



# Modelling and Management of Tail Risk in Insurance

IMF conference on operationalising systemic risk monitoring

Peter Sohre, Head of Risk Reporting, Swiss Re

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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

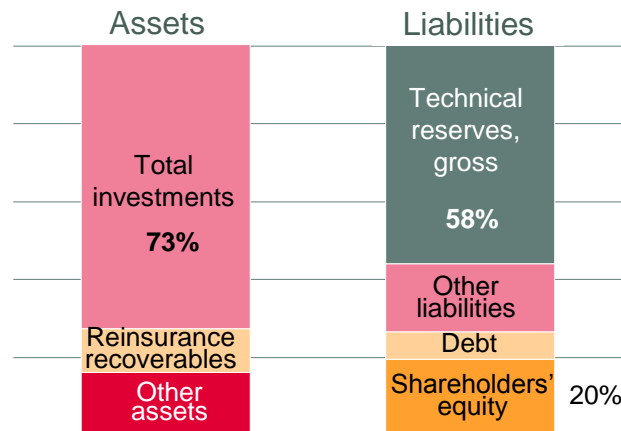
Reinsurance industry, 9 months 2009 (Based on a sample of 27 leading reinsurance companies, excl. Berkshire Hathaway)

Premiums paid by policyholders, . . .

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

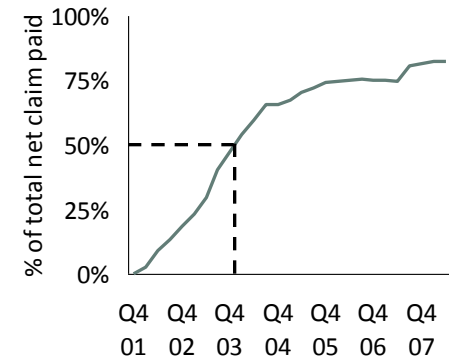
. . . but typically claim payments are time deferred

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



Source: Swiss Re, Economic Research & Consulting

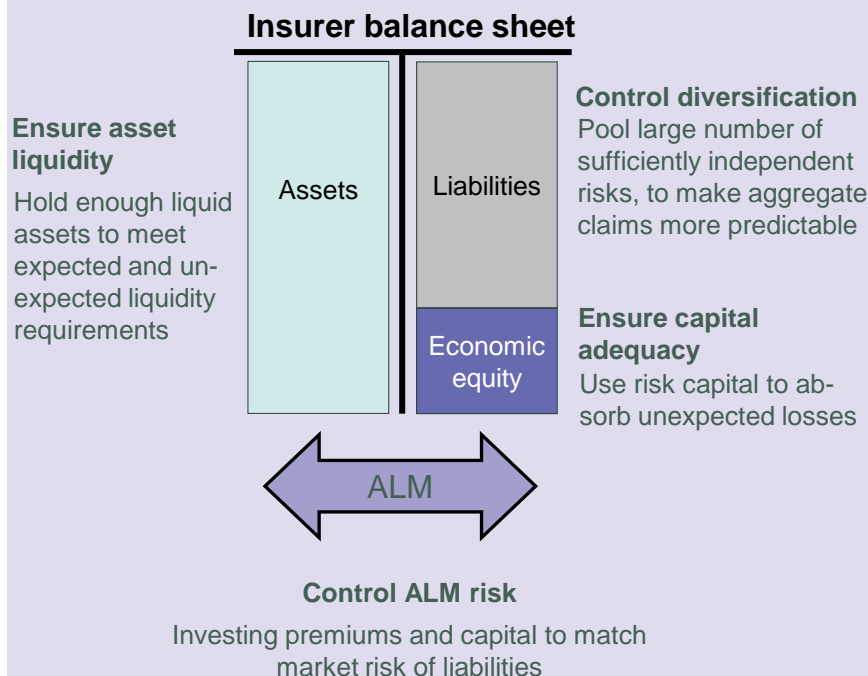
Example: World Trade Centre



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

# Capital and liquidity risk management are key if large loss events occur

## Four key control requirements for insurers ...



## ... 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

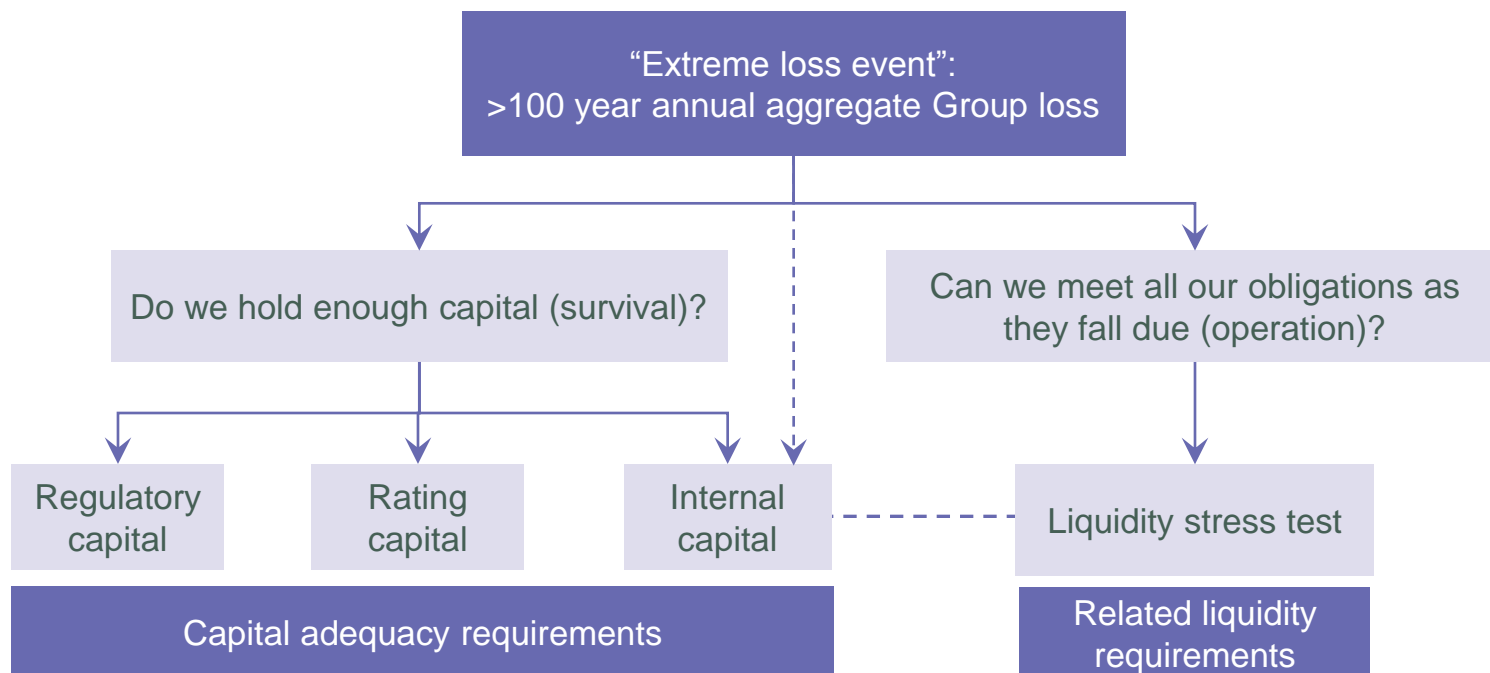
# Risk tolerance

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

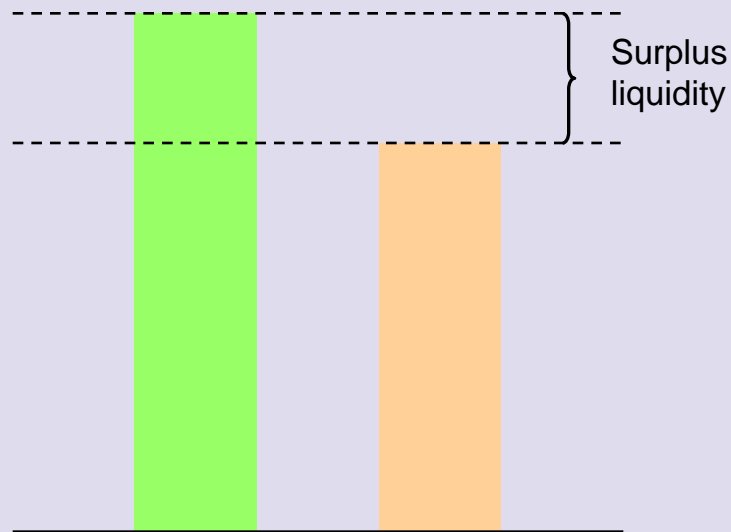


# Liquidity risk measured comparing stressed requirements and sources

Measured under normal and stressed conditions

## Measuring funding liquidity risk

(Illustrative example)



■ sources of cash and collateral

■ required cash and collateral

## Liquidity risk measures

- **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

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



# Internal capital modelling

Aims at assessing capital adequacy from an economic perspective

Possible external events

Swiss Re's link to events

Impact on Swiss Re

Financial position of entities

Reporting on capital adequacy testing

Risk factors and dependencies

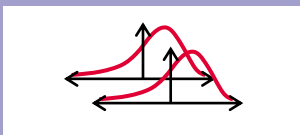
Gross exposures

Value change of assets and liabilities

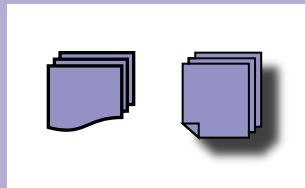
Economic result

Statistical measure and confidence level

Risk factor distributions



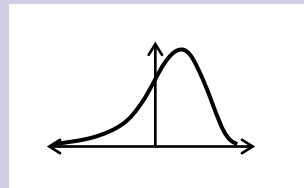
Value change of portfolio given a risk factor change



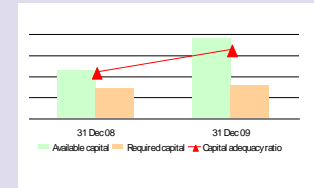
Assessment of financial impact of each scenario

€, £, \$, ¥

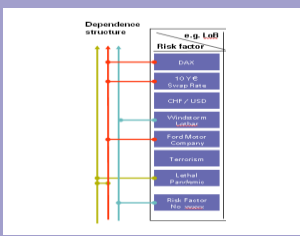
Economic net worth of entities in all scenarios



Comparison of economic net worth and 99% Tail VaR



Dependency structure



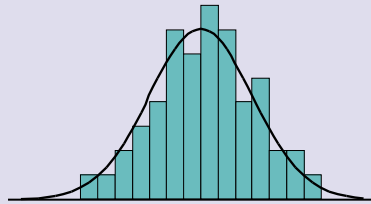


# Modelling risk factors and their structural relationships

Statistical analysis *and* expert judgement required

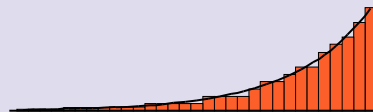
## Risk factor distributions

Statistical models derived from historical data



Scientific models and expert judgement

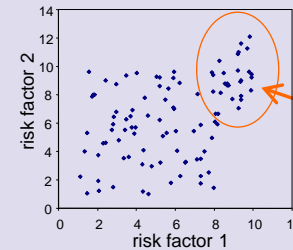
- conceivable losses
- potential changes to risk drivers



Threat scenarios

## Dependency structure

Statistical dependency captured by copula

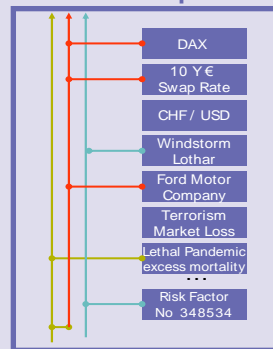


dependency in tail of distribution



## Structural dependencies *(illustrative examples)*

Risk factor dependencies Structural dependency of FM with Pandemic



Risk Factor*	Excess Mortality 1.5 per mille	Excess Mortality 4.0 per mille
Equity	-20%	-40%
Swiss real estate CH	-7.5%	-15%
Other real estate	-15%	-30%
BBB credit spread	100bp	200bp
AAA credit spread	54bp	108bp
P&C loss	CHF100m	CHF200m

# Capital adequacy framework to be embedded in comprehensive Risk Management framework

## The Three Pillars of Risk Management at Swiss Re

Quantitative risk management	Risk governance	Risk transparency and disclosure
<ul style="list-style-type: none"> <li>■ Sound economic valuation and risk measurement</li> <li>■ Reliable capital adequacy framework</li> <li>■ Quantitative risk limit monitoring system consistent with risk tolerance based on 99% Tail VaR</li> </ul>	<ul style="list-style-type: none"> <li>■ Clearly defined responsibilities for risk taking and risk mgmt</li> <li>■ Sound, documented:                             <ul style="list-style-type: none"> <li>– risk mgmt policies</li> <li>– operating, reporting, limit monitoring and control procedures</li> </ul> </li> <li>■ Internal and external audits of processes and figures</li> </ul>	<ul style="list-style-type: none"> <li>■ Company risk culture</li> <li>■ Peer reviews</li> <li>■ Internal risk reporting</li> <li>■ Financial and risk disclosure, including information on tail risk and scenarios</li> </ul>



# 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

## 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

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



## 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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