# Approach to Asset Liability Management by an Insurance Supervisor

Schweizer Solvenz Test
Test suisse de solvabilité
Proba di solvibilità svizzera
瑞士偿付能力测试

Basel, 29. July 2004

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  - Market
  - Credit
  - Life
  - Nonlife

  Risks
- Difficulties, Controversies and Future Steps

# ALM Risk

ALM is the practice of managing a business so that decisions on assets and liabilities are coordinated; it can be defined as the ongoing process of formulating, implementing, monitoring and revising strategies related to assets and liabilities in an attempt to achieve financial objectives for a given set of risk tolerances and constraints… ALM is relevant to, and critical for, the sound management of the finances of any institution that invests to meet liabilities

Traditionally, ALM has focused primarily on the risks associated with changes in interest rates. Currently, ALM considers a much broader range of risks including equity risk, liquidity risk, legal risk, currency risk and sovereign or country risk.

Society of Actuaries, Professional Actuarial Specialty Guide, Asset-Liability Management, Aug 98

**PRINCIPLES ON CAPITAL ADEQUACY AND SOLVENCY, IAIS**

## Principle 4: Matching

Capital adequacy and solvency regimes have to address the matching of assets with liabilities

The capital adequacy and solvency regimes should address the risk of loss arising from
mismatches in the:
a. currency;
b. timing of cash flows; and
c. amount of cash flows,
of the assets and the liabilities of the insurer adjusted to take account of off-balance sheet exposures.

# ALM Regulation

Insurance regulation in the past (in Europe):

Solvency I:

- Does not take into account ALM
- Asset risks are taken into account only rudimentary
- Liability risks mainly via volume measures (premium, provision,...)
- Asset-Liability Risks: Not taken into account
- System is focused on minimizing risks via prudent provisioning, limits on investment etc.

Solvency II, SST, ...

- Risk based supervision will take into account asset and liability risks
- System will be focused on explicitly measuring risks and minimizing systemi risk via transparency
- Convergence of regulatory measurement to company specific economic risks models

# ALM Regulation

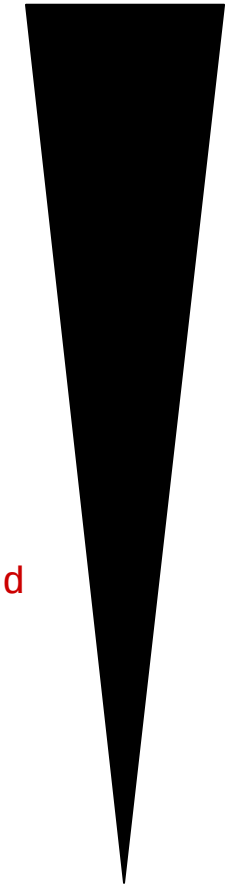
How much of the asset liability risk should the regulator manage?

- Formulaic requirements can lead to higher systemic risk
- Risk-based solvency supervision: Actual risk (e.g. insurance and asset risks) determine required capital
  - if a company has enough risk-bearing capital, it can invest riskier assets
  - if it lacks risk-bearing capital, basis-risk needs to be reduced or fresh capital needs to be injected
- Under the old system, investment possibilities were (in theory) limited, however limits were being eroded over time leading to European insurance crisis

Special requirements for regulatory models

- Need to be applicable for a wide range of companies (small, medium, large)
- Elements of the model can be substituted by internal models
- Need to be able to 'run' on a small set of data
- Reasonably simple to apply
- Transparent
- Parameters easy to calibrate
- Easy to extend and adjust
- Need to be able to quantify systemic risk

# ALM Regulation




| | | + | - |
|---|---|---|---|
| Solvency I | Disallowing asset classes<br>Imposing limits on investment | Easy to supervise<br>Consistent for all insurers | High systemic risk<br>Possibly inappropriate<br>Responsibility with regulator, not with management |
| | Capital Requirements | Risk relevant, direct link to risk-based target capital | Calibration difficult and needs to be adjusted regularly |
| Solvency II<br>APRA<br>NAIC<br>OSFI | Pillar 2 and 3, ALM and risk management requirements | Principle based<br>Induces risk management<br>Empowers management to do the 'right thing' | Complex to supervise<br>Requires high sophistication of market and regulator |

# ALM Regulation

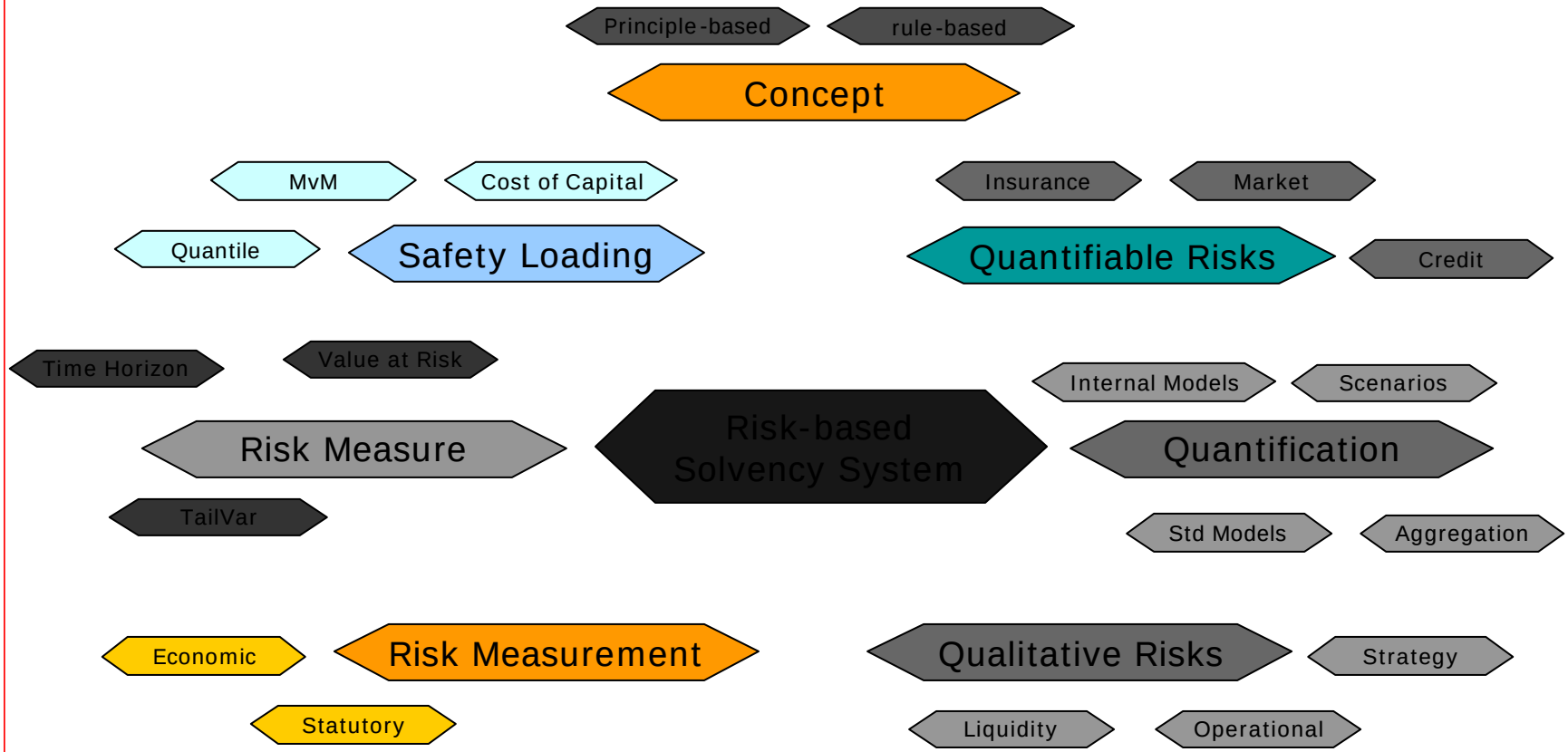
Decisions to take when developing a risk-based solvency framework:

- How to measure assets, liabilities and risks
  - Risk measure (VaR vs Expected Shortfall, 99% or 99.9% survival probability), statutory or 'fair value',...
- Which risks to treat quantitatively
  - Insurance, market, credit, operational?
- Which risks to treat qualitatively
  - Operational, liquidity, strategy?
- How much to prescribe
  - Principle-based or rule-based, Internal Models?
- How to measure systematic risks
- How much of the ALM risk should be managed by the regulator, how much by the companies?
- How is it possible for a regulator to model the ALM risk for each company?

} Specific regulatory concern

# Quantification of ALM Risks

Ingredients of a risk-based solvency system:



# Timeline of SST Development

- Herbert Lüthy becomes new director of FOPI (Federal Office of Private Insurance) in Fall 2002
- Reorientation of FOPI to increased Prudential Supervision
- New draft insurance supervision act specifies solvency to be risk-based
- Start of Swiss Solvency Test Project Mai 2003
  - All large insurers, reinsurers, actuarial and insurance association participated
- Finished first conceptual work December 2003
- Up to Mai 2004, work on nonlife standard model, formulation of scenarios, asset model and high-level documentation for test-run, simpler model for health insurers
- Test-run started Mai 2004
  - Large life and nonlife companies participate
  - B&W Deloitte, Ecofin, E&Y, MOW, Tillinghast run project office
- Insurance supervision act (likely) to be implemented mid-2005 or 1.1. 2006. Irrespective of date, 2005 field-test with all companies will be run
- Reinsurers and groups will have to have internal model compatible with SST

# General Framework

- Minimum solvency level: based on statutory calculation (Solvency I), target capital based on economic risk
- Target capital covers insurance, market and credit risks
- Target Capital: Expected Shortfall of change of risk-bearing capital
- Target capital for risks emanating during time horizon (1 year), safety margin for risks emanating after 1 year
- Risk-bearing capital based on market-consistent valuation (market value for assets, best-estimate + safety margin for liabilities)
- Market consistent valuation: Best estimate (discounted cash flows + valuation of all relevant options and guarantees) and safety margin
- Analytical models for normal situation, scenarios take into account situation when models break down
- Results of analytical models and scenarios are aggregated to arrive at target capital

# General Framework

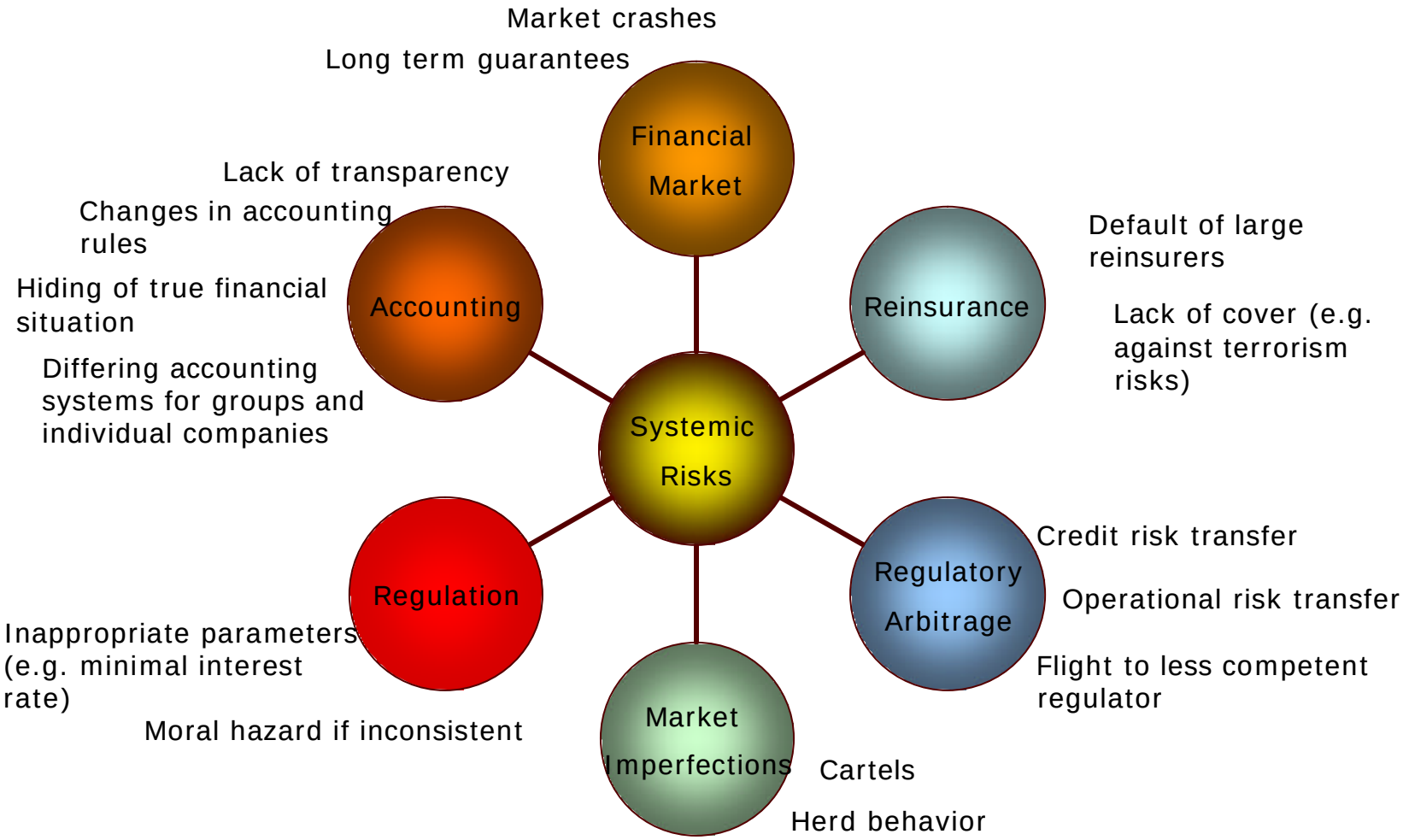
*To convert a model into a quantitative formula is to destroy its usefulness as an instrument of thought.*
*J.M. Keynes*

## Problems of regulatory models

- Systemic risks
  - Insensitivity to equity risk of Solvency I lead to large share exposures of European insurers
  - Coarse rating separation of Basel I was partly reason for Asian crisis
  - Regulatory arbitrage between insurers and banks and pension funds

- Systemic risks can be reduced by making model more risk specific -> but model becomes very complicated and intransparent, difficult to keep up,…
- SST tries to induce companies to develop internal models (within a given framework) and by integration models with scenarios. Companies can deviate from models, parameters etc. with permission of supervisor
- Appointed actuary has to evaluate effect of scenarios on risk-bearing capital of company. Some scenarios are given by regulator, some have to be tailored by actuary to reflect specific situation of company
- Appointed actuary has to add company specific scenarios

# Systematic Risks



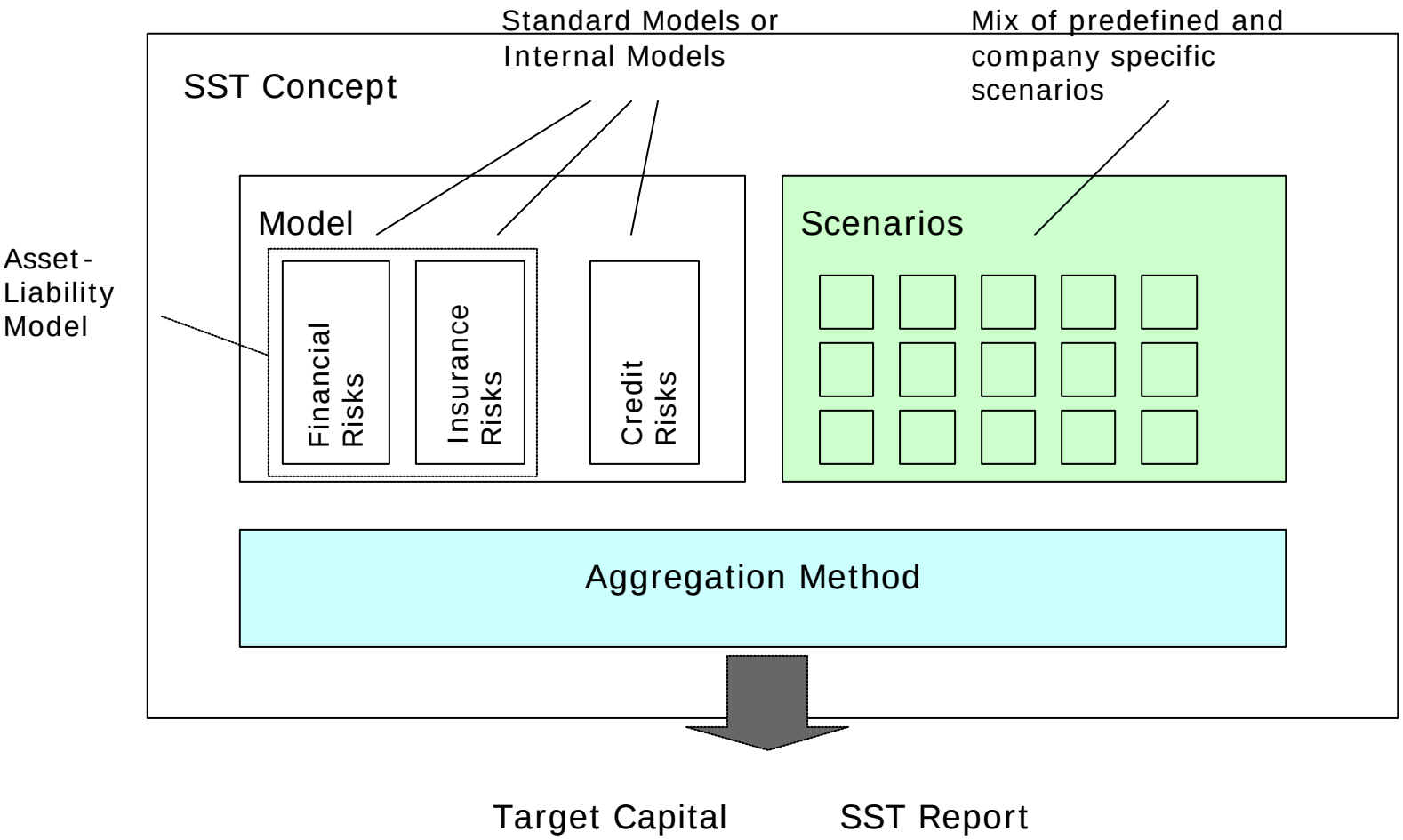
# Dangers of Regulatory Models

## Consequences for the SST

- To calculate target capital is a complex process
- No pure factor model but enhanced with scenarios
- The appointed actuary needs to take into account the specific risk situation o his company via
  - scenarios
  - company-specific parameters
  - internal models
- Insolvency can be triggered only on a simple and transparent basis -> Trigger for insolvency must be simple (->minimal solvency = Solvency 1)
- The responsibility should be with the insurance companies
- Regulator will give incentives that insurer replace part (or even all) of the standard models with internal models (with approval of regulator)
- All (insurers and regulator) should know the limits of the regulatory model

*In theory there is no difference between theory and practice. In practice, there is.* Yogi Berra

# General Framework



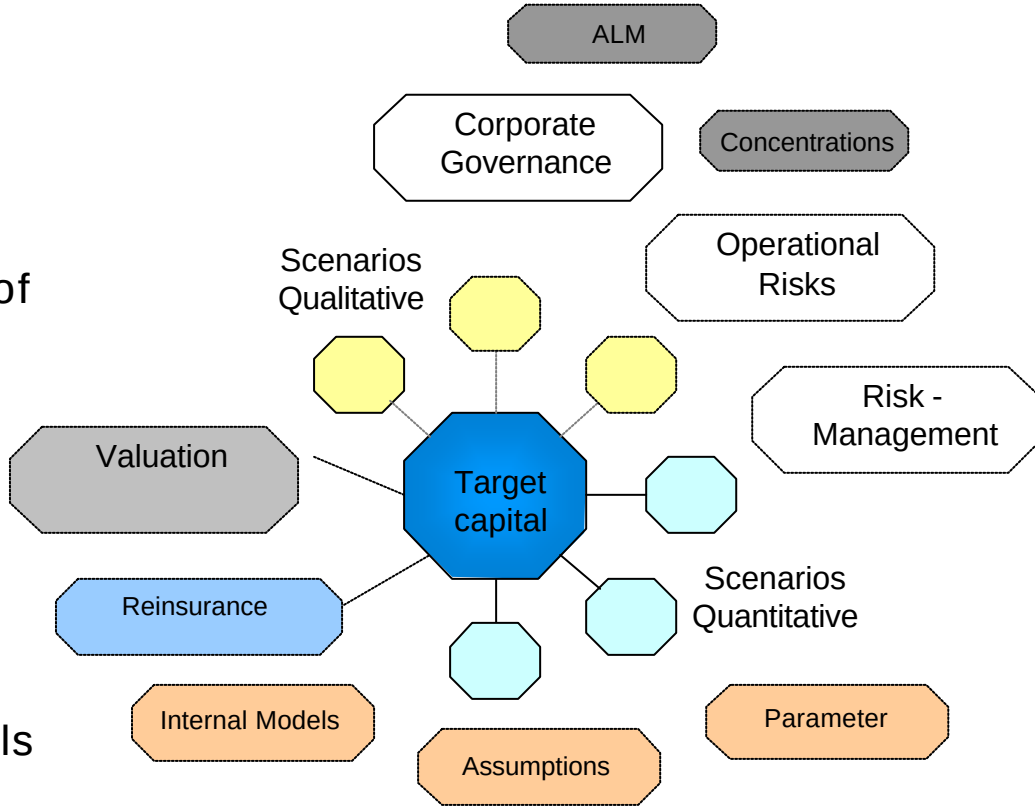
# General Framework

- Analytical models: for ‘normal’ situation where statistical data exists, normality assumption etc. are valid
- Scenarios: to supplement analytical models
  - To model additional risks
  - To reduce model risk
  - To take into account extreme events where model assumptions break down
  - To quantify systematic risks
- Aggregation: weighted (quantile-adjusted) average of scenarios with results from analytical model

# General Framework

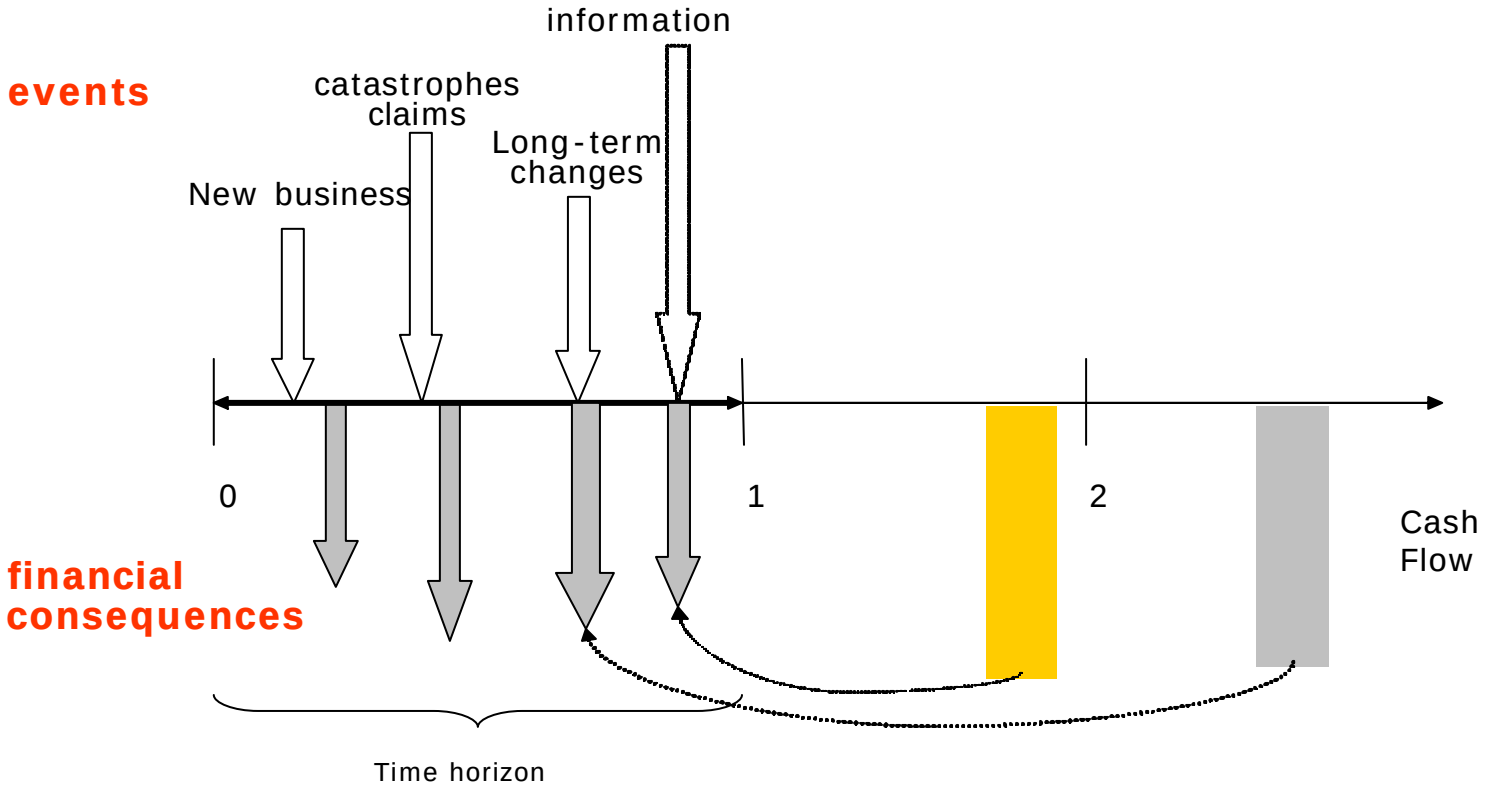
Appointed Actuary has to write SST-Report together with calculation of target capital

- Qualitative and quantitative description of risk situation of company
- Market consistent valuation of assets and liabilities
- Discussion of assumptions and parameters
- Discussion of situation of company given scenarios (specified by regulator and company specific)
- Description of internal models
- Analysis of reinsurance program, quantification of true risk transfer
- Target capital



# Risk-Measure: Time-horizon

- What should the time-horizon be for a solvency test?
- SST: 1 year (pragmatic and compatible with many internal models of insurers)



# Risk-Measure

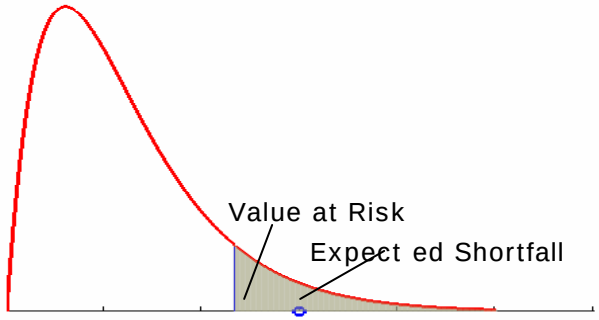
## Definition of target capital:

Target capital Z is defined as the Expected Shortfall of the change of risk-bearing capital on a given confidence level a

## Coherent Risk Measures: Expected Shortfall vs VaR

Shareholder: Only default or non-default is relevant not how bad the state of the insurer is in case of default as shareholders have a put-option on the insurer (Merton) -> Value-at-Risk is appropriate

Insurer: In case of default, it matters how much capital is left -> Expected Shortfall is more appropriate than VAR



# General Framework

Two complementary valuation methods are used:

- Statutory valuation: based on implicit prudency margins; there is no explicit valuation of options and no explicit consideration of specific risks (~Solvency I)
- Target capital calculation: based on economic risk; all quantifiable risks are considered explicitly, options and guarantees are valued explicitly

Target capital is based on market-consistent valuation: market value for assets, best-estimate for liabilities, valuation of assets and liabilities as consistent as possible

Best-estimate for liabilities: discounted cash flows + valuation of all relevant options and guarantees

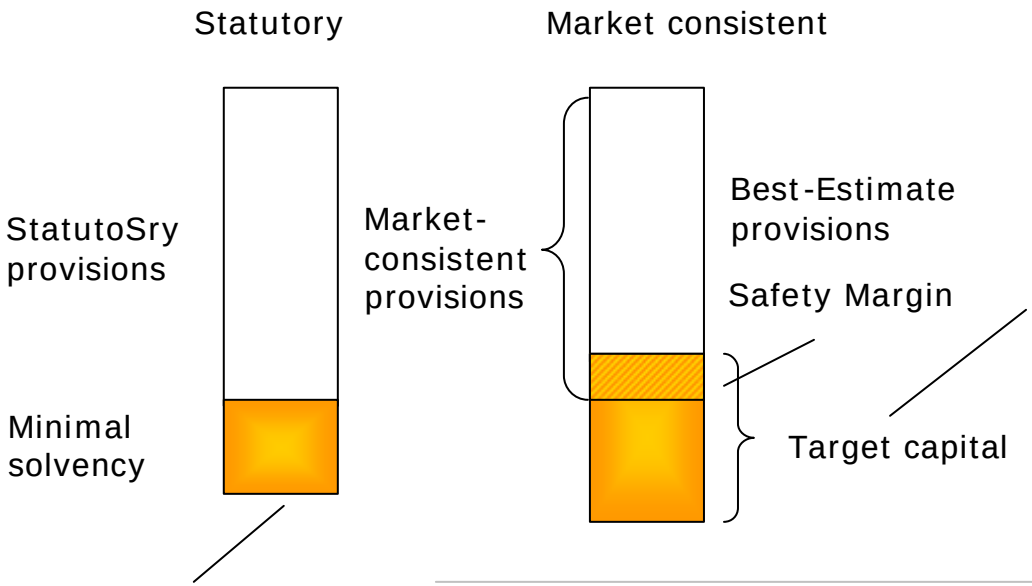
Consistency is easier to achieve within market-consistent framework than withi current statutory accounting frameworks

Statutory accounting frameworks are often compromises and are accreting ove time additional rules, exceptions and inconsistencies

They are developed having many different stakeholders (shareholders, regulators, accountants, management,...)

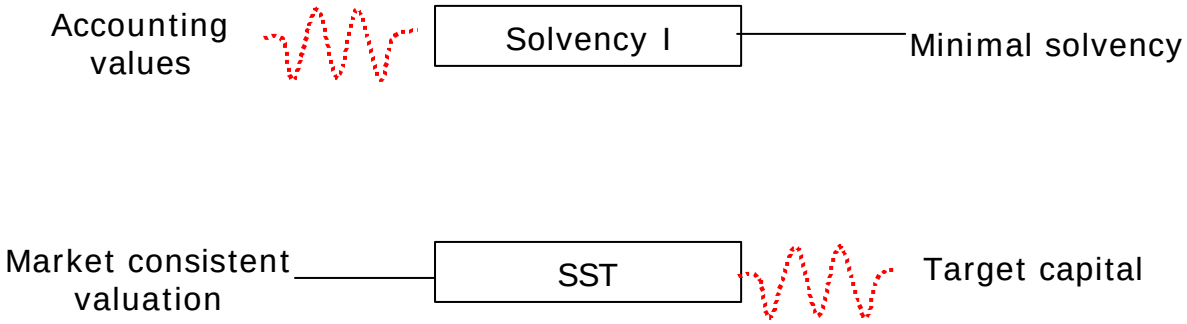
A consistent framework should (ideally) be simple and easy to understand

# General Framework

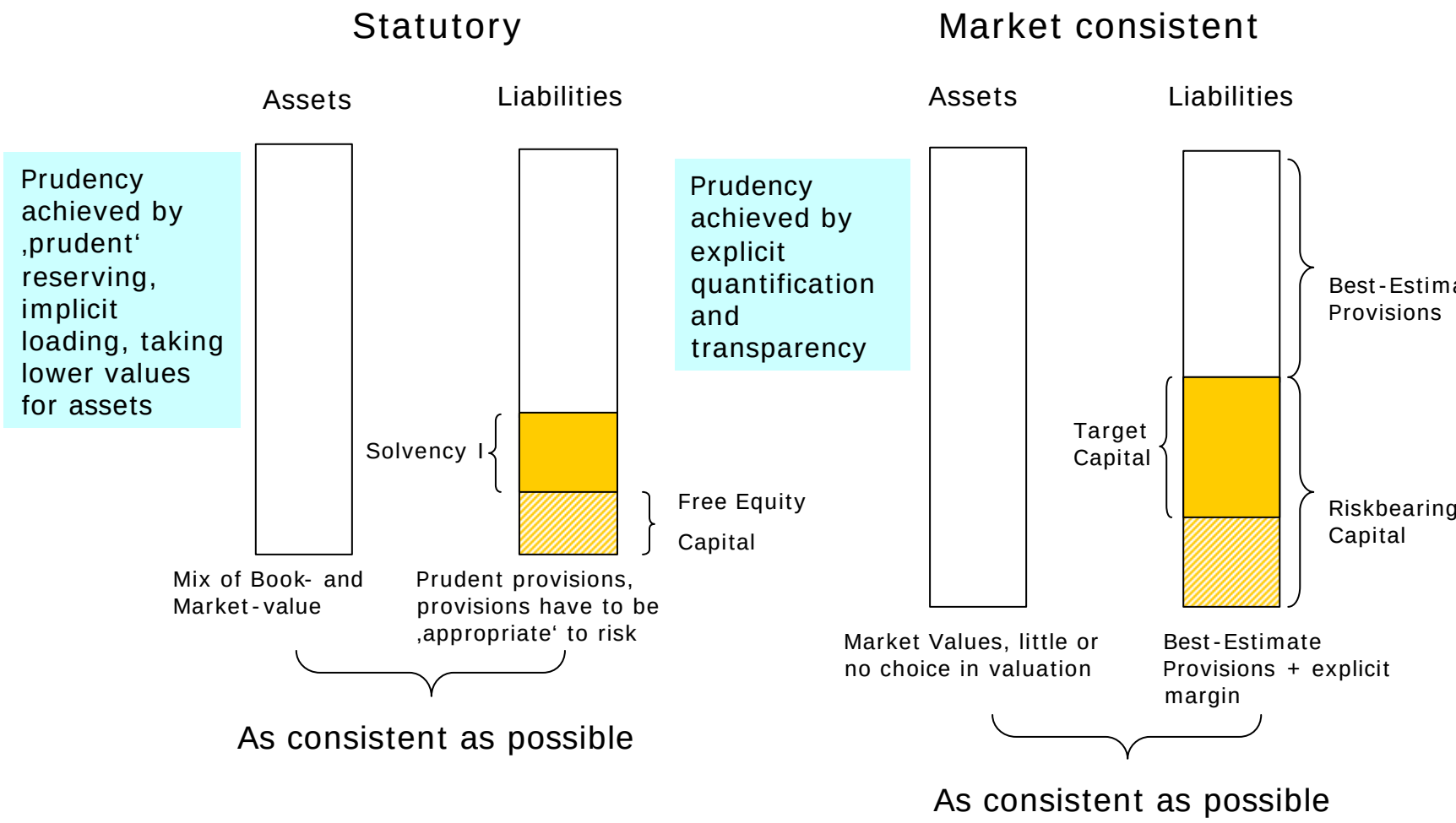



Early warning signal: risk specific but model dependent. If target capital condition is not achieved, company is not insolvent but graded regulatory measures are implemented

Last step before insolvency. Not risk sensitive but model-independent and ‚objective'



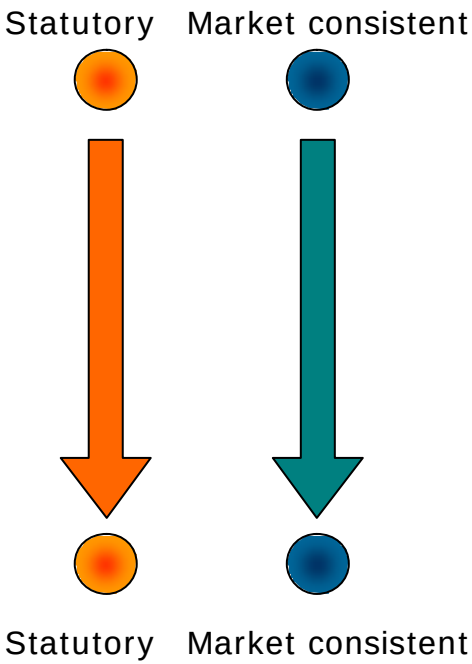
# General Framework



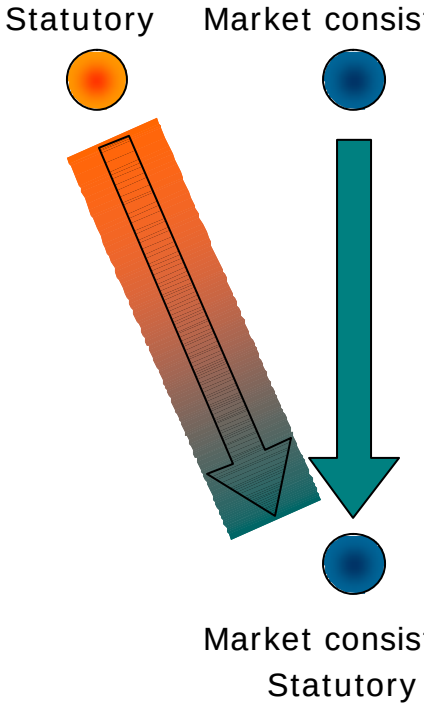
# General Framework

## Possible future development:

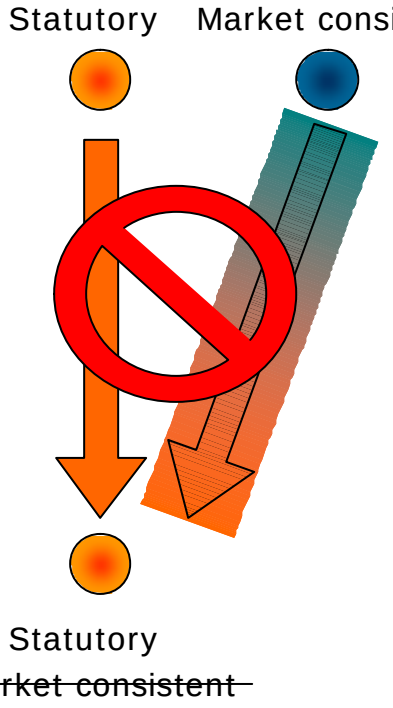
Statutory and market consistent Valuation methods stay separate and are complementary




Statutory Valuation converges towards Market Consistent Valuation




Market Consistent Valuation should not converge towards statutory valuation

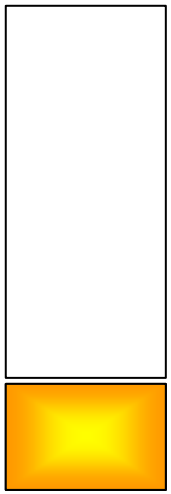


# Market consistent valuation

| Assets | Liabilities |
| --- | --- |
| Consistent valuation | |
| • Market values, if existent (Marking-to-Market)<br>– Liquid bonds, actively traded shares,...<br>• Derived from prices of similar, quoted financial instruments (Mix of Marking-to-Market and Marking-to-Model)<br>– illiquid bonds, property,...<br>• Marking-to-Model<br>– Private Equity,... | • Completeness: Valuation takes into account all options and guarantees<br>• Best Estimate-Principle: Valuation contains no implicit or explicit loading<br>• Up-to-date: Valuation based on most recent information<br>• Transparency: Models and parameters have to be explained to the regulator |

# Market consistent valuation

## Market consistent valuation of Liabilities = Best-Estimate + Safety Margin



Best Estimate

Safety Margin

Depends on risks and duration of liabilities and of capital cost

- Completeness: Valuation takes into account all options and guarantees
  - Valuation of financial options (e.g. interest rat guarantees, GMDBs, etc.) have to be based or recognized methodologies
  - However, policy holders may behave non-rationally -> models of policy-holder behavior need to be generated with company specific data; models can be used for valuing options

  Dependency of behavior on financial parameters of policy-holders has do be modeled
- Best Estimate-Principle: Valuation contains no implicit or explicit loadings, based on expected value of liabilities
- Up-to-date: Valuation based on most recent information
- Transparency: Models and parameters have to be disclosed to the regulator

# Risks

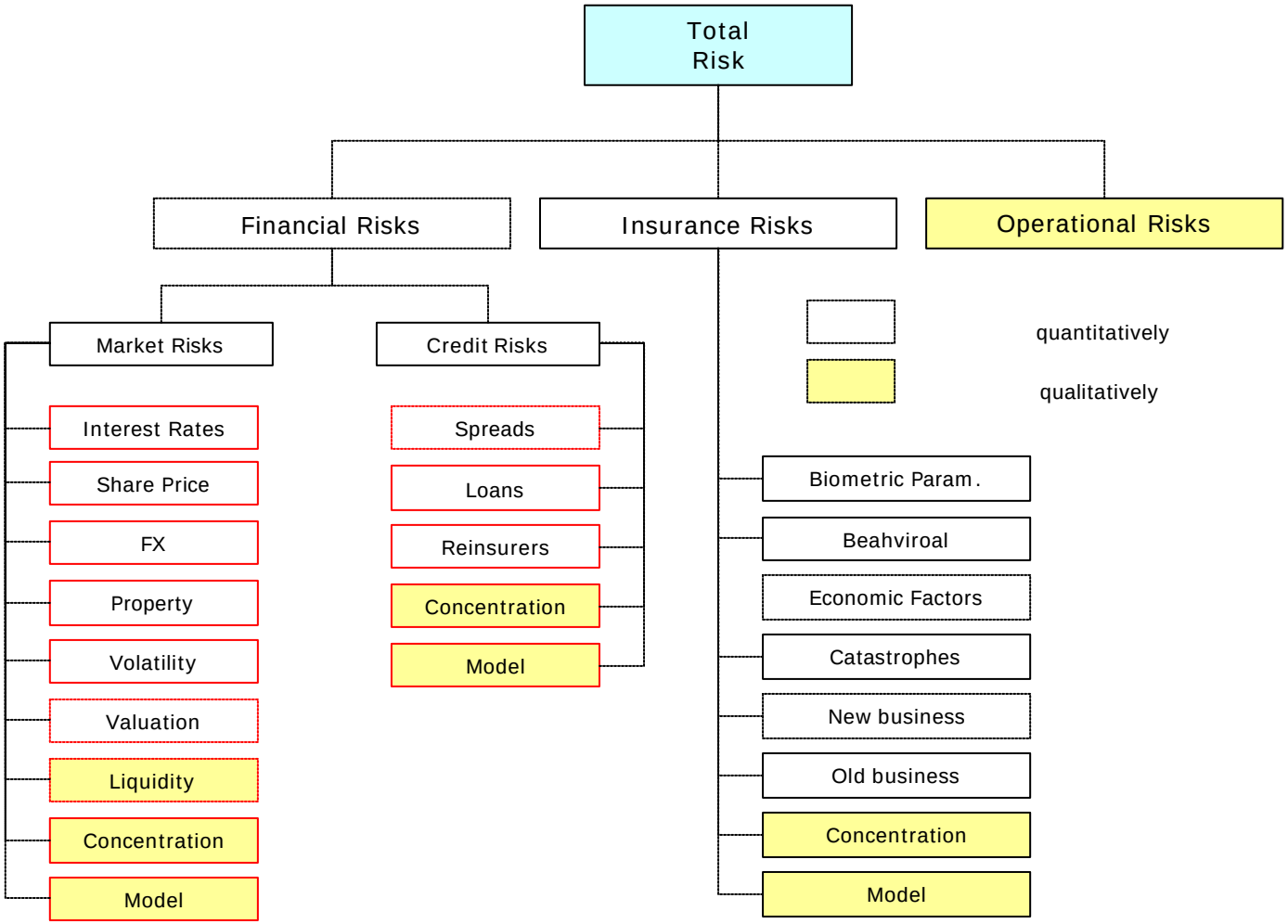
> *There are known knowns. These are things that we know. There are known unknowns. That is to say, there are things that we know we don't know. But there are also unknown unknowns. There are things that we don't know we don't know.* Donald Rumsfeld

On which risks should the target capital depend?

The solution is not unique as some risk

- can be quantified (Pillar I)
  - Insurance risks, market risks?
- should be treated qualitatively (Pillar II)
  - Liquidity risks, operational risks?
- can not be quantified
  - Management risk, strategic risks, operational risks?
- or should  not give rise to capital requirements (Pillar II?)
  - Rare events, risks which need to be eliminated?

# Risks


Total Risk
Financial Risks
Insurance Risks
Operational Risks
Market Risks
Credit Risks
Interest Rates
Share Price
FX
Property
Volatility
Valuation
Liquidity
Concentration
Model
Spreads
Loans
Reinsurers
Concentration
Model
Biometric Param.
Beahviroal
Economic Factors
Catastrophes
New business
Old business
Concentration
Model
quantitatively
qualitatively

# Why scenarios

Analytical models have limited scope:

- Parameters are based on 'normal' years
- Extreme events are often excluded or smoothed away
- Black box and not understood by management
- For risk management purpose one should use different approaches to reduce model risk

-> For SST, analytical models are supplemented with scenarios, where scenarios:

  – cover extreme events
  – risks which are not covered by analytical models
  – reduce model risk
  – give information on systematic risks

\+ Communicable with management
\+ Result is more than target capital
\+ Heterogeneity of risks is taken into account
\+ leads to explicit worst-case scenario
\+ facilitates dialog within company and company-regulator
\+ protects against systematic risks
\+ easy to adapt and enhance

\- More difficult to define and apply
\- More subjective to evaluate
\- Difficult to cover all risks with scenarios
\- Need to be aggregated with analytical models

# Why scenarios

Scenarios formulated for the field test 2004:

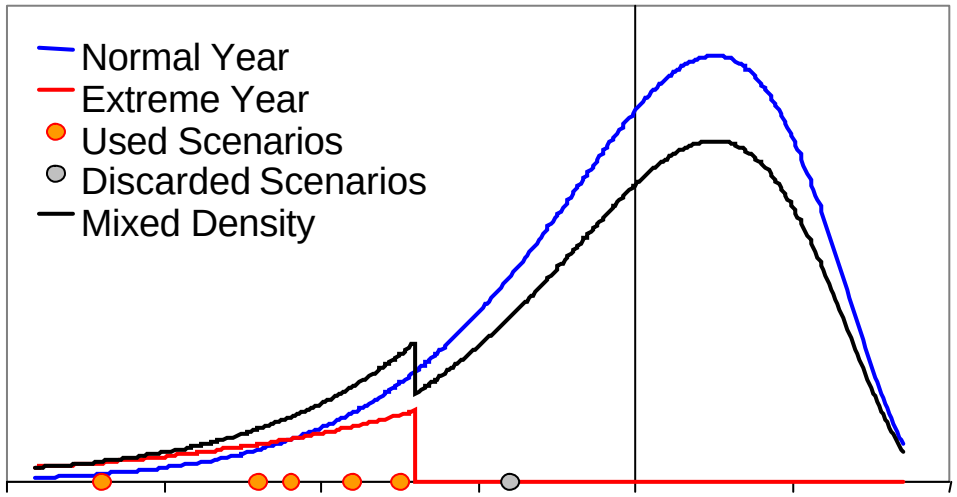
| Scenario | Life | Nonlife |
|---|---|---|
| Industrial accident | | X |
| Pandemic | X | X |
| Accident | | X |
| Aircraft | | |
| Hail | | X |
| Dams | | X |
| Disability | X | |
| Default of reinsurers | X | X |
| Financial distress | X | X |
| Cost scenario | | X |
| Anti-selection. | | |
| Historical market risk | X | X |
| Terrorism | X | X |
| Longevity | X | |

# Aggregation

How to aggregate results of analytical models with evaluation of scenarios?

Weighted combination of analytical model with scenarios

Scenarios are weighted according to probability of occurring




Change of risk-bearing capital within one year

Weight of models

Weight of scenarios

$$TC^{+} = \frac{a - r}{a} ES_{a'}[\Delta R] - \frac{r}{a} \cdot \sum_{m=1}^{k} c_i \cdot w_i$$

Target capital (combined)

Result from analytical models (Expected Shortfall)

Weighted average of scenarios

# Safety Margin

Markt/2543/03: Solvency II – Organisation of work, discussion on pillar I work areas and suggestions of further work on pillar II for CEIOPS

62. Increasing harmonization of technical provisions will be done through setting an explicit level of prudence.

77. One of the objectives of the Solvency II is to establish a harmonized framework for the calculation of technical provisions in non-life insurance through an explicit prudence margin. Establishing precise and binding claims management guidelines will also mark a step towards greater harmonization. This will favor equal competition between EU undertakings and more homogeneous practices.

86. The target capital together with technical provisions should ensure that the probability of failure of an insurance undertaking within a given period is very low (e.g. x % in y years).

IAA: The amount of required capital must be sufficient with a high level of confidence, such as 99%, to meet all obligations for the time horizon as well as the present value at the end of the time horizon of the remaining future obligations (e.g., best estimate value with a moderate level of confidence such as 75%).

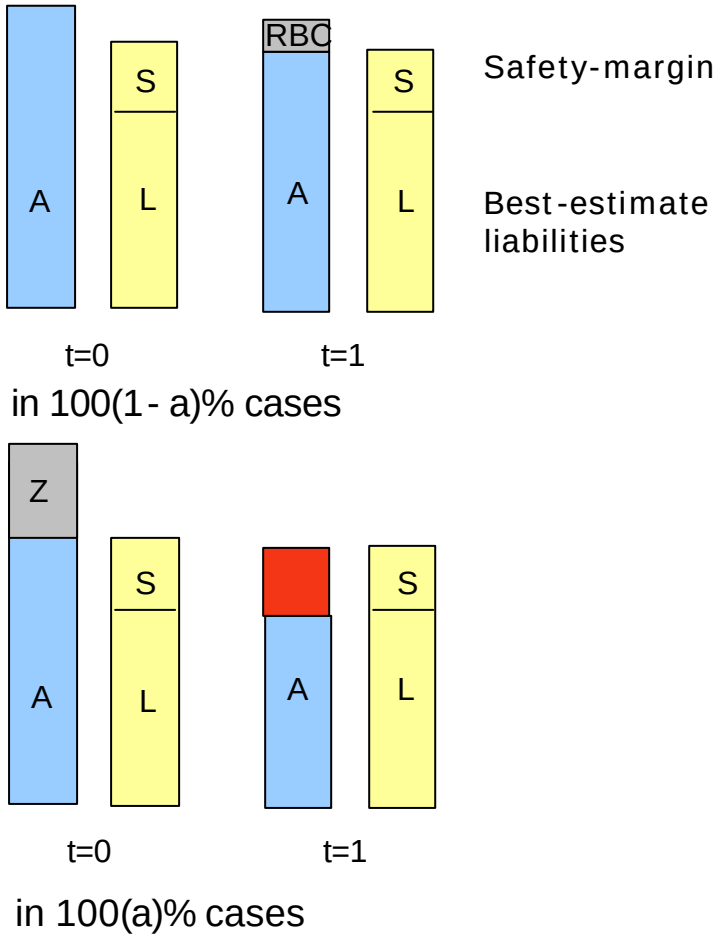
# Safety Margin

For insurance risks: target capital needs to take into account risks after time-horizon 1 year

Not good enough: Target capital defined such that risk-bearing capital is positive with given probability (e.g. 99%) after 1 year

Correct: Target capital defined such that risk-bearing capital exceeds safety margin S on best-estimate with given probability after 1 year

→ Solvency II / APRA / IAA compatible



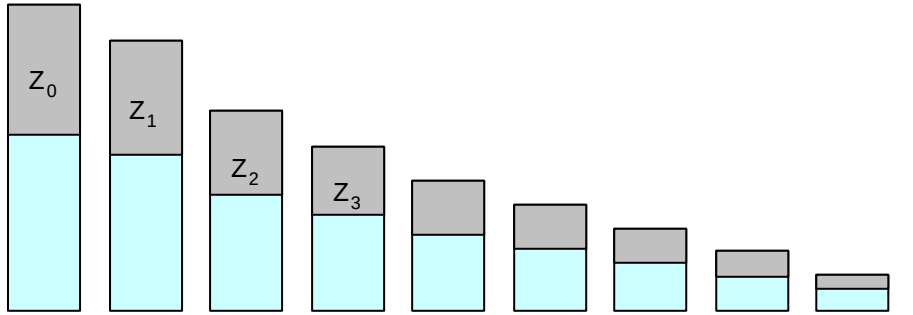
# Safety Margin

| **Possibilities**: | **Advantages:** | **Disadvantages:** |
|---|---|---|
| Safety Margin: 75% Quantile – Expected Value (also discussed by Solvency 2 and IAA Solvency Subcommittee) | Explicit, linked to risk of liabilities | Difficult to calculate |
| Implicit Margins: Solvency I Framework. Prescribed prudent mortality tables, general requirement of prudent provisioning, no discounting for some P&C provisions | Simple, easy to implement | Level of prudence is not transparent, prudency margin can erode |
| Market Value Margin (Fair Value) | Elegant, has an economic interpretation | Not yet defined |
| Cost of future regulatory capital (SST): Chosen such that third part would take over portfolio | | |

# Safety Margin

Safety margin on best-estimate provisions:

- Covers risks which emanate after 1 year time-horizon of SST (Run-off risks after 1 year) -> integral part of SST




Safety margin = cost for future regulatory capital

A third party taking over portfolio would be compensated for having to put up regulatory capital

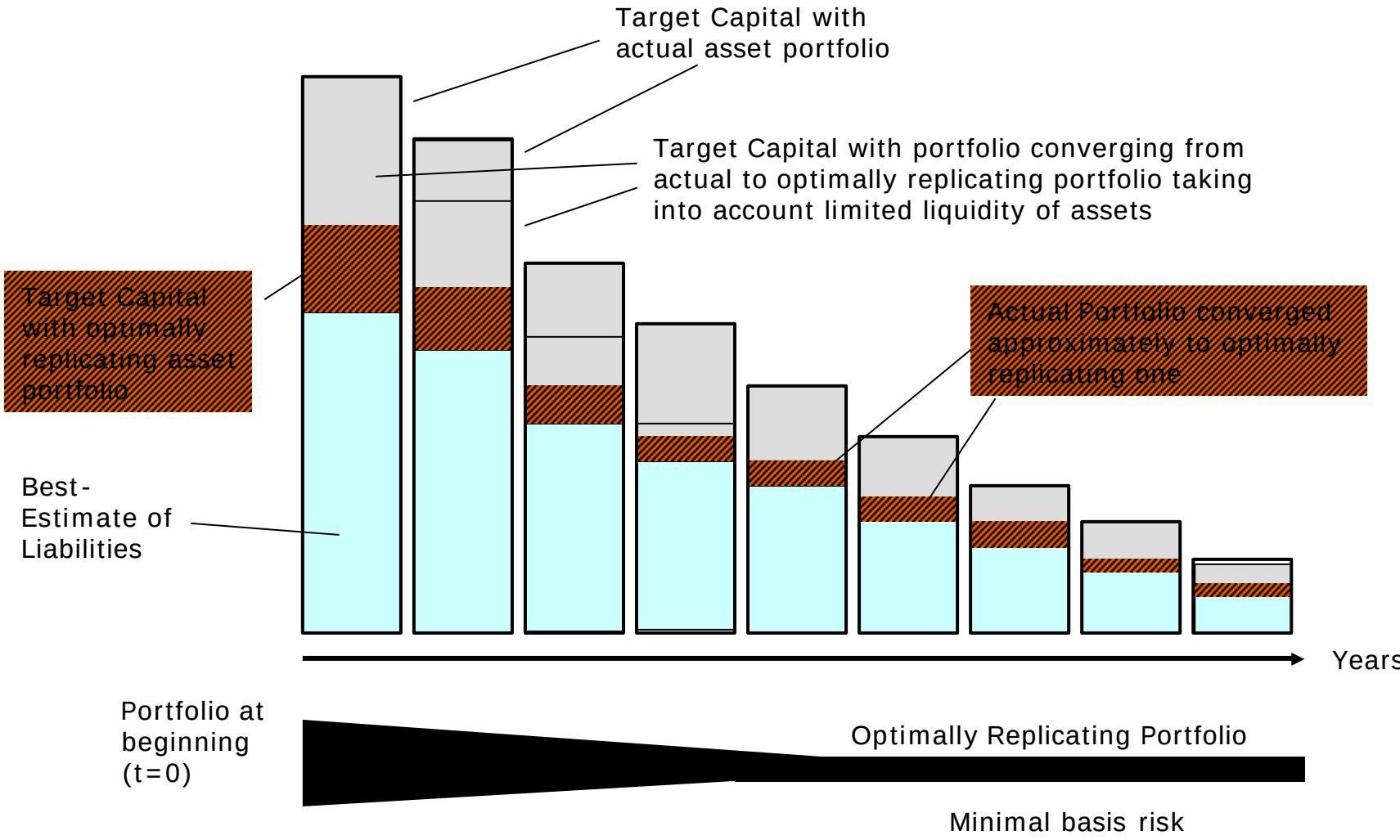
Calculation of safety margin: Assume future target capitals are proportional to best-estimate provisions-> future target capitals are given by run-off pattern

Cost of capital s: 5-10% (subject to calibration

Advantage of definition:

- Economic
- Market view enters calculation via cost of capital
- Depends on whole run-off
- Is easier to determine than a quantile approach

# Safety Margin



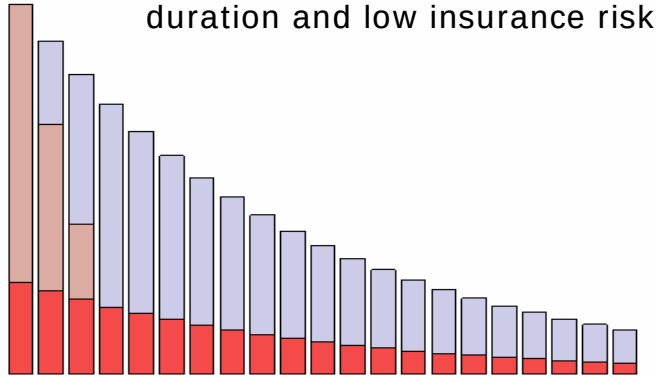
# Safety Margin: Illustrative Examples

Example: liabilities decreasing 10% each year, market risk contributes ~ 75% to target capital -> optimally replicating portfolio has 25% of initial target capital

Optimally replicating portfolio reached after 3 years

Safety margin ~ 25% of target capital

Life Portfolio with very long duration and low insurance risk

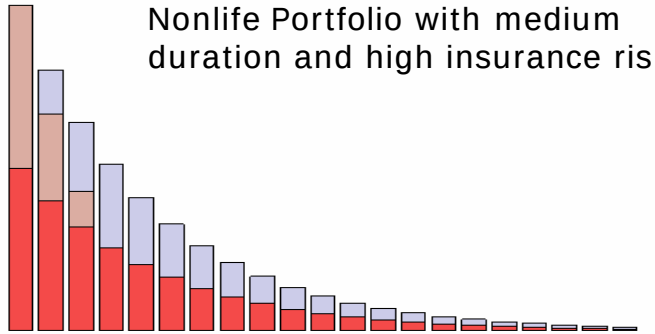


Example: liabilities decreasing 20% each year, market risk contributes ~ 50% to target capital -> optimally replicating portfolio has 25% of initial target capital

Optimally replicating portfolio reached after 3 years

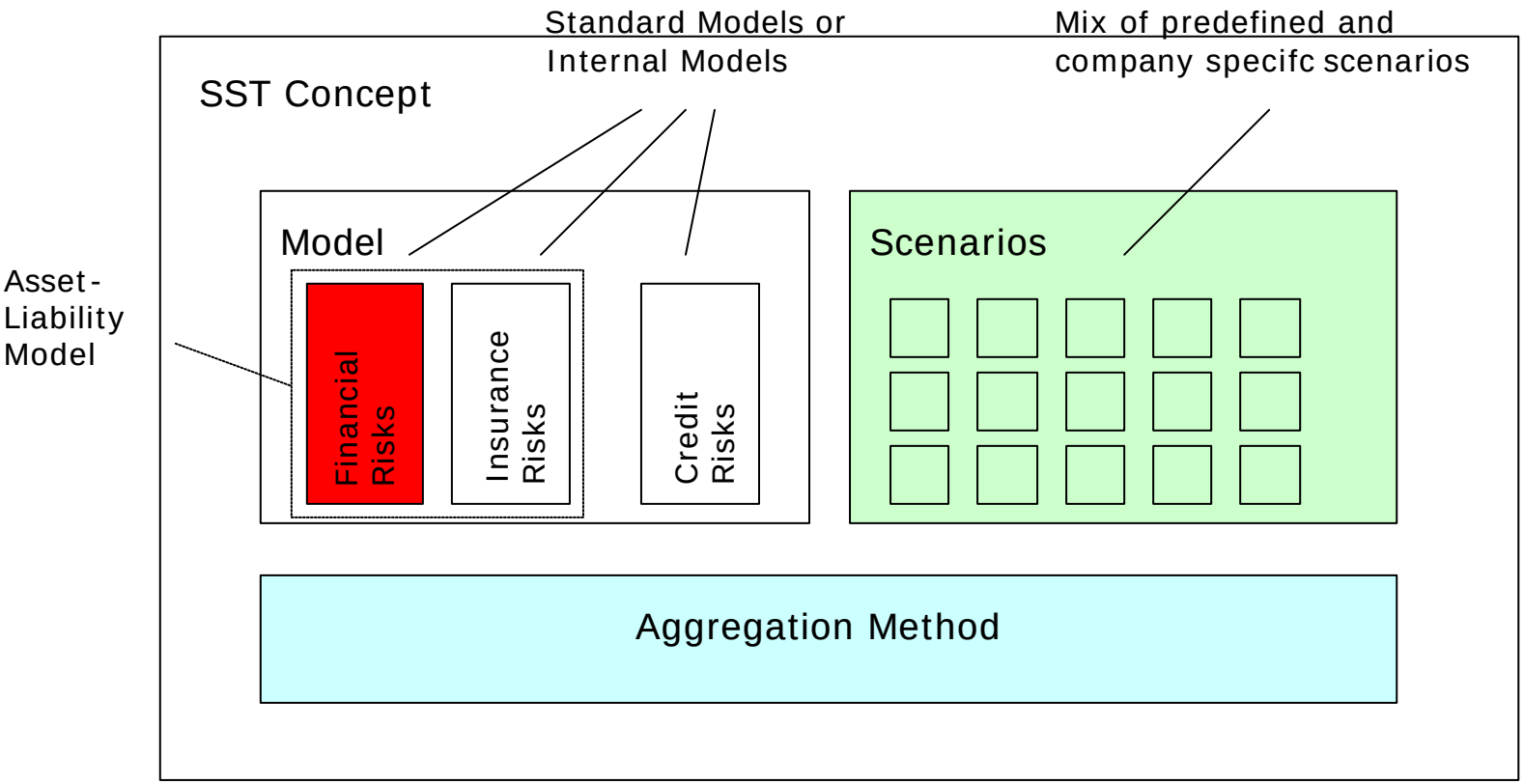
Safety margin ~ 20% of target capital

Nonlife Portfolio with medium duration and high insurance risk



Calculation assumes cost of capital of approx 8%

# Asset-Liability Model



# Asset-Liability Model

A number of risk-factors are specified and effects of changes in risk-factors have to be calculated for assets and liabilities at the same time

-> change in a risk-factor implies a change in risk-bearing capital

For the field-test, 18 market-risk risk-factors have been defined

Asset Model -> normal distributed with zero mean and given volatility: Simple RiskMetrics type model which is defined by a covariance matrix

## Risk Factors

- Interest Rate: risk-free prescribed by regulator
  - Sensitivities:
    - Shift for different time buckets
    - Interest rate volatility
- FX: EUR, GBP,USD, JPY
  - Sensitivities:
    - Changes for each currency
    - Volatility
- Equity (shares, alternative investments, property
  - Sensitivities:
    - Shares: global index and volatility
    - AI: AI-Index
    - Property: Index
- Credit Risk: Change of spread

Limited number of risk factors: they should cover main risks, but should not replace internal model.

If a company's asset risks are not captured by regulatory model, the appointed actuary needs to adapt model, e.g. by adding riskfactors or adjusting coefficients

The asset model is supplemented with scenarios to take into account non-normality

# Assets-Liability Model: Risk Factors

Toy Model with 2 Risk Factors: interest rate and shares

Correlation btw. 1. and 2. risk factor: -0.5
Quantile a = 0.99%

| Risk-factor | Volatility of risk-factor | Sensitivity of risk-bearing capital | Volatility of Change |
|---|---|---|---|
| Interest Rate | 10% | + CHF 30 for +1% change | CHF 30/0.01*0.1=CHF 300 |
| Share Price | 20% | + CHF 10 for +1% change | CHF 10/0.01*0.2=CHF 200 |

$$\text{Variance} = \begin{pmatrix}\text{CHF } 300 & \text{CHF } 200\end{pmatrix}\begin{pmatrix}1 & -0.5\\ -0.5 & 1\end{pmatrix}\begin{pmatrix}\text{CHF } 300\\ \text{CHF } 200\end{pmatrix} = \text{CHF}^2\ 70000$$

Volatility of Change

Correlation Matrix

# Assets-Liability Model: Risk Factors

$$\text{VaR} = \sqrt{\text{Variance}} \cdot \Phi^{-1}(a) = \text{CHF } \sqrt{70000} \cdot 2.3 = \text{CHF } 615$$

$$\text{ES} = \sqrt{\text{Variance}}\, \frac{j(\Phi^{-1}(a))}{1-a} = \text{CHF } \sqrt{70000} \cdot 2.66 = \text{CHF } 705$$

## Diversification:

| Risk-factor | Volatility | VaR (in CHF) | ES (in CHF) |
|---|---|---|---|
| Interest Rate | 300 | 300*2.3=698 | 300*2.66=800 |
| Share Price | 200 | 200*2.3=465 | 200*2.66=533 |
| Total | 265 | 615 | 705 |
| Diversification Benefit | | 698+465-615=548 | 800+533-705=627 |

# Asset-Liability Model: Diversification

- There are no explicit capital charges for different asset classes (in contrast to S&P model or some other regulatory models)
- Capital charges for specific asset categories are implicit in model, but they depend on portfolio -> capital charges are company specific
- If a company is highly concentrated to specific asset categories (e.g. shares), then target capital is high
- If a company holds a well diversified portfolio, target capital is lower than with a concentrated portfolio

Advantage:

- Elegant
- rewards diversification
- easy to calibrate,
- well understood RiskMetrics-type model

Disadvantage:

- Less intuitive
- More difficult to apply than simple capital charges

# Asset-Liability Scenarios

For test run: historical scenarios:

- Stock Market Crash 1987
- Nikkei Crash 1989
- European Currency Crisis 1992
- US Interest Rates 1994
- Russia / LTCM 1998
- Stock Market Crash 2000
  - Effects are mapped on risk factors -> Evaluation of scenarios can be done using sensitivity analysis
- Default of reinsurer
- Financial distress of company
- Appointed actuary has to add company specific scenarios if asset scenarios do not cover risks sufficiently

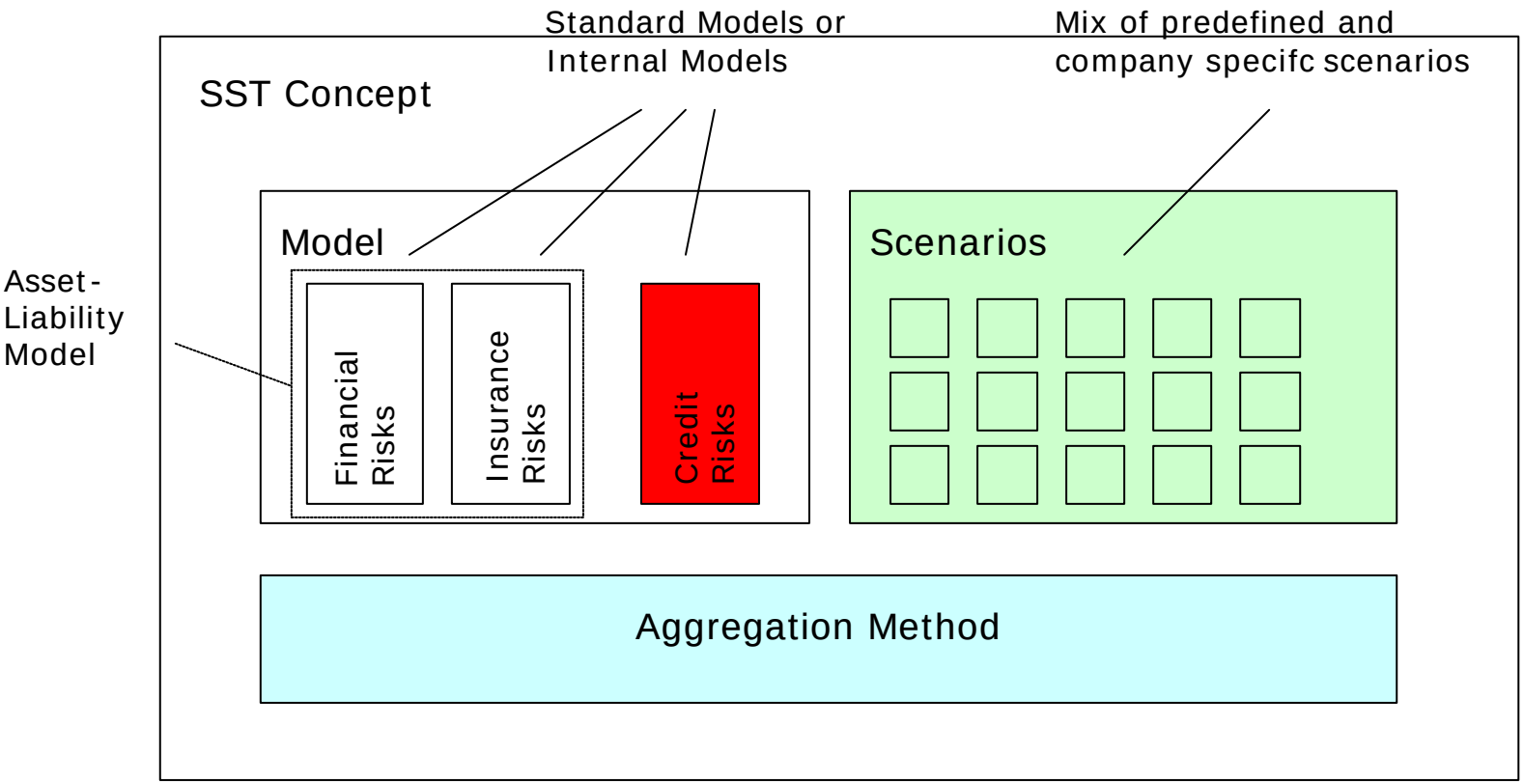
Example: Financial Distress

The Financial Distress Scenario is inspired by collapse of First Executive

Definition

- Equity-like instruments drop by 30%
- Parallel-shift of risk-free interest rate by 300bp
- Storno = 25%
- New business reduced by 75%
- If insurer has a rating, rating is reduced to subinvestment grade

# General Framework



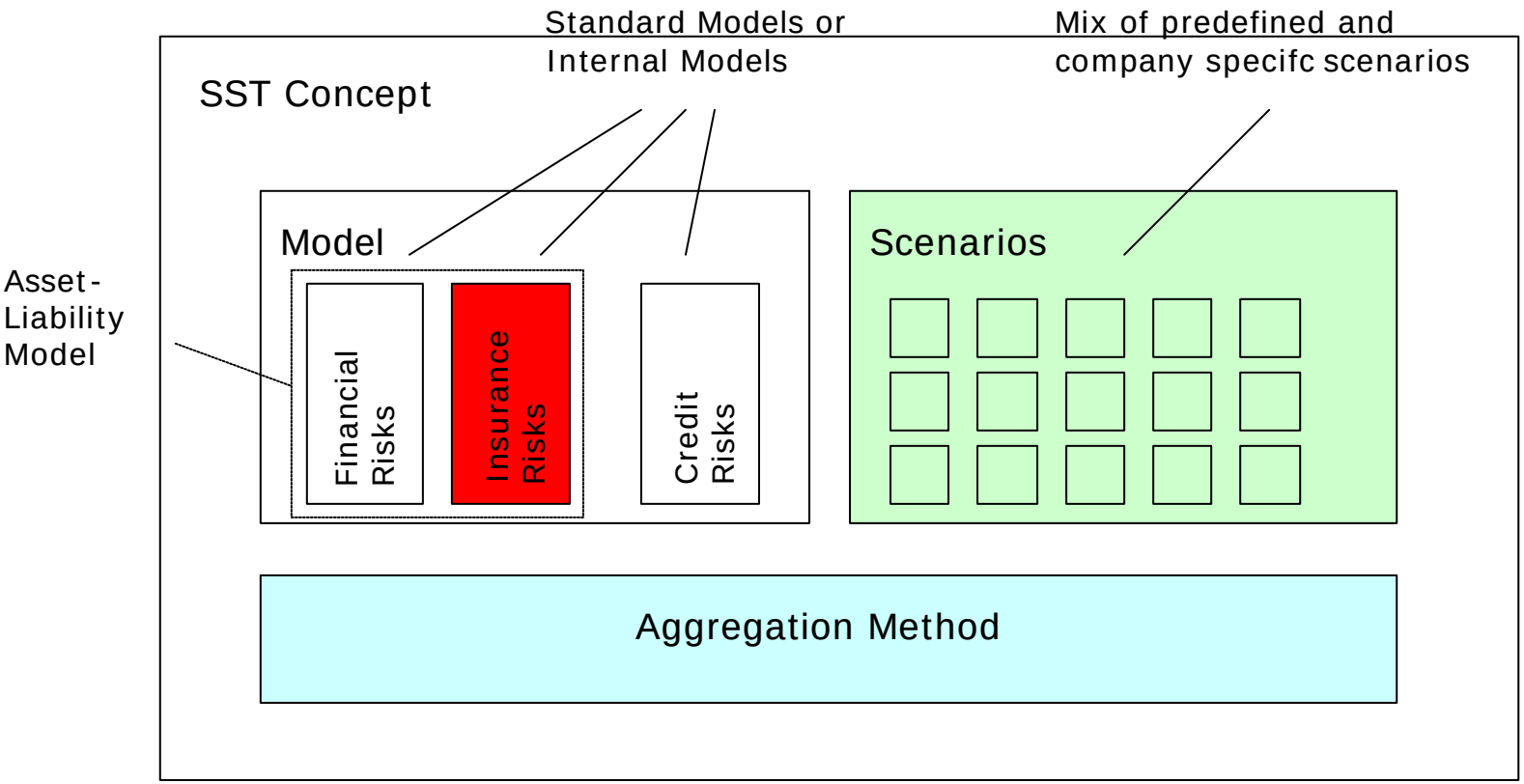
# Credit Risk

- Credit risk (excluding reinsurers) are handled with analytical model (spread volatility) and a credit risk capital charge (CRCC)
- CRCC will be added to target capital
- CRCC equals Basel II credit risk charge using the standard approach

- Reason for special treatment of credit risk:
  - Using this approach, consistency with banking regulation is achieved (For banks Basel II credit risk charge is added to market risk charge)
  - Easy to calculate
  - Basel II standard approach is not based on (explicit) risk measure. It would be impossible to derive distribution function (or scenario) from Basel II credit risk capital charge

- Companies can use internal portfolio models for credit risk (e.g. CR+, Credit Metrics, …) but have to use Basel II risk measure and quantile. Capital charge from internal models has to be added to target capital

# Life Insurance



# Life Insurance

Standard Model:

- Risk Factors:
  - Mortality, longevity, morbidity, recovery rates, lapse, option exercise, costs
- Assumptions:
  - Changes of risk factors are normally distributed
  - Specified covariance for test-run
  - Life model -> normal distribution with zero mean and given volatility
  - Biometric risks are assumed to be independent to market risk factors
  - In contrast to financial market, there are no high-frequency time series etc. to estimate volatility (often actuarial gut-feeling)

# Life Insurance

Scenarios:

- Pandemic (Spanish Flu 1918 translated to 2004)
- Disability scenario (short term increase + systemic increase)
- Mortality: long term changes (to take into account of systemic over- or underestimation)
- Longevity
- Lapse scenario (combined with interest rate increase)
- Scenarios defined by appointed actuary

Scenarios are defined via simultaneous changes of risk factors
-> no extra work when sensitivities are already calculated

# Scenario: Pandemic

## Spanish Flu (~ 1918/19)

| | Children | Healthy Adults (15-49) | Healthy Adults (50-65) | Elderly | High Risk Adults (15-65) | High Risk Elderly (66+) | Health Care Workes | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| Suspectible Population | 1249000 | 3155000 | 1080000 | 700000 | 383000 | 328000 | 269000 | | 7164000 |
| Cases of Illness | 1001136 | 2242890 | 485603 | 228701 | 226314 | 107163 | 173252 | | 4465059 |
| GP visits | 508549 | 966972 | 210059 | 123902 | 128886 | 66497 | 78093 | | 2082958 |
| Hospitalisations | 2928 | 13287 | 1884 | 2824 | 8317 | 2570 | 1411 | | 33221 |
| Bed Days | 20555 | 25592 | 6404 | 25641 | 76694 | 58961 | 8857 | | 222704 |
| Deaths | 4831 | 10295 | 3521 | 3072 | 4995 | 14190 | 1096 | | 42000 |
| Work days lost | 0 | 8519486 | 1836142 | 0 | 921977 | 0 | 849512 | | 12127117 |

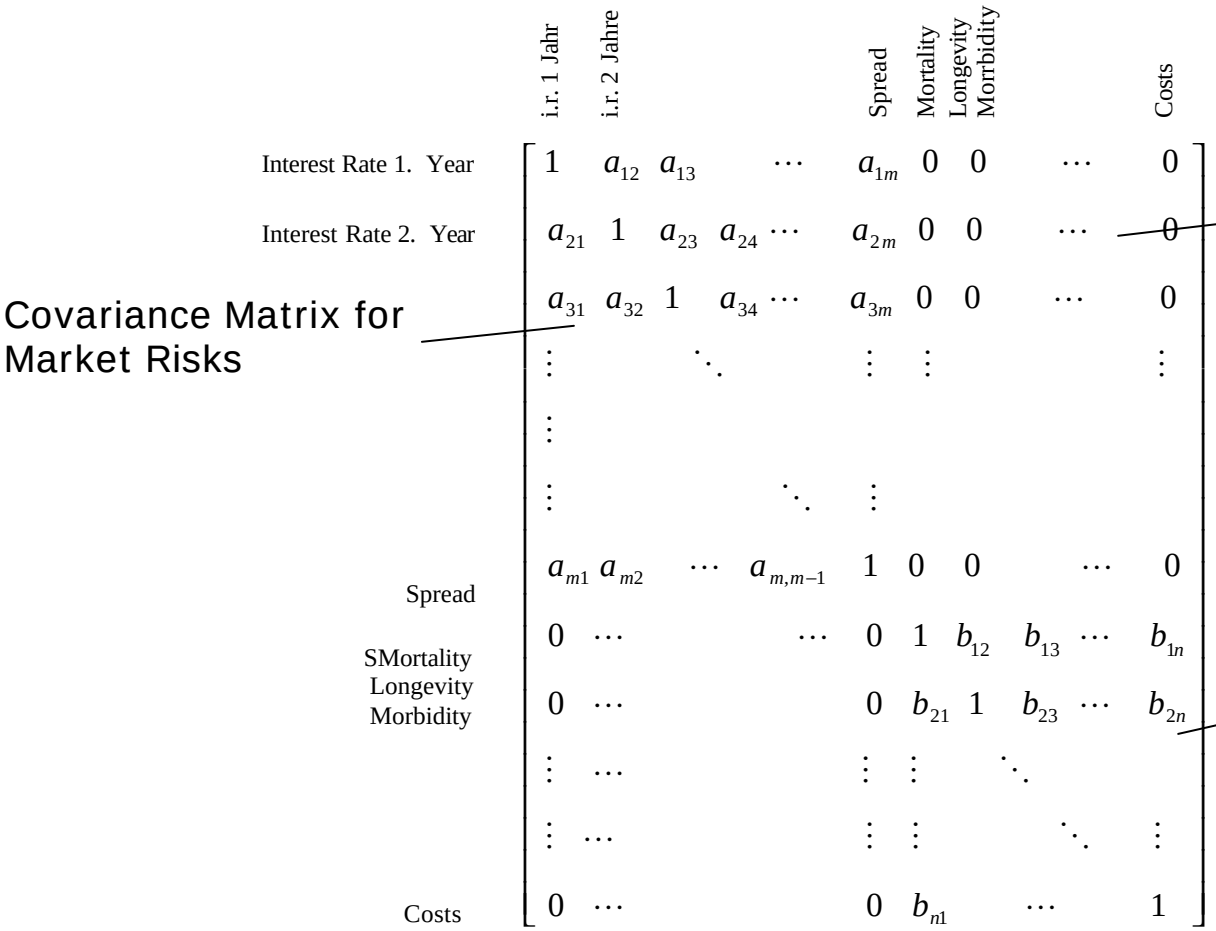
Insurer have to calculate effect of flu pandemic based on company specific portfolio (market share, exposure to high risk group, (e.g. nurses etc.))

Scenario based on publication by FOPH

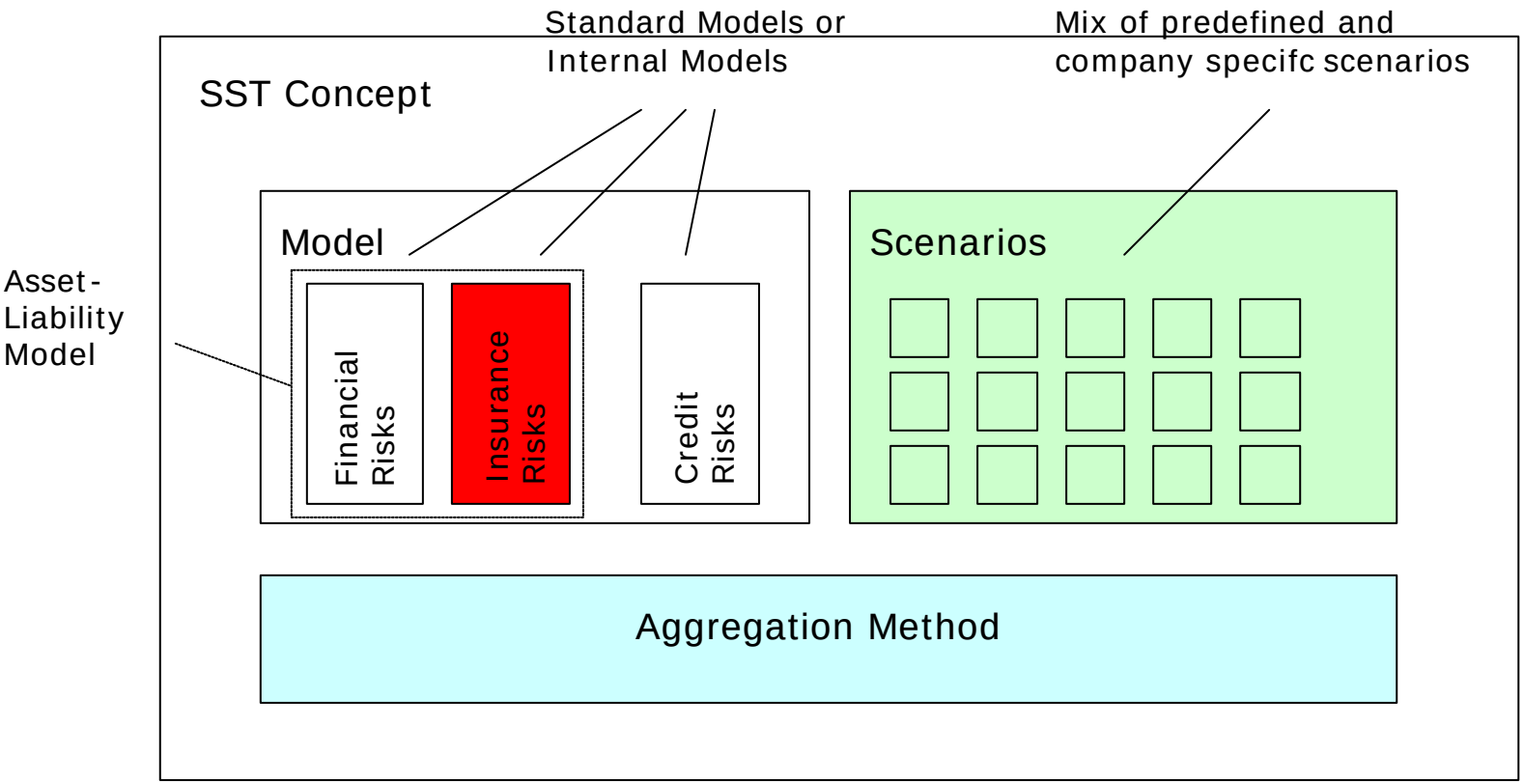
- The Economics of Pandemic Influenza in Switzerland, Prepared by MAPI VALUES for The Swiss Federal Office of Public Health, Division of Epidemiology and Infectious Diseases, Section of Viral Diseases and Sentinel Systems, James Piercy / Adrian Miles, March 2003

# Life Insurance

## Covariance Matrix for life insurance risk factors



# Nonlife Insurance



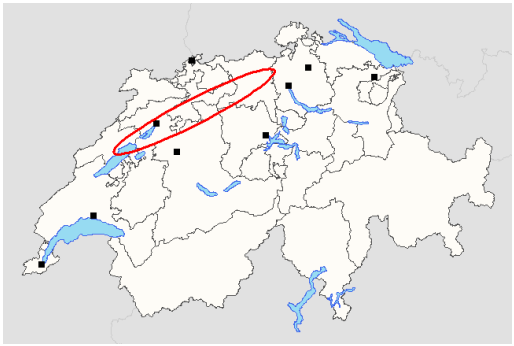
# Nonlife Insurance

- Standard Model:
  - Framework rather than black box
  - Modular, parts or all can be replaced with internal models (with permission of supervisor)
  - Split into current year and previous year
  - Normal claims, large claims and catastrophes
    - Aggregate normal claims modeled using parameterized distribution and specified correlation matrix
    - Large claims modeled using company specific data or specified distribution (e.g. Pareto,…)
    - Catastrophes modeled using scenarios or specified distributions
  - Parameters: some company specific, some supplied by regulator
  - Reinsurance: has to be modeled by companies
  - Pools (Nat cat, nuclear, airplane, dams): partly modeled by regulator for test-run, later has to be model by companies if capital relieve is to be granted
- Scenarios:
  - Pandemic (Spanish Flu 1918 translated to 2004)
  - Natural catastrophes (hail, windstorm, flood)
  - Industrial Accident/Catastrophe
  - Company specific Scenarios defined by appointed actuary
- More detailed description in ”Übersicht SST-Standardrahmen für das Nichtlebengeschäft”, Damir Filipovic, BPV

# Scenario: Nonlife Insurance, Hail

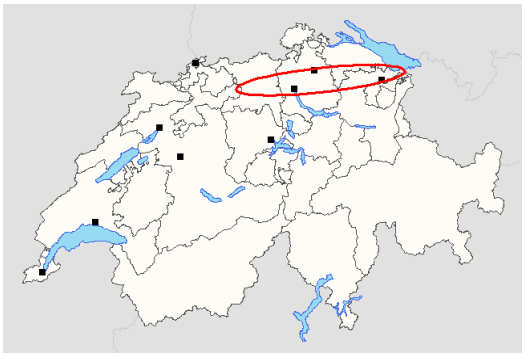
Hail Scenario: 4 Footprints (and corresponding loss grades for each ZIP code) are defined and most relevant has to be used by companies

Neuchâtel - Biel - Grenchen - Solothurn - Olten - Aarau

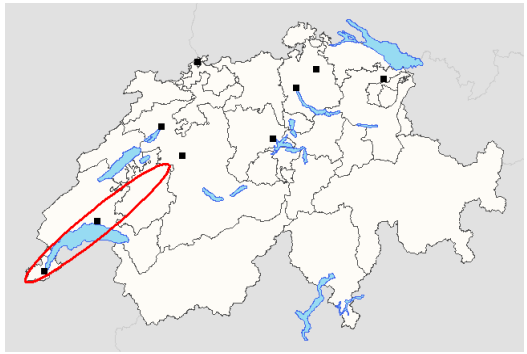


Bern - Luzern - Zug

Aarau - Zürich - Winterthur - St. Gallen



Genève - Lausanne - Fribourg



# State of the SST Development

To early for complete numbers

- Financial risk model calibrated
- Biometric parameters will be fine-tuned
- Nonlife model is being programmed by some companies and main risk drivers are being identified
- First results (Fall 2004)
- SST for reinsurers is being developed
- Seminar on pricing of embedded options planned for this year
- Education program for Appointed Actuaries is being developed together with Swiss Actuarial Association
- Test run for year 2005 planned with more companies after fine-tuning of the parameters
- Full implementation likely in 2006
- Quantification of long-term investment strategy (e.g. 5 years) similar to Canadian DCAT (planned at a later stage)

# Controversies

Some companies would like to have the ALM prescribed by the regulator

Preference by some for black-box type of regulatory model

There is increasing pressure to implement standard models suitable for specific companies

Principle-based supervision will be challenging to implement

Realization by some that SST is not standard economic risk model:

- will contain safety margins in parameters to give incentive to develop internal models
- Contains safety margin to take into account risks emanating after 1 year -> some internal models will need to be adjusted to be compliant
- Capital requirement can differ from internal model

# SST Project

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