

SST for Life Companies

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

Federal Office of Private Insurance
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Standard Model and SST

Standard Model

- Functional dependence of P&L on risk factors linear
- All risk factors multivariate Normal
- Risk introduced via sensitivities of portfolio values at 1 January → implicit assumption that assets and liabilities at the beginning of the year are the same as at the end of the year
- No technical and financial profit included
- Disconnect with European Embedded Value (EEV)



Standard model is adequate for ,simple` companies with few optionalities and stable business

Realistic Model based on SST Methodology

- Realistic dependence of P&L on risk factors
- Dependency between risk factors can be modeled more flexibly (e.g. tail dependency)
- Risk introduced via generation of scenarios of the economic state of the company in one year's time
- Technical and financial profit can be taken into account
- Valuation and one year risk consistent
- Conceptually more consistent with EEV
- Model can map better company's internal view of business → embedding of the model easier



Realistic model is adequate also for companies with optionalities in both assets and liabilities



Assumptions in the AVO

Some decrees have been chosen to simplify the calculations, mainly with a view to the standard model. This should not preclude companies to take risks consistent with the SST methodology into account

- PRE (policyholders reasonable expectations) are fully risk bearing (e.g. are not considered as a liability → Assumes full rationality of management)
- Hybrids are fully risk bearing if duration > 5 years
- Tax liabilities are fully risk bearing

In the AVOs: Solvency Ratio = RBC/TC

Correct: RBC ← RBC - PRE, TC ← TC - PRE (approximately),

Solvency Ratio \approx (RBC - PRE)/(TC - PRE)

The effect on the SST solvency ratio is probably not material but the approach distorts the true picture of the financial situation: Both risk-bearing capital and target capital are too high

SST becomes less relevant to management of companies doing the EEV



Realistic Model based on SST Methodology

Core Ideas:

- Required capital to cover risks emanating during a 1-year time horizon = Expected Shortfall of the change of available capital
- Available capital at $t=0$:
 - Given by the economic balance sheet at $t=0$
- Available capital at $t=1$:
 - Contingent on the financial state of the company, has to take into account insurer's option to distribute profit, implies the valuation of assets and liabilities based on hypothetical states of the financial and insurance market



Risk as Change of Available Capital

At the core of the SST is the fact that SCR is the Expected Shortfall of the change of risk bearing (or available) capital over a one year time horizon

→ Available capital at $t=1$ needs to be modeled

→ The economic balance sheet of the company at $t=0$ needs to be determined

$$AC(t) = V(A(t)) - V(L(t)), t=0,1$$

$$SCR = - ES(AC(1) - AC(0))$$

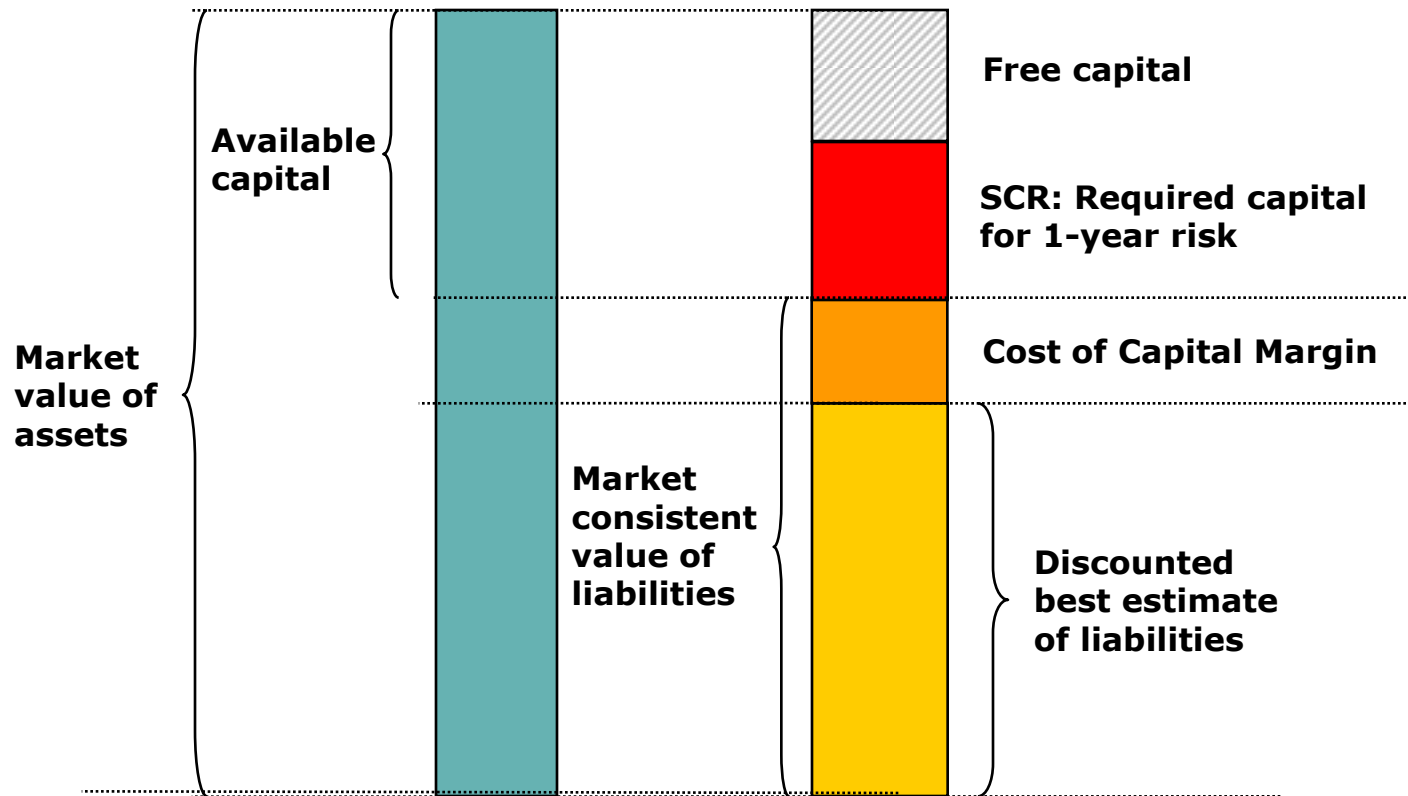
Available capital at
time t : random variable

Available capital at
time 0: known



The Economic Balance Sheet

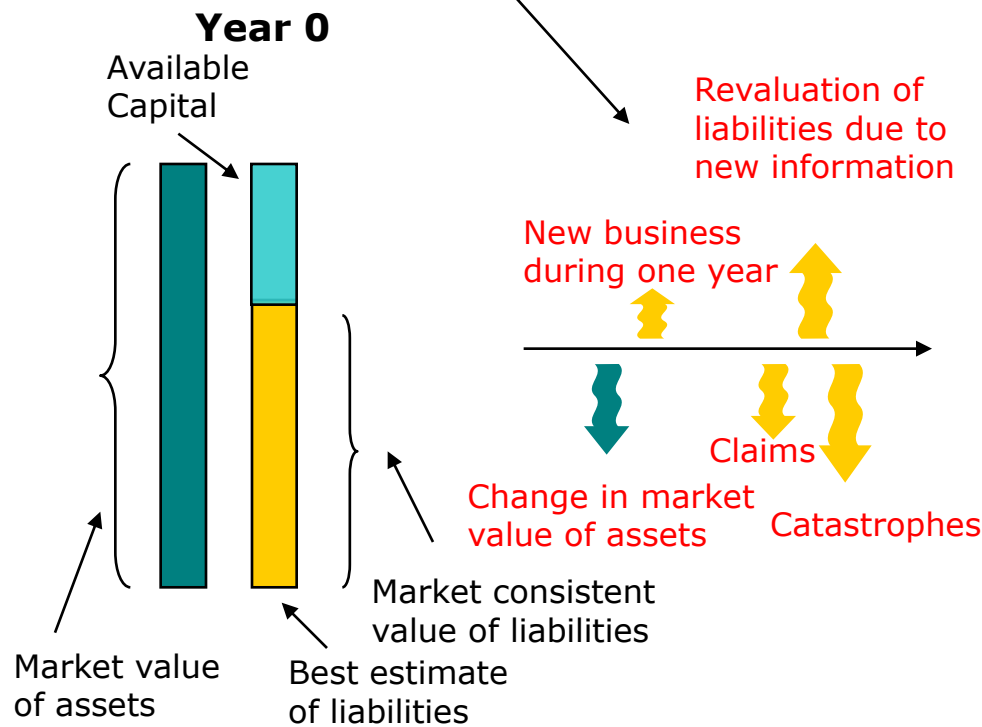
The market consistent (economic) balance sheet



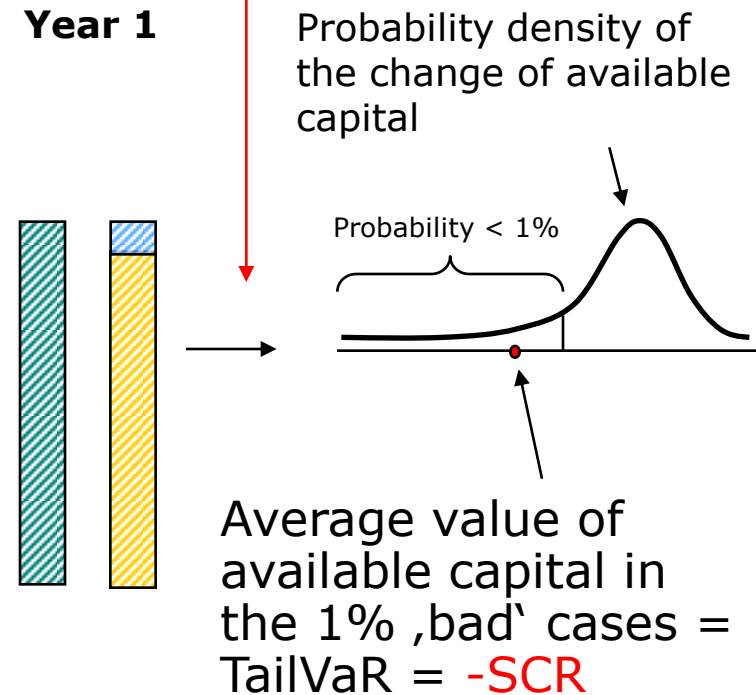
Risk as Change of Available Capital

Available capital changes due to random events

Risk quantification via standard models or internal models



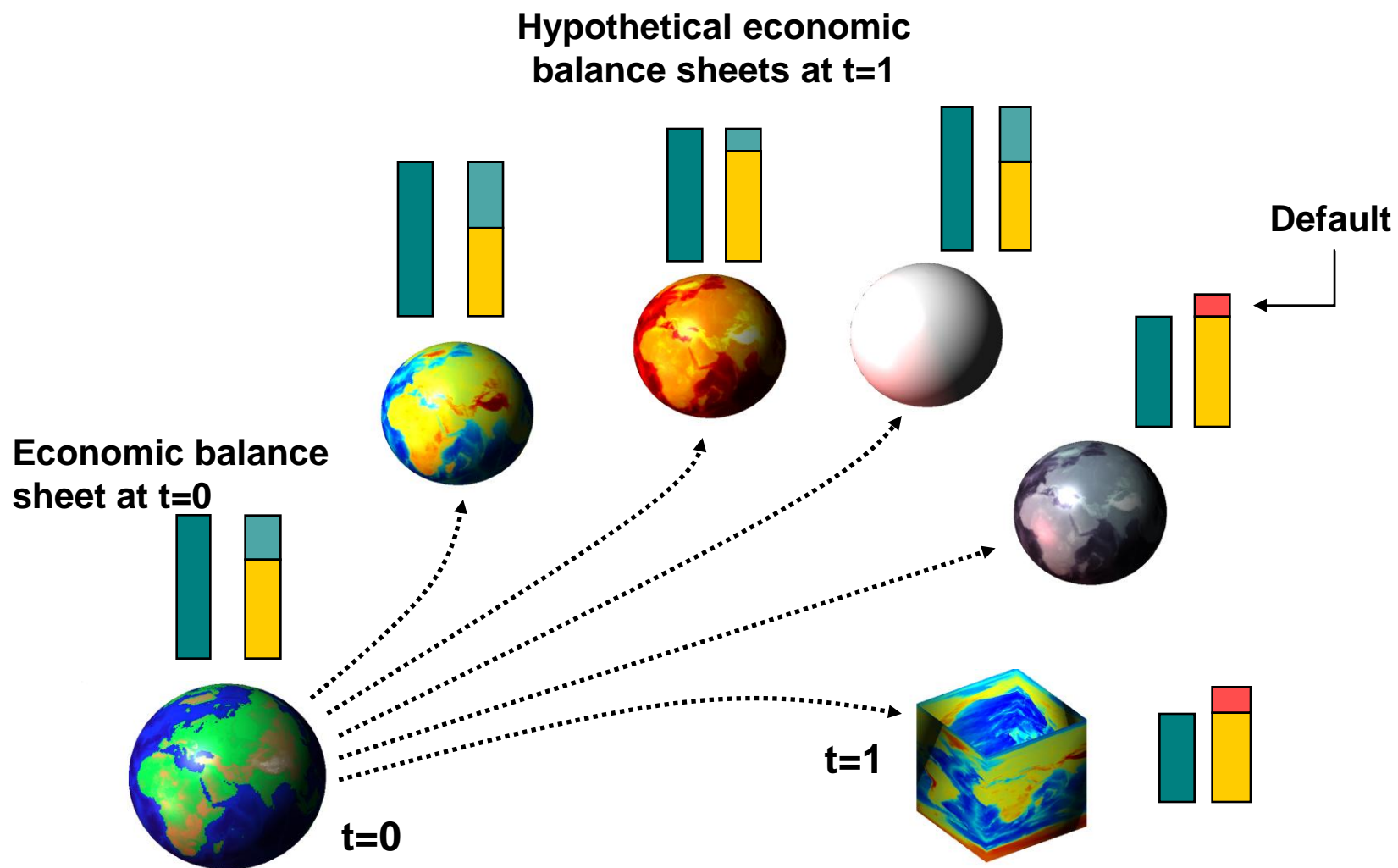
Economic balance sheet at t=0 (deterministic)



Economic balance sheet at t=1 (stochastic)



Risk as Change of Available Capital



Risk as Change of Available Capital

A Generic Description of the SST Methodology:

- SCR is a function of the risk of the change of available capital over a one year time horizon
- Conceptually, a company needs to determine available capital at $t=0$ (based on the economic balance sheet) and the hypothetical available capital under (many) different scenarios at $t=1$
- This implies:
 - the generation of hypothetical states of the world at time $t=1$
 - Identify relevant risk factors of the company (e.g. yields, equity indices, mortality, optionalities...)
 - Model the evolution of the risk factors over one year, taking into account dependency between the risk factors
 - the revaluation of assets and liabilities given the different hypothetical states
 - Define a replicating portfolio of the portfolio given the simulated state of the world and determine Cost of Capital Margin
 - Take into account the features of relevant hybrid instruments



Internal Models

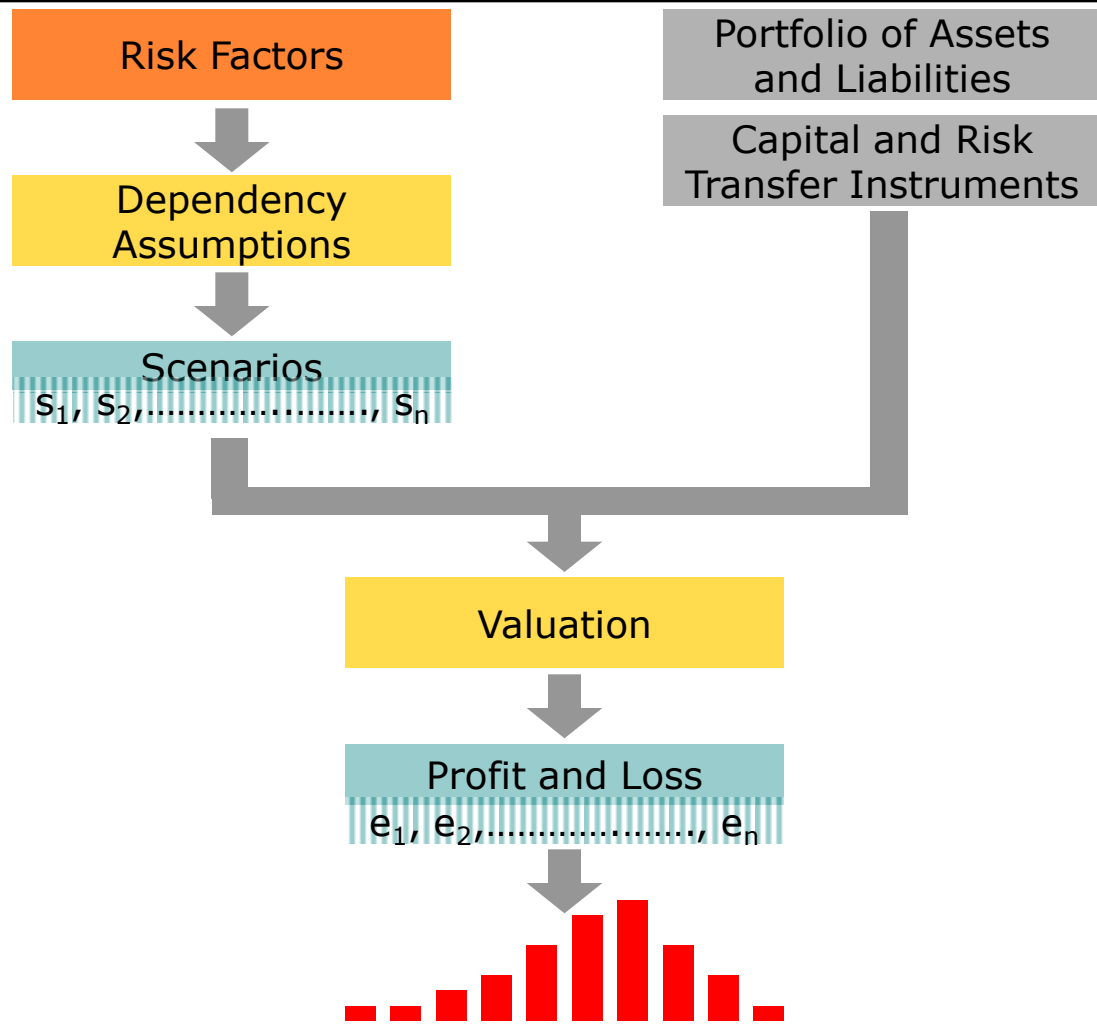
A generic, scenario based model for economic capital calculations

The main task of an model used for the SST is the projection of the economic balance sheet of a company from now ($t=0$) to 1 year in the future ($t=1$)

For the valuation of assets and liabilities in one year's time, the (possible) states of the world have to be determined

In a scenario based model, future states of the world at $t=1$ have to be simulated. These states encompass the evolution of all relevant risk factors over the whole duration of the assets and liabilities

Other approaches than scenario based are possible. Scenarios are however more intuitive for explanations



Future States of the World at $t=1$

- Risk factors need to be projected to possible future states in one year's time
- The projections should lead to consistent states of the world
 - Arbitrage-free
 - Dependencies between the risk factors need to be taken into account
 - Dependencies should also take future state of the world into account → in stressed situations, some risk factors might exhibit higher dependency
 - The states evolve according to physical probabilities, not risk-neutral → based on observed, historical data
- Risk Factors
 - Market Risk: Yield curves, spreads, equity indices, real estate prices, FX rates, embedded options...
 - Insurance Risk: Mortalities, morbidities, embedded options...
 - Credit Risk: Defaults, LGDs,...
- The functional dependence on risk factors need to be modeled, for instance lapse rates in function of interest rates, the economic state of the company,...



Re-Valuation at $t=1$

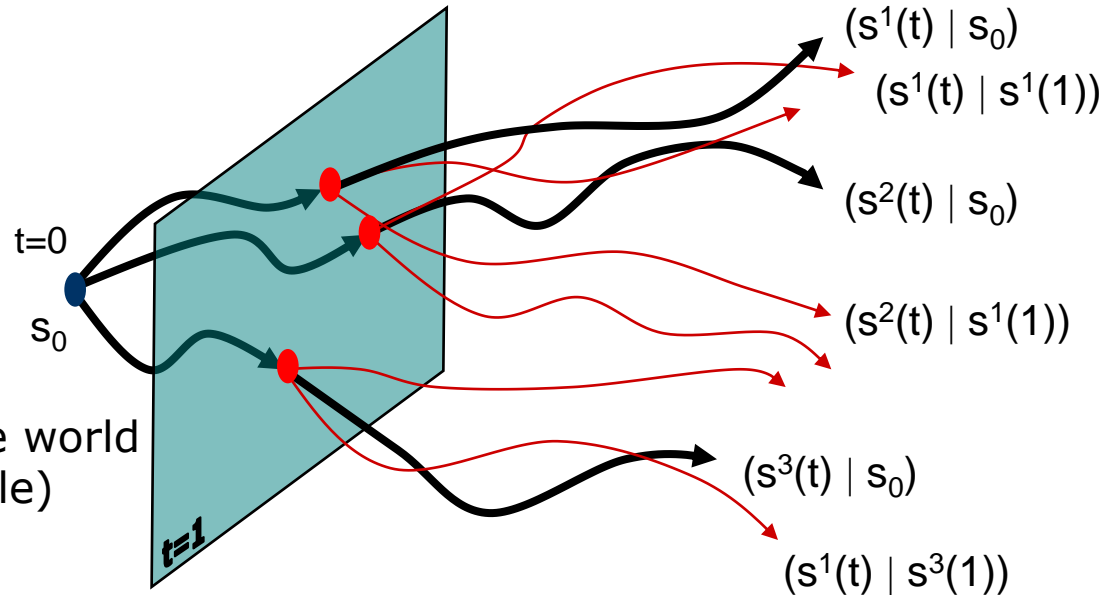
- For each simulated state of the world: Re-value portfolio of assets and liabilities
 - Define set of financial instruments consistent with the simulated state of the world
 - Define market consistent value of the financial instruments using a risk-neutral framework/no-arbitrage condition
 - Replicate liabilities using financial instruments (with values consistent to the hypothetical state at $t=1$)
 - The value of liabilities equals the value of the replicating portfolio + cost of capital margin for non-hedged risk
 - Value assets analogously
- Take into account optionalities embedded in all relevant financial securities in the portfolio of assets and liabilities
 - Consider hybrid instruments (e.g. issued hybrid loans, etc.)
 - Consider possible risk and capital transfers (e.g. from guarantees, etc.)
 - Management options (policy holder profit participations, etc.)
 - Policy holder options



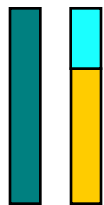
Risk as Change of Available Capital

- Simulated possible states of the world at $t=1$, based on information at $t=0$

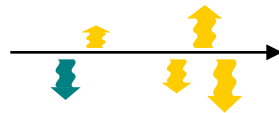
$\rightsquigarrow (s^i(t) | s_0)$: Projected evolution of risk factors based on information at $t=0$



s_0 : State of the world now (observable)



Economic balance sheet at $t=0$

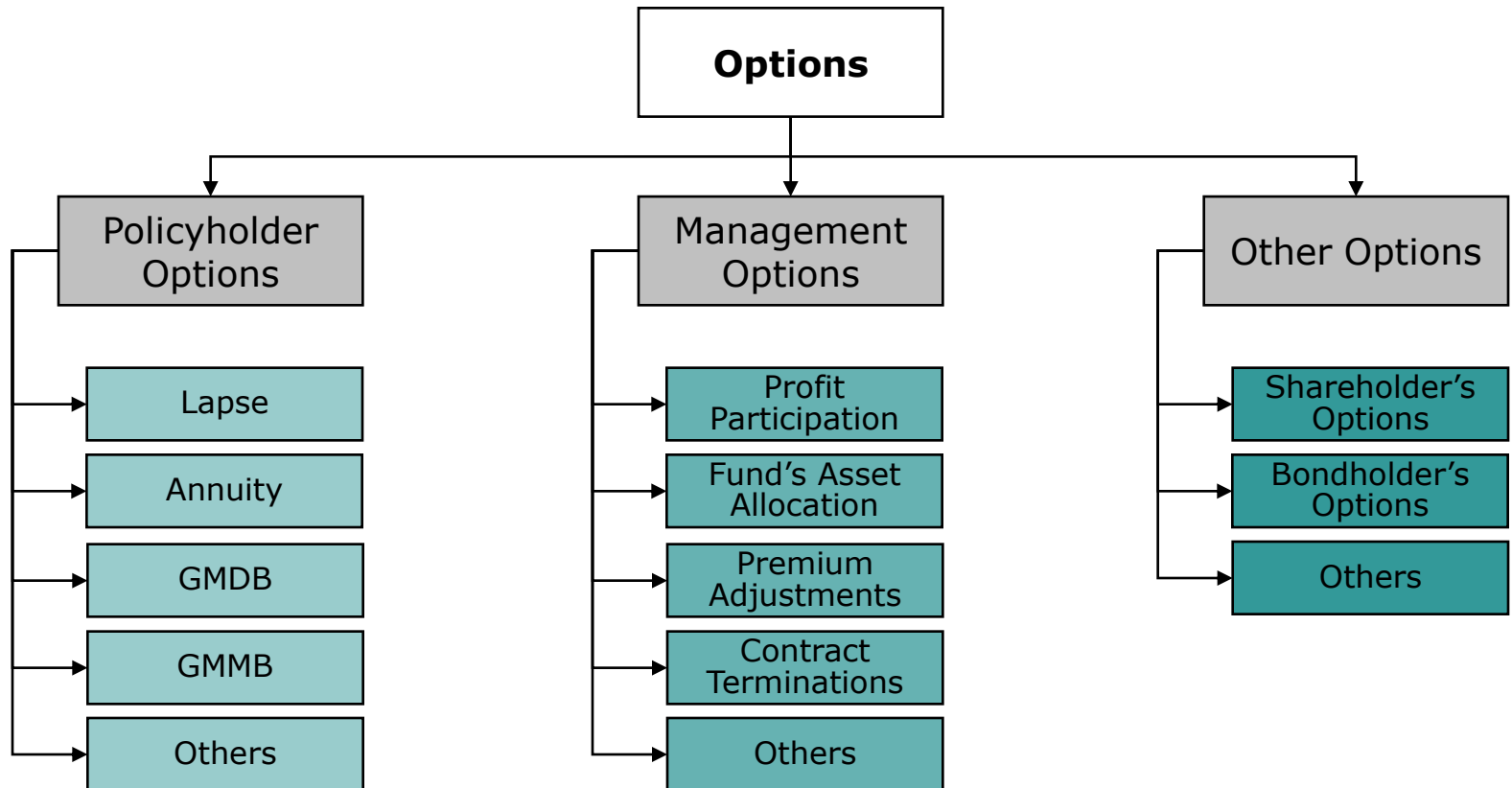


Economic balance sheet at $t=1$

$\rightsquigarrow (s^i(t) | s^j(1))$: Projected evolution of risk factors based on simulated state of the world at $t=1$



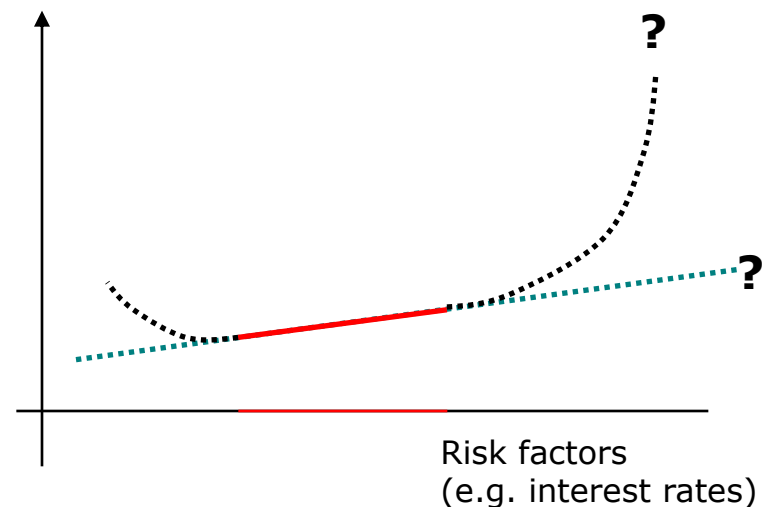
Options



Policyholder Options

- For the market consistent valuation: each company has to determine the relevant options and guarantees in its liabilities
 - Lapse, annuity, performance guarantees, premium guarantees...
- They have to be valued using realistic assumptions, using historical data but also models
- Valuation based on observation taken under a very narrow range of experiences (e.g. interest rates over the last years) would not be realistic.

Policy holder behavior
(e.g. lapse)



- It might be realistic to consider the possibility that policyholders might become more financial rational in the future (e.g. if secondary markets for liabilities develop)
- There are many different approaches for the valuation, e.g. analytic, economic scenario generators, replicating portfolios
- It is up to the company to use an appropriate mix of methods and convince FOPI that it leads to an acceptable approximation of the market consistent value
- FOPI will not define the methodology for the valuation, in particular not simplified ways of taking into account options and guarantees



Management Options

The options the company owns have to be taken into account

- Examples:
 - The option to decide on how much profit to share with policyholders
 - The option to change the asset allocation in funds, e.g. switching to bonds if the fund's value deteriorates

How to take the management options into account?

- Possibilities
 - Assume profits will not be distributed in case of financial problems and that the fund is instantly rebalanced into government bonds
 - Unrealistic and modeling is most likely not connected to management's own view of business; is incompatible with EEV but is easy to implement
 - Take into account realistic assumptions on management's behavior
 - More difficult but compatible with EEV, more likely to be congruent with management's view



Management Options: PRE

- The valuation should take into account the realistic behavior of the company
- The expected (but not contractual guaranteed) profit participation of policy holders (policy holder reasonable expectation (PRE)) are a hybrid instrument
 - In most financial states of the company, the PRE will be paid out to policy holders
 - In some extreme states it becomes risk bearing
- The methodological correct approach would be to reserve the PRE but take the risk-mitigating feature into account in the SCR



Management Options: PRE

- The model needs to be able to capture:
 - The exercise of the management options
 - The value of the management options
- Management strategy needs to be formalized and captured in an algorithm
- The value of the management options depends also on the asset mix
→ Value of PRE depends also on the asset allocation over time
- In an ideal model, the asset allocation over time is modeled using a long-term financial market model, assumptions on how management distributes profit according to the company's economic state both absolute and in comparison with its competitors and other factors
- If the model adequately models management options, expected return during year $[0,1)$ can be taken into account
- New business



FOPI's Expectation

- The model should be in line with the complexity of the business and be integrated into the companies' risk management
- FOPI does not expect that all companies will implement 'perfect' models and that different levels of simplifications are acceptable
- Life insurers have to show how they intend to arrive at an acceptable model
- FOPI recognizes the fact that the development of an adequate model might be a multi-year project
- However, FOPI expects that there will be sufficient support by senior management
- The plan to be submitted latest end of march to FOPI has to outline how the company plans to model its life liabilities appropriately if deviations of the standard model are necessary as well as intermediate step towards the more appropriate model

