

Swiss Re



# Internal Capital Models

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## What does an internal model do ?

Determines the probability distribution of the change in economic value of a company over a one year time horizon.

For this, we need to understand

- to which risk factors the company is exposed to
- how do these risk factors impact the economic balance sheet

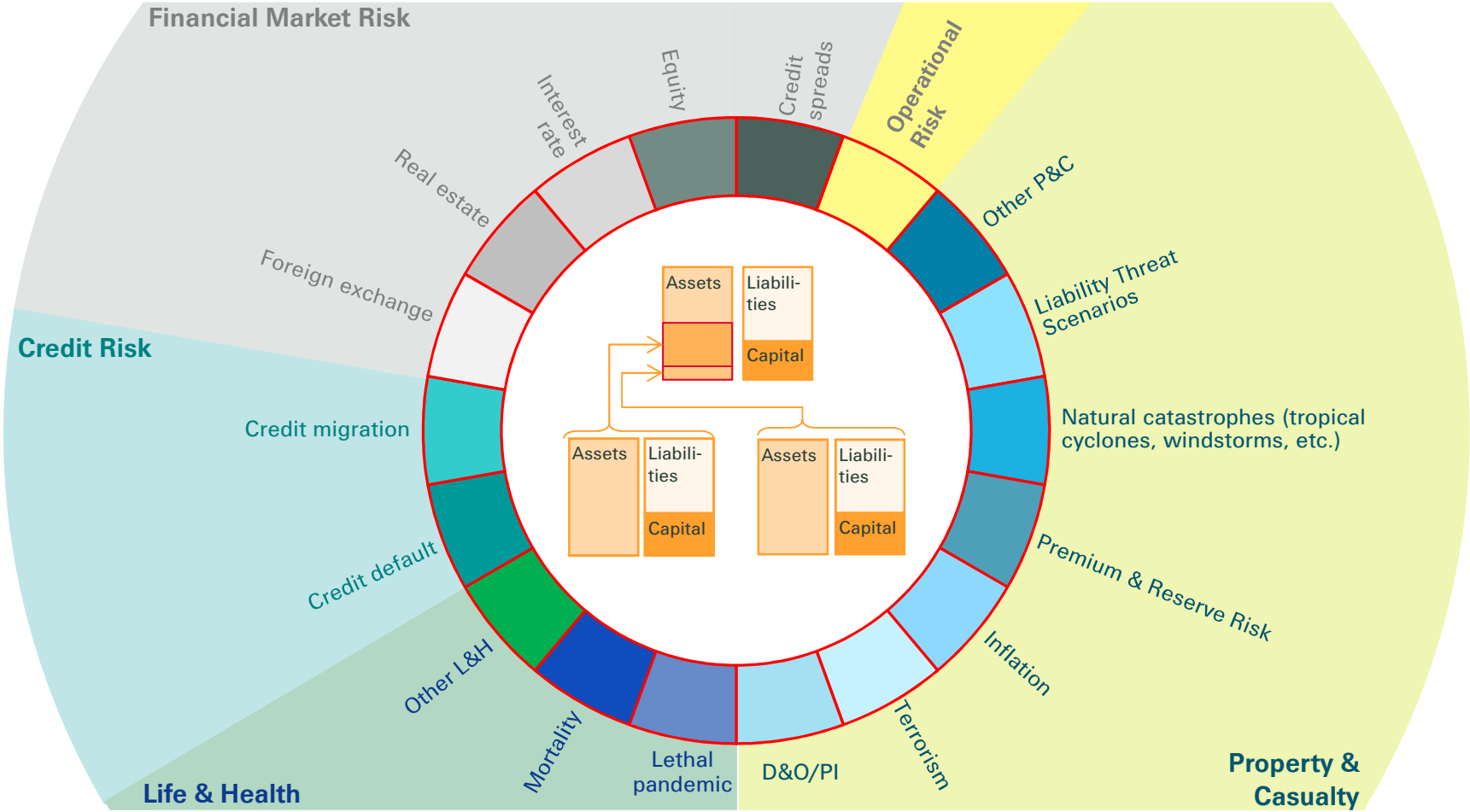


## Economic Capital Modeling Relies on Four Types of Models

- Economic (market-consistent) valuation models for assets and liabilities
- Risk Factor models describing the uncertainty of the outside world over a one year time horizon
- Dependency models describing the joint behaviour of these risk factors
- Exposure models describing how economic values respond to realisations of the risk factors

→ A good model distinguishes risk and exposure to risk

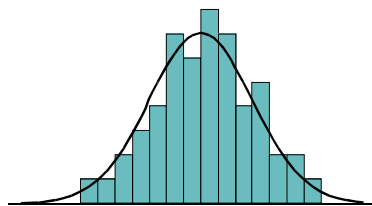
# A variety of risk factors impact the economic balance sheet



# Modelling risk factors requires statistical analysis and expert judgement

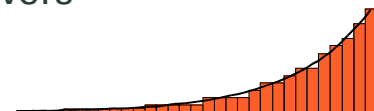
## Risk factor distributions

Statistical models derived from historical data



Expert judgement and scientific models

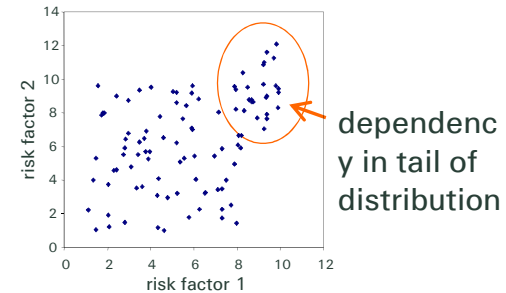
- ❖ conceivable losses
- ❖ potential changes to risk drivers



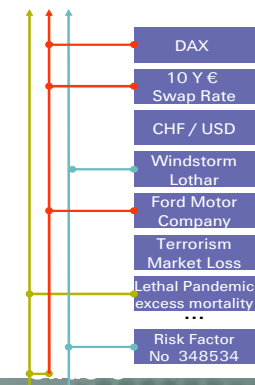
Threat scenario

## Dependency structure

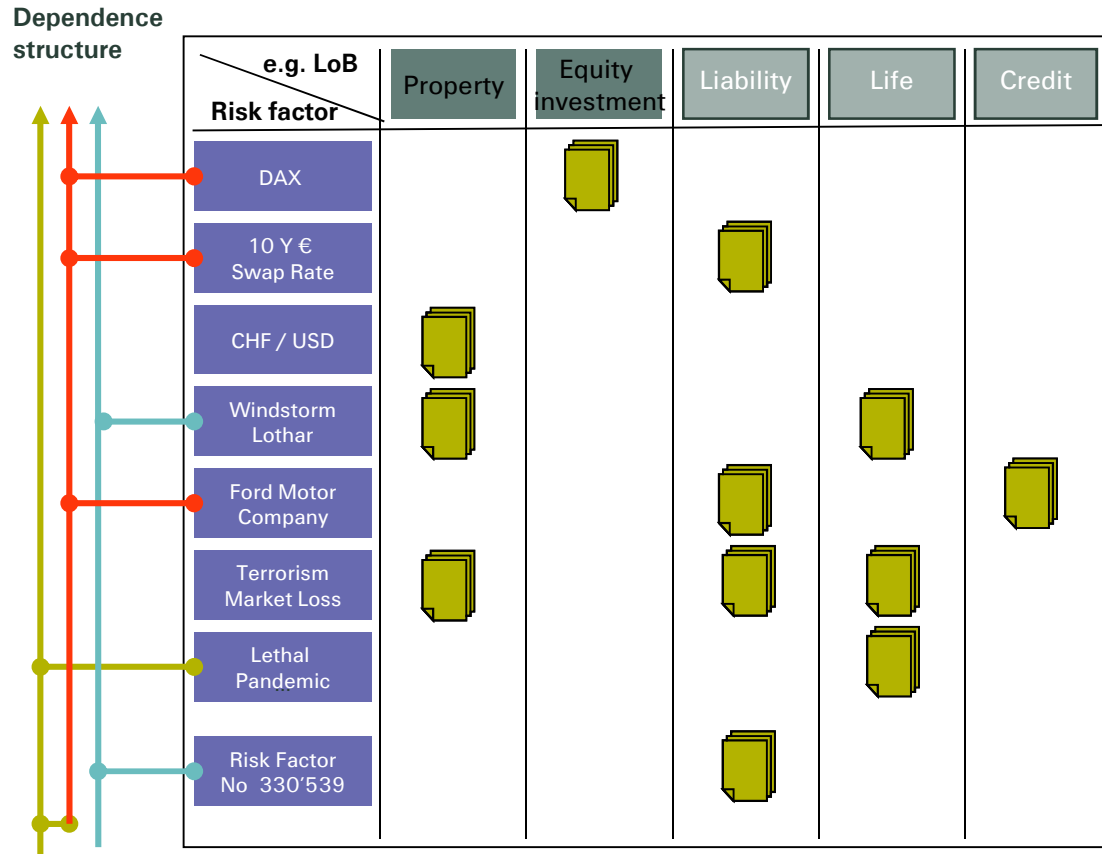
Statistical Dependency captured by copula



## Functional Dependency



# Separation of risk factors and exposure supports business steering



Ideally suited for ...

- ... assessing overall risk
- ... determining contributions to overall risk
- ... analysis of drivers of risk
- ... accumulation control
- ... as-if analysis of portfolio changes (no recalibration)

→ enables more accurate and targeted risk management

## There is no perfect Risk Measure

Two risk measures arise in the new solvency frameworks:

Shortfall (also called TailVar) used in the Swiss Solvency Test, VaR, used in Solvency II

	Var	Shortfall
Subadditive	no	yes
Backtestable	yes	no
Currency invariant	yes	no



## Diversification between Portfolios

If we merge two portfolios, the risk of the combined portfolio is usually smaller than the sum of the standalone risks. This difference is called diversification benefit.

- if we use VaR as risk measure, the notion of diversification is not clear due to the lack of subadditivity
- diversification benefits are not comparable across companies since they depend on the portfolio segmentation and size
  - its more meaningful to focus on the impact of dependence assumptions than on the comparison of diversification benefits
- in the real world, diversification benefits between legal entities can be realized through intra-group transactions



## Stress Tests

Stress testing means: evaluating the impact of one specific scenario

Stress Tests are useful for:

- plausibilizing models
- identifying events which jeopardize the company's solvency (reverse stress tests)
- evaluating risks which do not impact the economic balance sheet but are nevertheless important (e.g liquidity)

## Change and maintenance are inevitable to keep the internal model useful

- Risk modelling is a young discipline – there is modelling progress at all times
- In addition, specific events unearth modelling weaknesses
- New products call for an extension of the set of relevant risk factors or for refined modelling including dependencies
- Enhanced business systems provide information for enhanced modelling, e.g. assumptions can be replaced by facts
- Improved IT technology enables more granular assessment of the portfolio
- Increasing use of the internal risk models calls for embedding into swifter processes

→ Clear model governance and top management approval need to be accompanied by a change and maintenance friendly environment