90 days</td>
<td>90 days</td>
<td>90 days and 1 year</td>
</tr>
<tr>
<td>Loss amount</td>
<td>200-year period plus operational loss</td>
<td>credit and financial market aggregate stress loss</td>
<td>99%, 1 year aggregate Tail VaR</td>
</tr>
<tr>
<td>Ratings downgrade</td>
<td>none</td>
<td>downgrade</td>
<td>significant downgrade</td>
</tr>
<tr>
<td>Asset sales</td>
<td>not considered</td>
<td>not considered</td>
<td>allowed for over 1 year subject to haircuts</td>
</tr>
<tr>
<td>External funding</td>
<td></td>
<td>only on secured basis, subject to haircuts</td>
<td></td>
</tr>
<tr>
<td>Intra-group funding</td>
<td></td>
<td>only if contractually provided for or with unregulated entities</td>
<td></td>
</tr>
<tr>
<td>Funding from new reinsurance business</td>
<td>decrease</td>
<td>decrease</td>
<td>significant decrease</td>
</tr>
<tr>
<td>Commitments</td>
<td>normal conditions</td>
<td>stressed conditions</td>
<td>stressed conditions</td>
</tr>
<tr>
<td>Discretionary funding pipeline</td>
<td>continued</td>
<td>discontinued</td>
<td>discontinued</td>
</tr>
</tbody>
</table>

Swiss Re considers a number of different scenarios and key assumptions.
Internal capital modelling
Aims at assessing capital adequacy from an economic perspective

<table>
<thead>
<tr>
<th>Possible external events</th>
<th>Swiss Re’s link to events</th>
<th>Impact on Swiss Re</th>
<th>Financial position of entities</th>
<th>Reporting on capital adequacy testing</th>
</tr>
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<tbody>
<tr>
<td>Risk factors and dependencies</td>
<td>Risk factor distributions</td>
<td>Value change of assets and liabilities</td>
<td>Economic result</td>
<td>Statistical measure and confidence level</td>
</tr>
<tr>
<td>Dependency structure</td>
<td>Value change of portfolio given a risk factor change</td>
<td>Assessment of financial impact of each scenario</td>
<td>Economic net worth of entities in all scenarios</td>
<td>Comparison of economic net worth and 99% Tail VaR</td>
</tr>
</tbody>
</table>

- Risk factors and dependencies: €, £, $, ¥
- Dependency structure:
- Swiss Re’s link to events:
- Impact on Swiss Re:
- Financial position of entities:
- Reporting on capital adequacy testing:
- Statistical measure and confidence level:

Available capital | Required capital | Capital adequacy ratio
---|---|---
31 Dec 08 | 31 Dec 09 |
Modelling risk factors and their structural relationships
Statistical analysis and expert judgement required

Risk factor distributions
Statistical models derived from historical data

Dependency structure
Statistical dependency captured by copula

Scientific models and expert judgement
- conceivable losses
- potential changes to risk drivers

Threat scenarios

Risk factor dependencies (illustrative examples)

<table>
<thead>
<tr>
<th>Risk factor*</th>
<th>Excess Mortality 1.5 per mille</th>
<th>Excess Mortality 4.0 per mille</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equity</td>
<td>-20%</td>
<td>-40%</td>
</tr>
<tr>
<td>Swiss real estate CH</td>
<td>-7.5%</td>
<td>-15%</td>
</tr>
<tr>
<td>Other real estate</td>
<td>-15%</td>
<td>-30%</td>
</tr>
<tr>
<td>BBB credit spread</td>
<td>100bp</td>
<td>200bp</td>
</tr>
<tr>
<td>AAA credit spread</td>
<td>54bp</td>
<td>108bp</td>
</tr>
<tr>
<td>P&amp;C loss</td>
<td>CHF 100m</td>
<td>CHF 200m</td>
</tr>
</tbody>
</table>

DAX
10 Y €
Swap Rate
CHF / USD
Windstorm
Lothar
Ford Motor
Company
Leveraged
Market Loss
Lethal
Pandemic
excess mortality
Risk Factor
No. 348534
...
Capital adequacy framework to be embedded in comprehensive Risk Management framework

### The Three Pillars of Risk Management at Swiss Re

<table>
<thead>
<tr>
<th>Quantitative risk management</th>
<th>Risk governance</th>
<th>Risk transparency and disclosure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sound economic valuation and risk measurement</td>
<td>Clearly defined responsibilities for risk taking and risk mgmt</td>
<td>Company risk culture</td>
</tr>
<tr>
<td>Reliable capital adequacy framework</td>
<td>Sound, documented:</td>
<td>Peer reviews</td>
</tr>
<tr>
<td>Quantitative risk limit monitoring system consistent with risk tolerance based on 99% Tail VaR</td>
<td>– risk mgmt policies</td>
<td>Internal risk reporting</td>
</tr>
<tr>
<td></td>
<td>– operating, reporting, limit monitoring and control procedures</td>
<td>Financial and risk disclosure, including information on tail risk and scenarios</td>
</tr>
</tbody>
</table>
| | Internal and external audits of processes and figures | }
Implications for systemic risk surveillance

Sensible concepts to assess tail risk in a comprehensive fashion are successfully applied in insurance for almost two decades.

However, lack of agreement on global standards across industries regarding:

- application of total balance sheet approach measuring all risks that are ultimately borne by the respective balance sheet (including off-balance sheet special purpose entities)
- development of consistent supervisory capital stresses as basis for consistent sector or global aggregation
- inclusion of liquidity stress tests tied to capital stresses

... in parallel to a general strengthening of risk management in financial institutions

Comments

- Especially for conglomerates and groups
  Legal entity versus consolidated view (comprehensive group supervision)
- Raised to IMF during its Financial Sector Assessment Programme 2006/7
- Especially for banking
Key messages

- Due to its business model, core insurance business is not a source of systemic risk; insurance is rather a shock absorber and long-term investor.

- Liquidity stresses complemented by appropriate capital adequacy levels are a cornerstone of systemic risk mitigation.

- Total balance sheet approach should be applied consistently within all financial institutions globally, supplemented by consistent stress tests for capital and liquidity.

- Expert judgement is an important element in risk and capital modelling, especially when enhancing statistical analyses by threat scenarios.
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