Pojistný matematik a Solventnost II
Pojistný matematik v praxi

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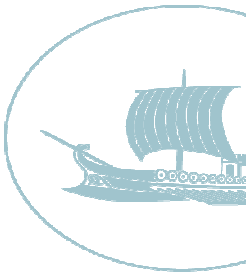
ACTUARIA

OBSAH



1. Pojistný matematik v SII
2. Výpočet technických rezerv
3. SCR

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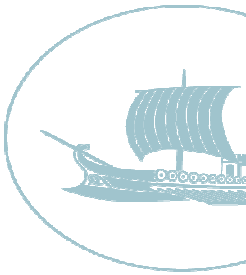

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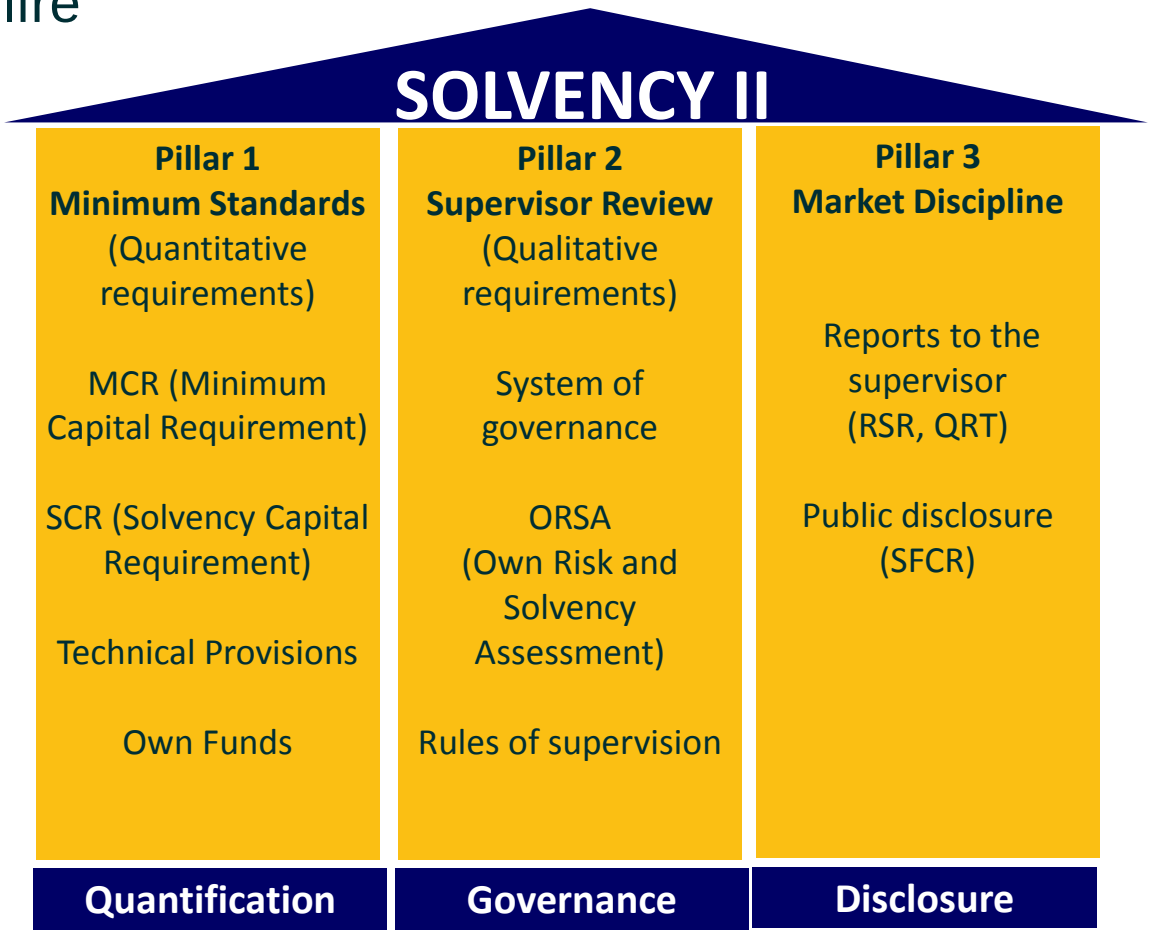
Solvency II - 3 pilíře



Pojistný matematik v SII

- LEGISLATIVA
  - L1 = Směrnice 2009/138/ES
  - L2 = Nařízení komise 2015/35 z 10.10.2014
  - L3 = EIOPA Guidelines
    - Obecné pokyny k oceňování technických rezerv
    - Obecné pokyny k řídícímu a kontrolnímu systému
    - Obecné pokyny k vlastnímu posouzení rizik a solventnosti (ORSA)
    - …

Aktuárská funkce

- L1 Článek 48 odst. 1

a) koordinuje výpočet technických rezerv;

b) zajišťuje přiměřenost používaných metodik a podkladových modelů, jakož i předpokladů učiněných při výpočtu technických rezerv;

c) posuzuje dostatečnost a kvalitu údajů používaných při výpočtu technických rezerv;

d) srovnává nejlepší odhady se zkušeností;

Tech.Rez.

e) informuje správní, řídící nebo kontrolní orgán o spolehlivosti a adekvátnosti výpočtu technických rezerv;

Reporting

f) dohlíží na výpočet technických rezerv v případech stanovených v článku 82;

g) vyjadřuje názor na celkovou koncepci upisování;

h) vyjadřuje názor na adekvátnost zajistných ujednání;

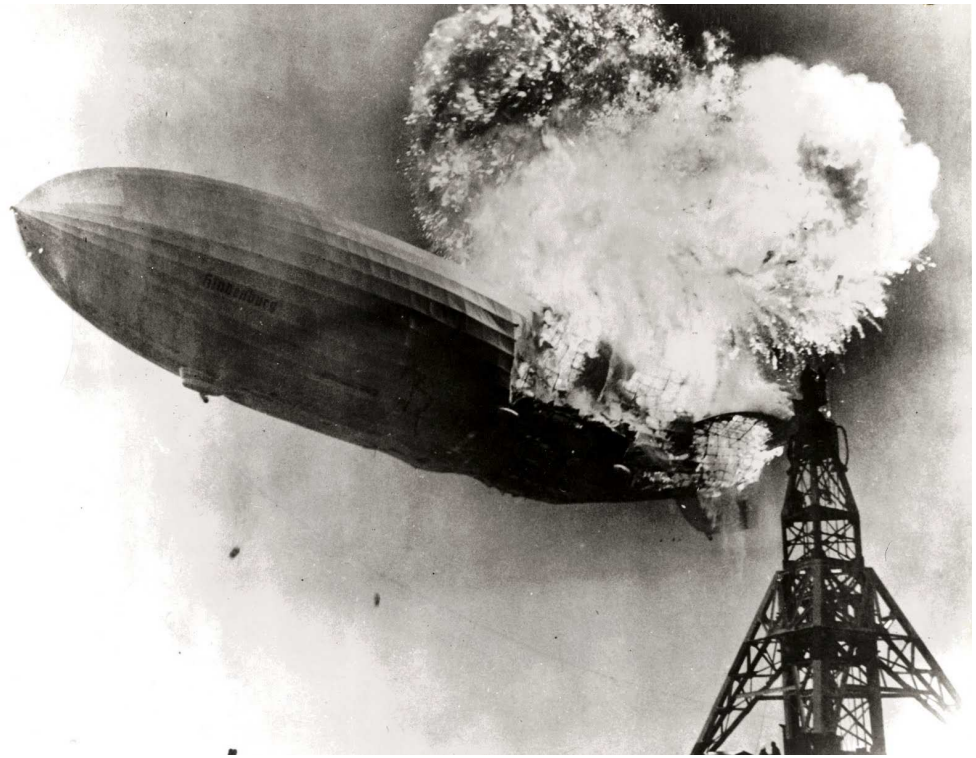
Názor

i) přispívá k účinnému provádění systému řízení rizik uvedeného v článku 44, zejména pokud jde o konstrukci rizikových modelů, které jsou podkladem výpočtu kapitálových požadavků stanovených v kapitole VI oddílech 4 a 5 a pokud jde o posouzení uvedené v článku 45.

Řízení rizik

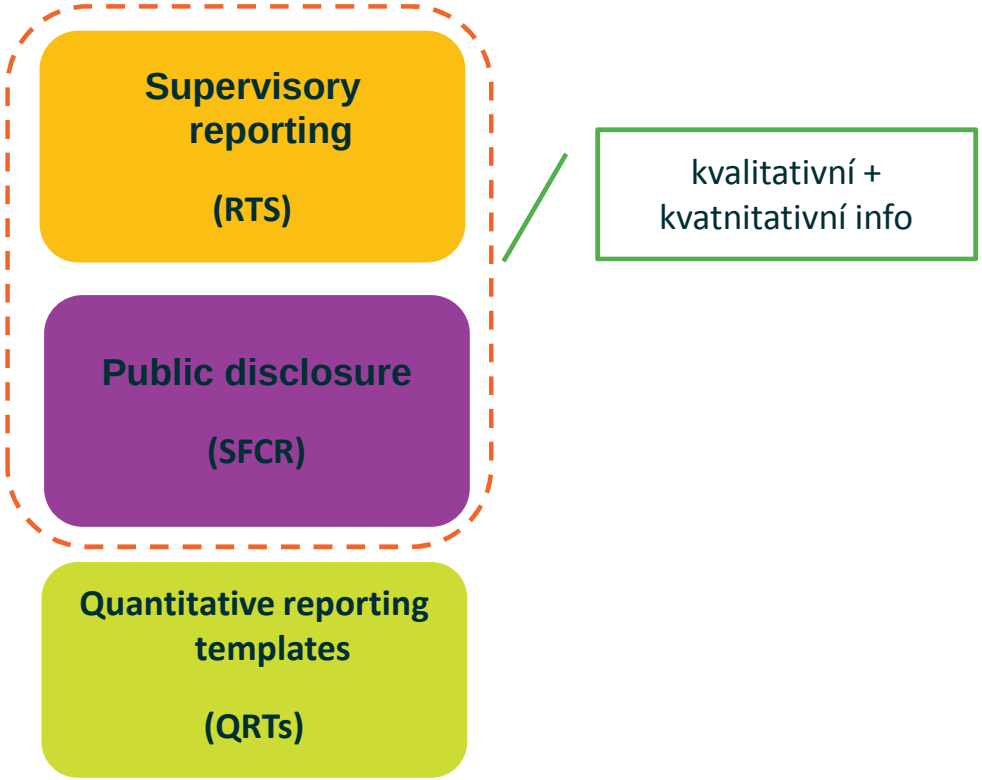
Podpora risk managementu

- SCR a MCR výpočet
- ORSA, scénáře a stres testy projekcí
- Modelování rizik
- Kvalita dat- posouzení
- Risk management směrnice



Reporting

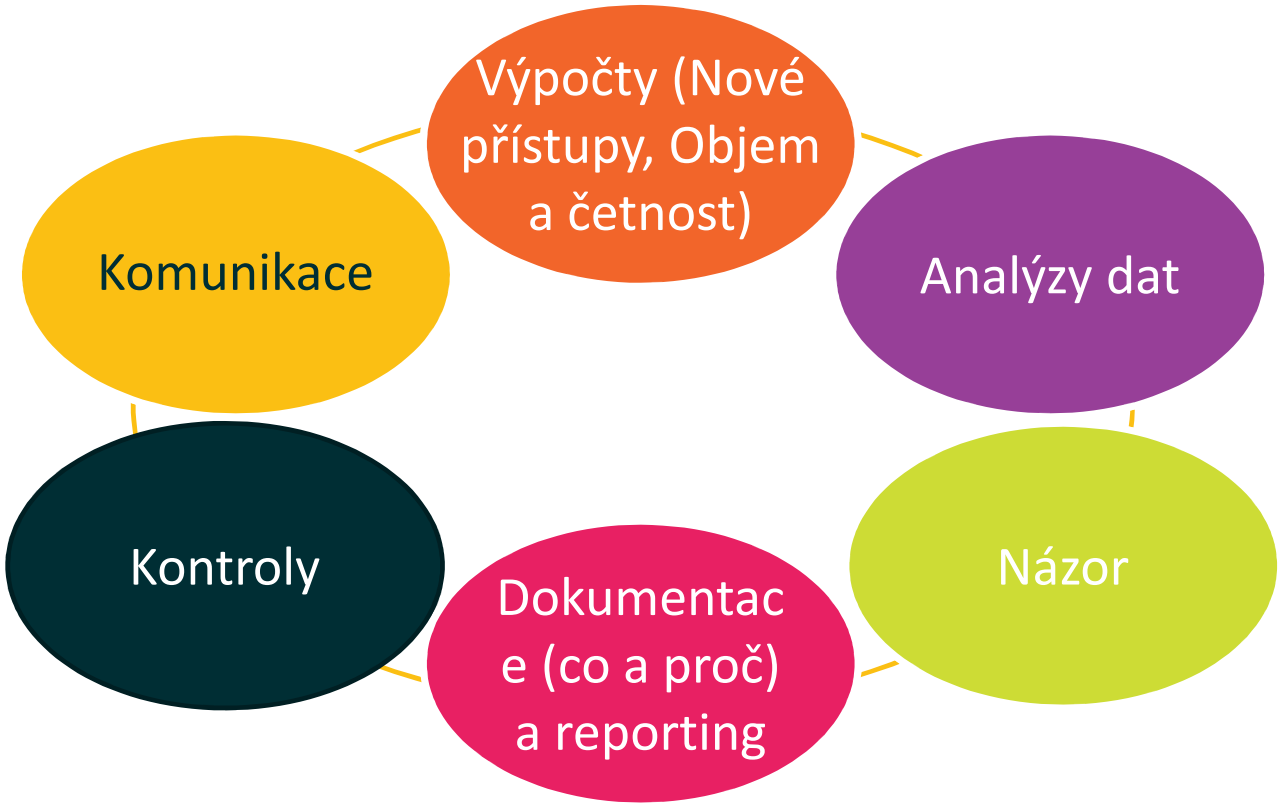
- ZVEŘEJNĚNÍ – PILÍŘ 3



- ZPRÁVA AKTUÁRSKÉ FUNKCE
  - Písemná zpráva - minimálně 1x ročně
  - Předkládaná správnímu, řídícímu nebo kontrolnímu orgánu
  - Obsah
    - Všechny úkoly AF a jejich výsledky
    - Nedostatky
    - Doporučení, jak by tyto nedostatky měly být odstraněny.

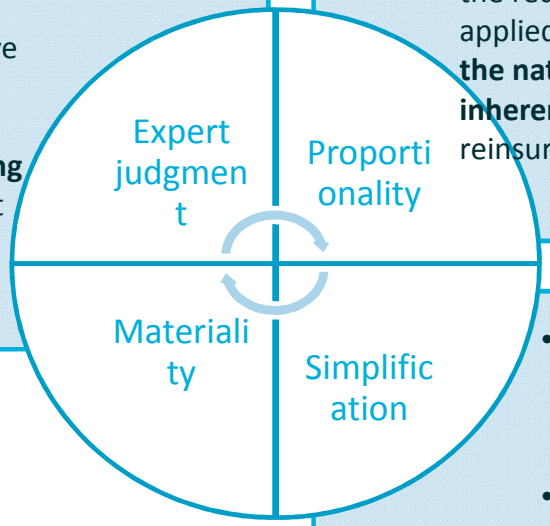
- ORSA REPORT
  - RozsahORSA
  - ORSA proces a zodpovědnosti klíčových osob v ORSA procesu
  - Stress testy a jejich výsledky
  - Celková finanční a solventnostní situace
  - Capital management strategy
  - Frekvence a obsah interního reportingu
  - Validace (nezávislé review ORSA)

ZMĚNY PRO AKTUÁRA?



ZMĚNY PRO AKTUÁRA?

- Scope
  - **Data, assumptions or model choice**
  - Should **not be applied in isolation** unless there is no alternative
  - **Prudence** in selection of alternative options
  - Only applied by experts with relevant **knowledge, understanding and comprehension** of the subject and adequate **experience**
- Documentation
- Back-testing



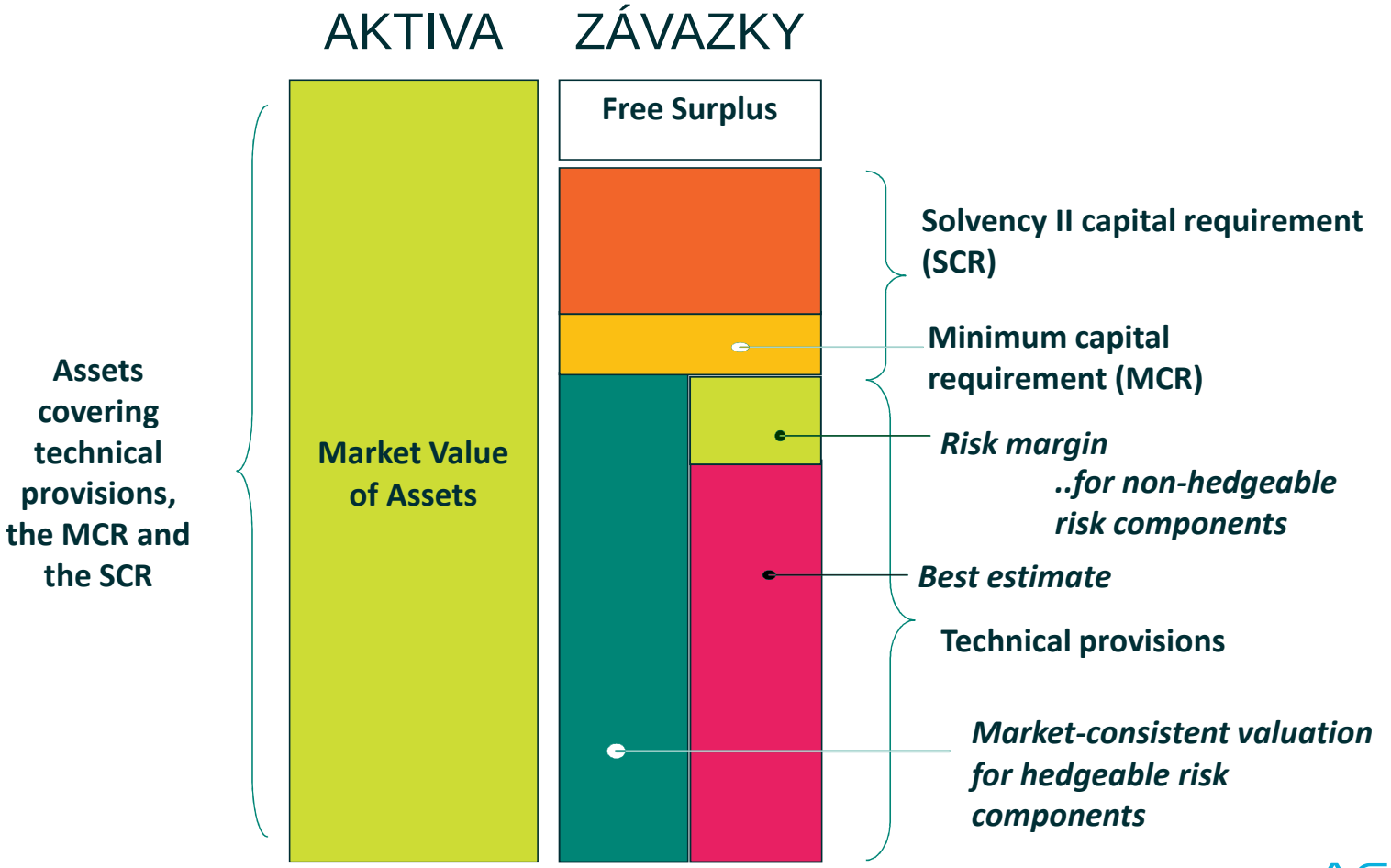
- "This Directive should **not be too burdensome for small and medium-sized insurance undertakings."** "Member States shall ensure that the requirements laid down in this Directive are applied in a manner which is **proportionate to the nature, scale and complexity of the risks inherent in the business of an insurance or** reinsurance undertaking."

- "simplified method" - a situation where a specific valuation technique has been simplified, in line with the proportionality principle.
- **"simplified method" (or "simplification")** could also be used to refer to a valuation method which is considered to be **simpler than a "commonly used" benchmark** or reference method.

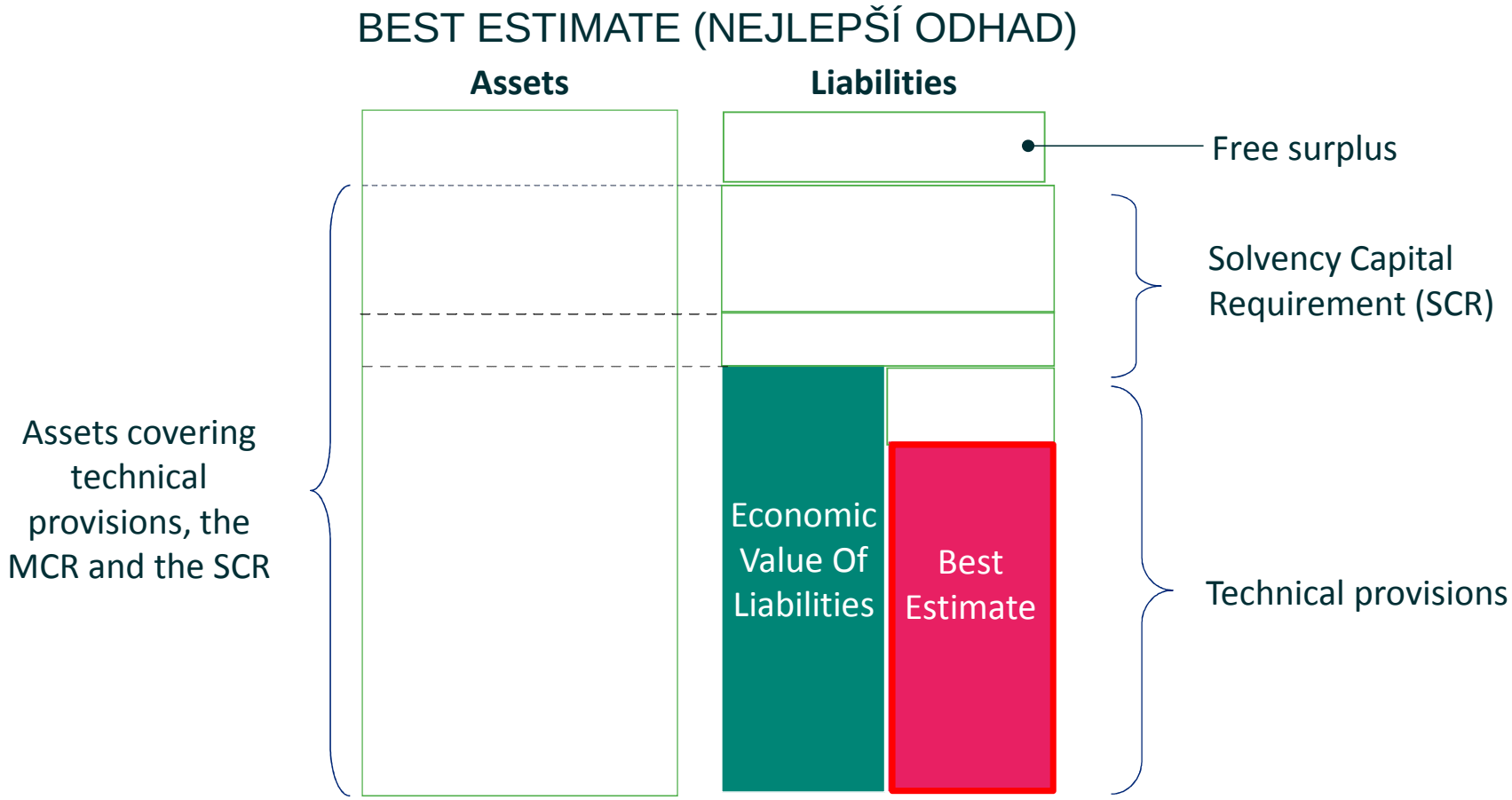
OBSAH

- Pojistný matematik v SII
- Výpočet technických rezerv
- SCR

Rozvaha SII


AKTIVA
ZÁVAZKY
Free Surplus
Assets covering technical provisions, the MCR and the SCR
Market Value of Assets
Solvency II capital requirement (SCR)
Minimum capital requirement (MCR)
Risk margin
..for non-hedgeable risk components
Best estimate
Technical provisions
Market-consistent valuation for hedgeable risk components

Technické rezervy



Best estimate

- DEFINICE

– **Probability weighted average** of all future cash in- and out-flows required to settle the obligations over the lifetime thereof, taking into account the time value of money, using the relevant risk free interest rate term structure

"…should be carried out by a person who has knowledge of actuarial and financial mathematics, commensurate with the nature, scale and complexity of the risks… and who are able to demonstrate their relevant experience….."

Best estimate – Výpočetní proces

Gathering and analysing data

- Quality of internal and external data
- Data criteria
- Expert judgement

Determination Assumptions

- Adequate reflection of the uncertainty of the underlying cash-flows

Selecting and running model

- Appropriate valuation method
- Explore key drivers

Validation and documentation

- Relevance of method and data
- Comparison against experience
- Documentation and communication

Best estimate - Data

DATA

- All relevant available data whether external or internal data -> to arrive at the assumption which best reflects the characteristics of the underlying insurance portfolio.
- **All information needed** to carry out a valuation of technical provisions
- **Assumptions** are **not regarded as data**, although the use of data is an important basis to develop actuarial assumptions

NEDOSTATKY DAT

- E.g. due to changes in legal environment
- **Adjustments** could be made to the data, based on or complemented with **expert opinion**. Those should be justified and documented and not overwrite the raw data
- **Simplifications** could be used to calculate the technical provisions
- In no case the use of simplifications should be seen as an alternative to implementing appropriate systems and processes for collecting material relevant information and building historical databases

KRITÉRIA PRO DATOVOU KVALITU

Appropriateness	• Suitable for the intended purpose and relevant to the portfolio of risks being analysed?
Completeness	• Recognition of all of the main homogeneous risk groups? Sufficient historical information?
Accuracy	• Free from material mistakes, errors and omissions (e.g. due to human error or IT failures)? Adequate recording, timely and consistent over time?

Best Estimate – Segmentace a Unbundling

- Obligations should be segmented into **homogenous risk groups** when calculating technical provisions
- As a **minimum** segmentation should be performed by **lines of business**
- **Unbundling** - when contract covers risks across different lines of business

Best Estimate - Segmentace – lines of business

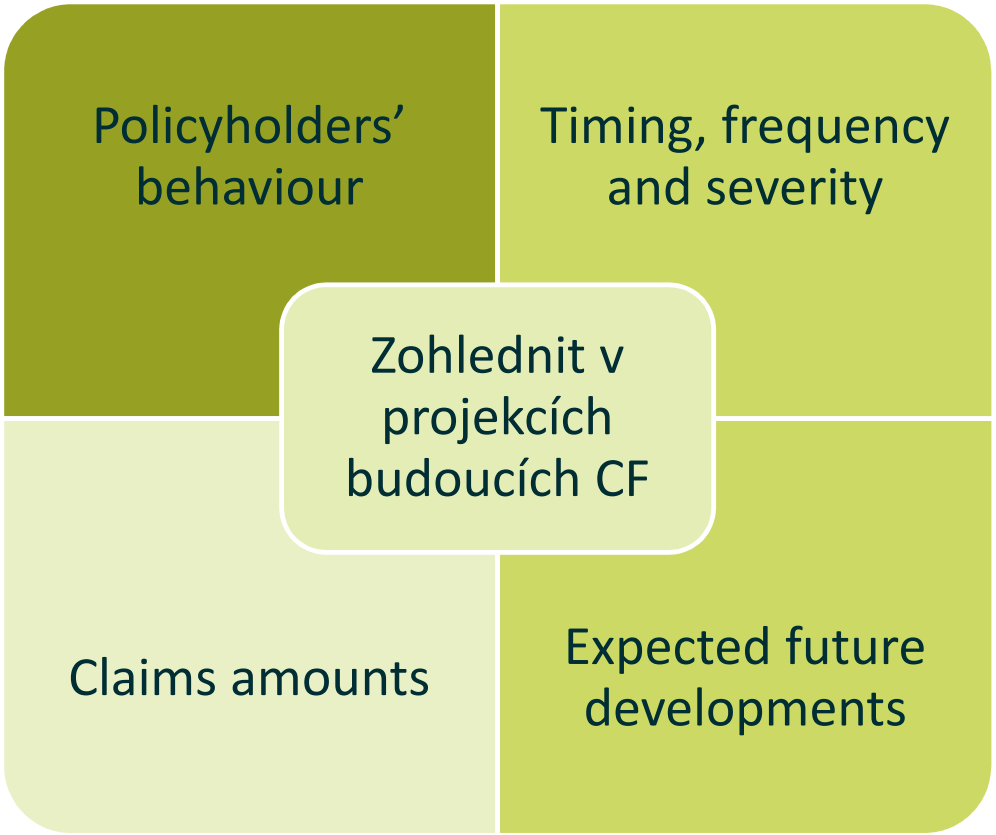
LIFE

1. Health insurance
2. Insurance with profit participation
3. Index-linked and unit-linked insurance
4. Other life insurance
5. Annuities stemming from non-life insurance contracts and relating to health insurance obligations
6. Annuities stemming from non-life insurance contracts and relating to insurance obligations other than health insurance obligations

NON-LIFE

1. Medical Expenses
2. Income protection
3. Workers' compensation
4. Motor vehicle liability
5. Motor, other classes
6. Marine, aviation and transport
7. Fire and other damage
8. General liability/third party liability
9. Credit and suretyship
10. Legal expenses
11. Assistance
12. Miscellaneous non-life insurance

Best Estimate - nejistota v cash flow projekcích



OČEKÁVANÝ BUDOUCÍ VÝVOJ

– Future developments (demographic, legal, medical, technological, social, environmental and economical) which create uncertainties shall be taken into account

Best Estimate

CHOVÁNÍ POJISTNÍKA

- Assumptions about **contractual option exercise rates** e.g. surrender rates, paid-up rates and annuity take-up rates
- Policyholders' behaviour should **not be assumed independent** from **financial markets**, an undertaking's **treatment of customers** or publicly available information **unless proper evidence** to support the assumption can be observed

JEDNÁNÍ MANAGEMENTU

Best estimate - cash-flow - části

Gross cash in-flows

- Future premiums
- Receivables for salvage and subrogation
- No investment returns

Gross cash out-flows

- Benefits
- Expenses
- Other e.g. taxation payments charged to the policyholder

Benefits

- Claims payments
- Maturity, Death, Disability benefits
- Surrender benefits
- Annuity payments
- Profit sharing

Investments

- Projection of investments is necessary for cash flows of obligations derived from assets
- Example: management fee of 0.5% of fund value
- Investment should be projected consistently with liabilities (“risk free rate”)

Best estimate - cash-flow - budoucí pojistné

Which cash-flows?

- The cash-flow projection used in the calculation of the best estimate shall take account of **all the cash in- and out-flows** required to **settle** the insurance and reinsurance **obligations** over the lifetime thereof
- Only the cash-flows relating to **existing obligations** should be recognized in the solvency balance sheet

Recognition of existing contracts

- Undertaking becomes a **party** of the contract
- Usually when the contract with the policyholder is **legally formalized**
- **Might be earlier than inception** of the insurance cover
- **Tacit renewals** where the cancellation period has already expired

Boundaries of existing contracts

- **All future cash-flows** specified in the terms and conditions should be taken into account in the valuation of the liability
- If a **loss** is expected from **contractual options** (e.g. extension of period, coverage, guaranteed annuities) which the insurer cannot reject or amend, related future premiums (and losses) are to be taken into account with realistic option exercise rates.

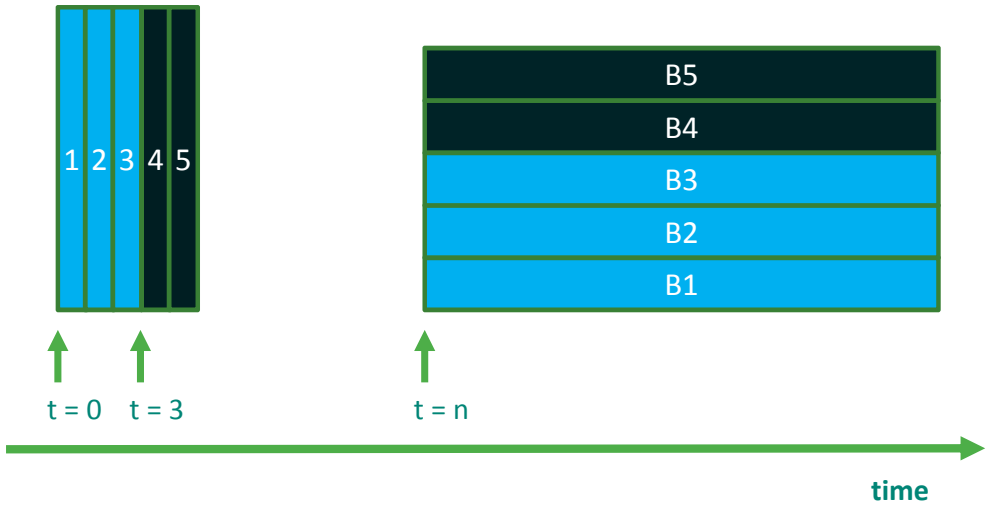
Best estimate - cash-flow - hranice závazků

- The contract boundaries have to be properly reflected within the calculation
- Premiums after the contract boundary as well as obligations arising from that premiums should be excluded from the technical provisions
- Boundaries of the contract defined by the unilateral right of a company to
  - Terminate the contract
  - Reject premiums payable under the contract
  - Amend premiums in a way that they fully reflect the risks

- CZ
  - Life policies with non-life riders
    - Premiums after the renewal (i.e. typically after the first year of projection) should not be considered
    - Negative impact on the BEL (as riders are usually profitable)

Best estimate - cash-flow - hranice závazků - příklad

- Consider a group pension contract.
  - The term of the contract is strictly limited to 3 years, after which a renewal can be negotiated.
  - If the contract ends, the policyholder may surrender the contract or the contract can be made paid-up.
- Each annual premium leads to a series of benefit cash-flows to be paid from the pensionable age (t = n) onwards.
- Premiums 1, 2 and 3 and the corresponding benefits B1, B2 and B3 (blue) are part of the contract and included in the calculation of the technical provisions. Reasonable assumptions should be used for the possible surrender.
- Premiums 4, and 5 and the corresponding benefits B4 and B5 (gray) are not part of the contract and not included in calculation of technical provision, even though they might be expected from a business perspective.



Best estimate - opce a garance

Contractual options

- **Right** to change the benefits (or reduce premium) on the deliberate decision **of the (policy)holder**
- Examples: surrender value option, paid-up policy option, annuity conversion option, policy conversion option, extended coverage option

Financial guarantees

- **Possibility** to **pass losses** to the insurer or **receive additional benefits** (or reduce future premiums)
- Examples: guaranteed invested capital, guaranteed minimum investment return, profit sharing

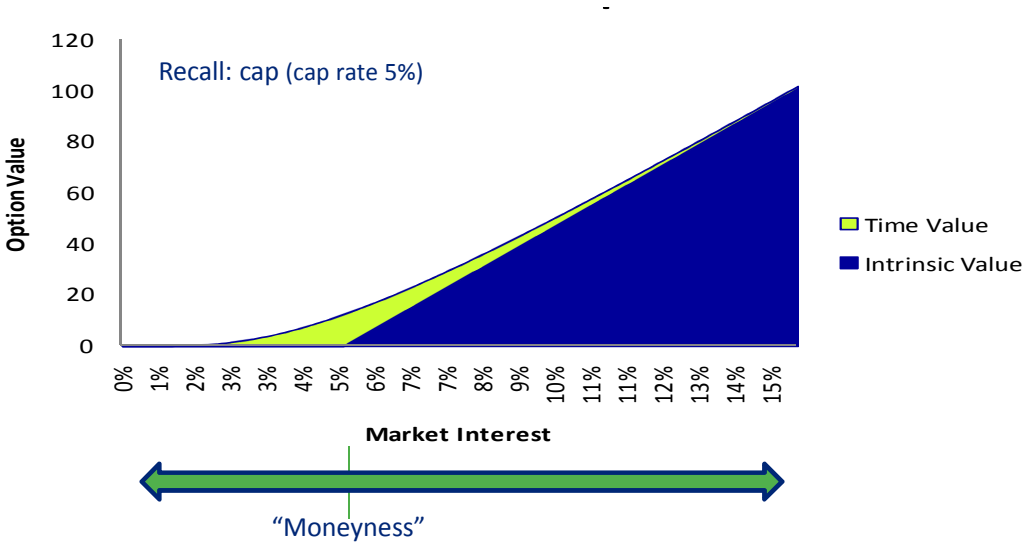
Non-financial guarantees

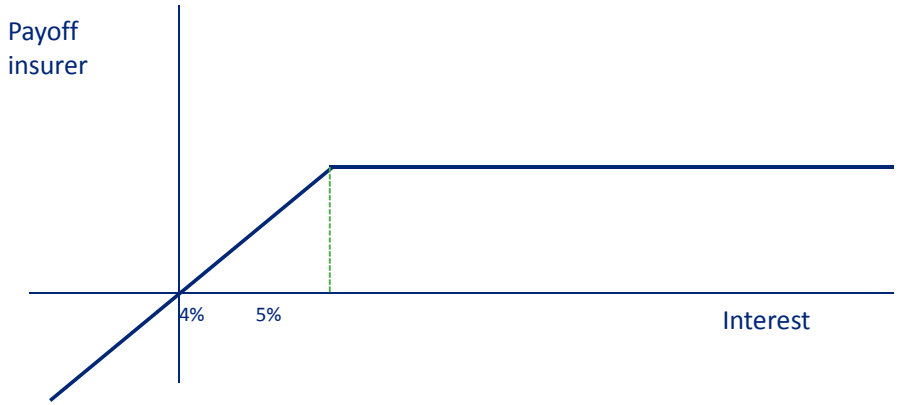
- Benefits driven by the **evolution of non-financial variables**
- Examples: reinstatement premiums in reinsurance, experience adjustments

Methodologies

- **Stochastic approach** (both closed form and stochastic simulation)
- Series of deterministic **projections with attributed probabilities**
- **Deterministic valuation**

- Best estimate - opce a garance -ocenění – příklad profit sharing
  - Consider the following profit sharing rule:
  - x% * (y% * Return – z% * Guaranteed Interest – Margin)
  - For simplicity assume x%=y%=z%=100% and Margin = 1%, for a contract with a guaranteed interest rate of 4% we get the following payoff function:





Best estimate - předpoklady

Consistency

- Consistent with information provided by financial markets
- Consistent with available data on insurance and reinsurance technical risks

Determination

- Set in realistic manner
- Based on credible data
- Derived consistently from year to year without arbitrary changes; the changes and their impact should be quantified , traced, explained and documented

Assumptions consistent with financial markets

- Risk free interest rate
- Exchange rates
- Market inflation rates (consumer price index or sector inflation)
- Economic scenario files (i.e. set of scenarios of correlated market variables)

Undertaking and portfolio specific data

- Assumptions consistent with generally available data on (re)insurance technical risks should be based on characteristics of the portfolio, where possible regardless of undertaking holding portfolio.

Best estimate - předpoklady

BIOMETRICKÉ PŘEDPOKLADY

- Underwriting risk related to human life conditions:
  - Longevity / Mortality
  - Disability / Morbidity
- Mortality vs. Longevity risk :
  - Mortality: risk = the number of deaths > expected
  - Longevity: risk = the number of deaths < expected
  - Best estimate common practice is deterministic, with stochastic approach for reserving of the-value of options and guarantees
  - Underlying assumption is choice of a base mortality table

POŽADAVKY

- Best estimate assumptions should take into account
  - Current observed experience (best estimate at valuation date)
  - Expected change in the future (best estimate of future trend)

Best estimate - předpoklady - náklady

Which expenses?

- Incurred in servicing all **obligations related to existing (re)insurance contracts** over the lifetime thereof
- **Allocated expenses** directly assignable to individual claims, policies or transactions
- **Unallocated (overhead) expenses**: all other expenses which the insurer incurs in settling its obligations assuming that the undertaking continues to write further new business.

Types of expenses

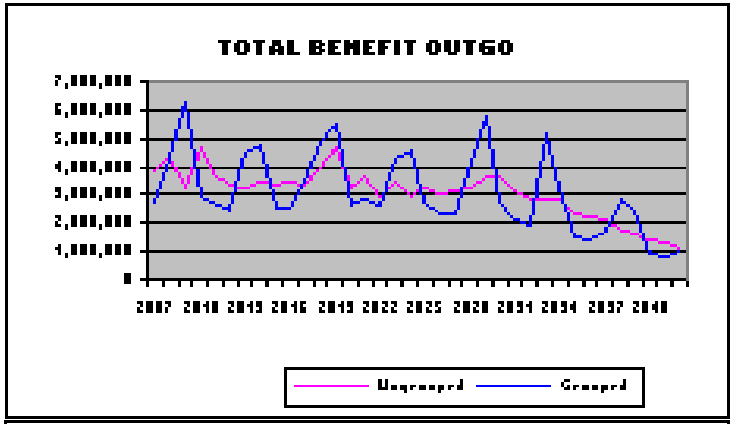
- Administrative expenses
- Investment management expenses
- Claims management expenses / handling expenses
- Acquisition expenses including commissions which are expected to be incurred in the future

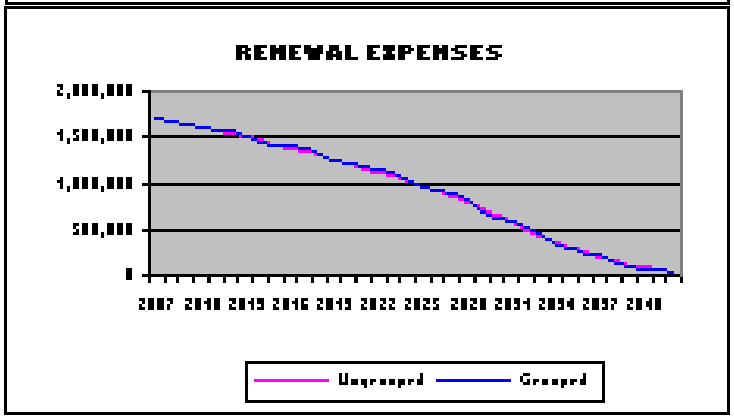
Determination of assumptions

- Non-life: allocation between premium and claims provisions
- Based on own analysis and relevant market data. Allowance for inflation should be consistent with economic assumptions. Allowance for expected future cost increase

Best estimate - životní závazky

EXAMPLE OUTPUT





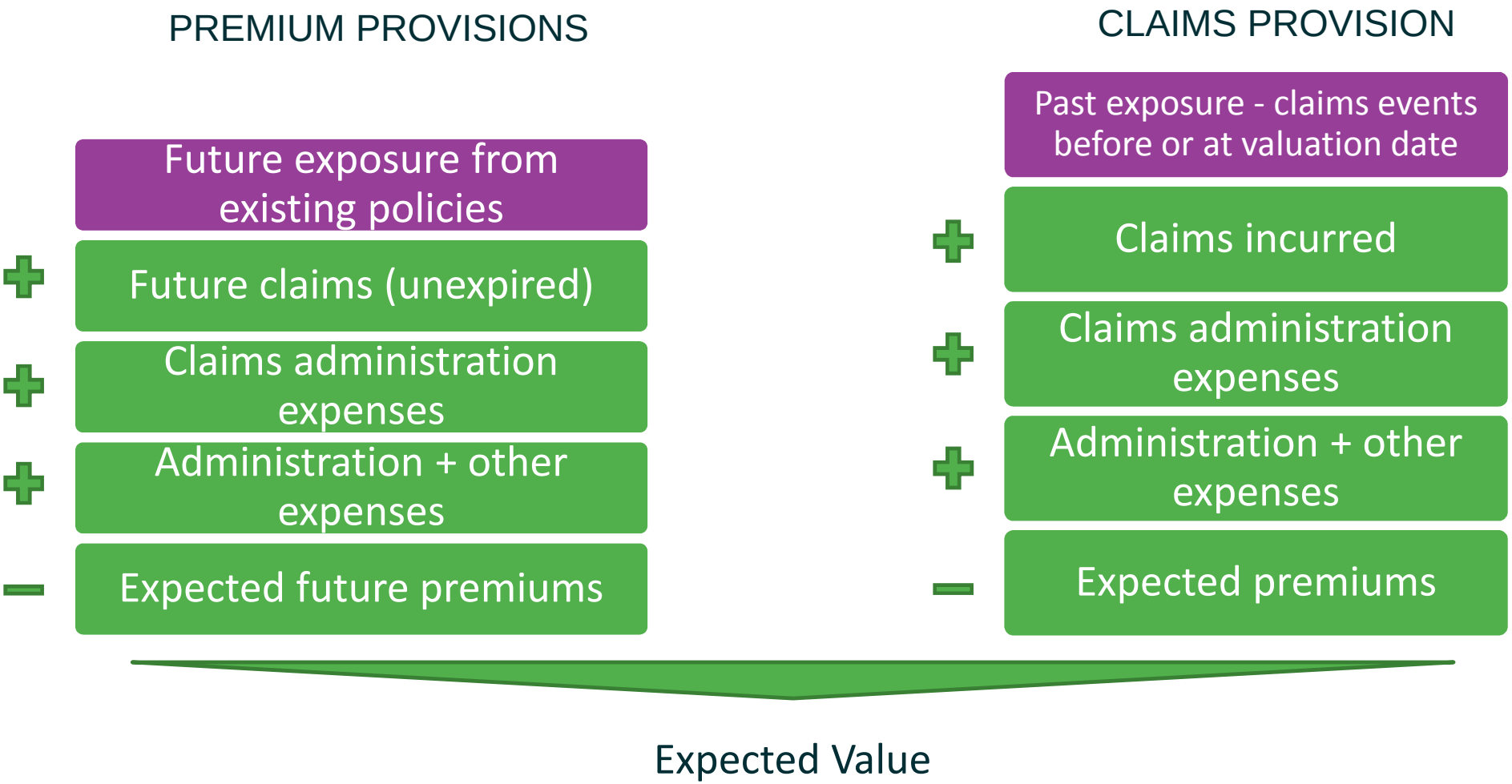
VALUATION

- Cash-flow projection should be based on a **policy-by-policy approach**, but reasonable actuarial methods and approximations may be used
- **Negative best estimates** are allowed and **no surrender floor** assumed

CONDITIONS FOR USING MODEL POINTS

- No significant differences in the nature, scale and complexity of the risks underlying the policies that belong to the same group;
- Grouping does not misrepresent the risk underlying the policies and does not misstate their expenses;
- Grouping likely to give approximately the same results, in particular in relation to financial guarantees and contractual options.

Best estimate – neživotní závazky



Best estimate - výběr modelu

PROPORTIONALITY

- Sound rationale for the choice of one technique over other relevant techniques
- Assessment of the risks underlying obligations - nature, scale and complexity of these risks.
- Assessment of the degree of judgment required in each method and whether the undertaking is able to carry out this judgment in an objective and verifiable way
- To demonstrate that the valuation technique and underlying assumptions are realistic
- Valuation technique should be chosen on the basis of the nature of the liability being valued
- Assumptions shall be validated and reviewed
- Valuation technique and its results is auditable
- Demonstration of appropriateness of grouped data
- Undertaking shall ensure that their capabilities (e.g. actuarial expertise, IT systems) are commensurate with the actuarial and statistical techniques used

LIFE INSURANCE

- Deterministic
- **Simulation** (monte carlo) - more appropriate and robust valuation for participating contracts or other contracts with embedded options and guarantees,

NON-LIFE INSURANCE

- Deterministic (e.g. Chain ladder, Bornhuetter Ferguson, average cost per claims, outliers via case-by-case reserving, stress and scenario testing)
- Analytical techniques (e.g. Black & Scholes, Mack method)
- Stochastic

Best estimate - simplifikace

Proportionality

- Valuation method should be **suitable** to achieve a market consistent valuation - but **not more sophisticated than is needed** in order to reach this objective

Which risks?

- All risks which materially affect the **amount or timing** of cash flows required to settle the obligations (insured risks but also e.g. inflation)

Proportionality assessment

Assess nature, scale and complexity of risks

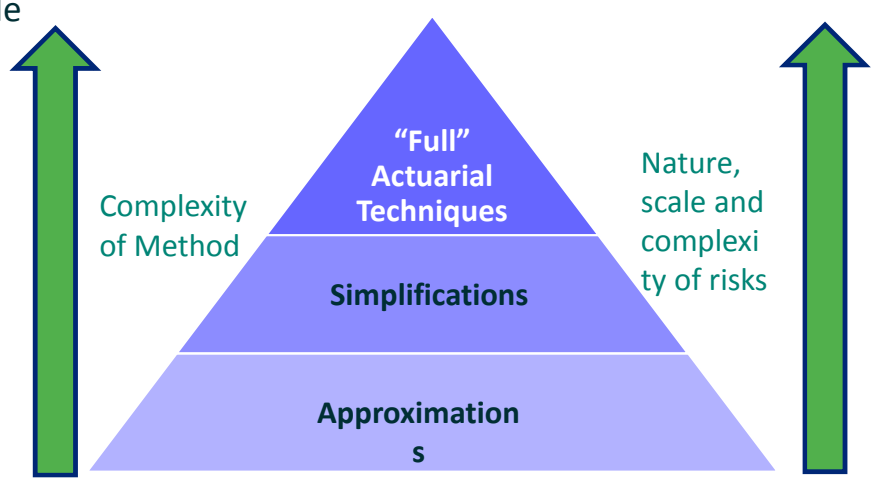
- Principles based
- Undertakings are expected to use an interpretation based on their risk profile

Assessment model error

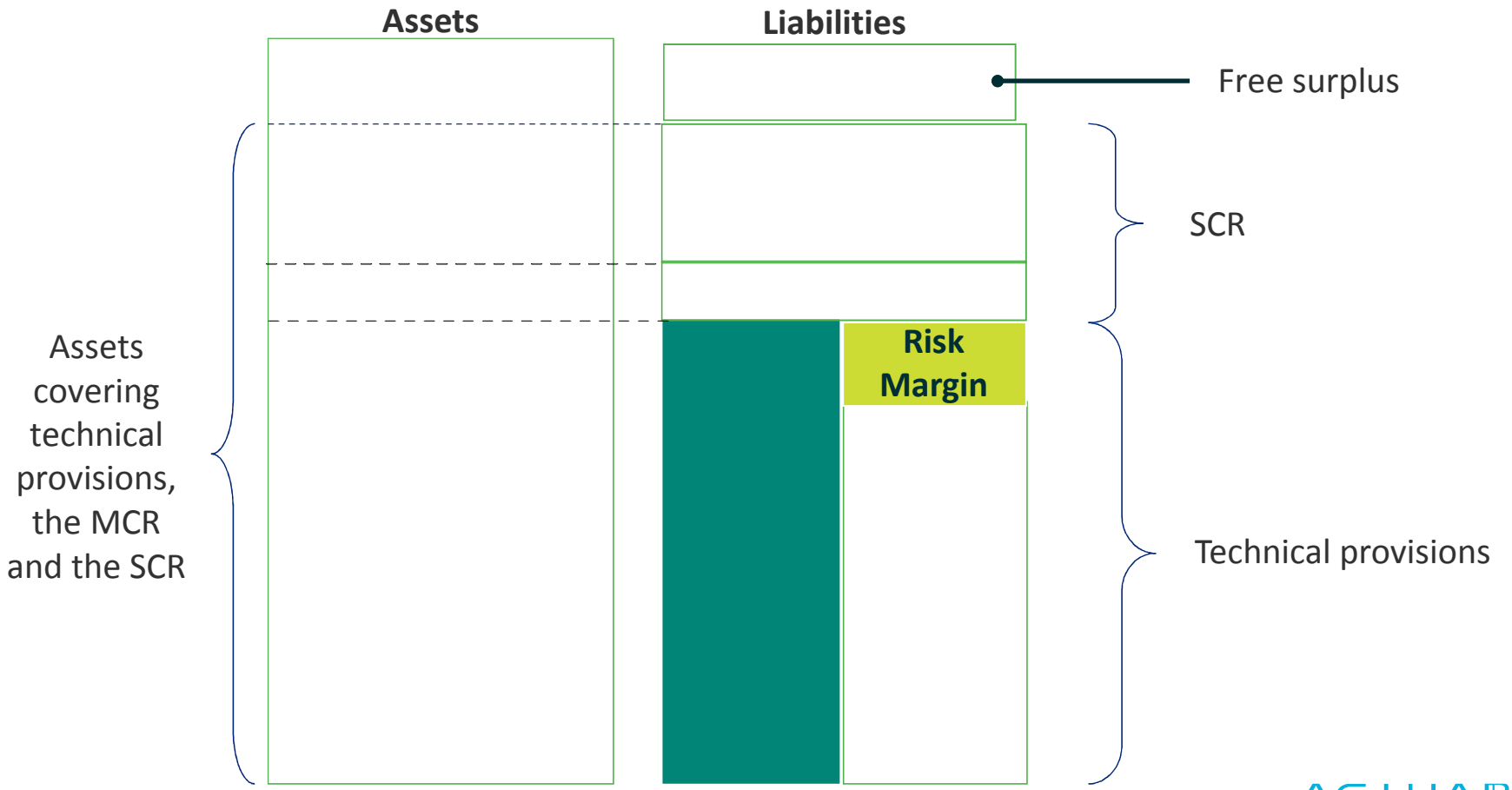
- Adequacy of valuation methodology to nature, scale and complexity of the risks

Back testing

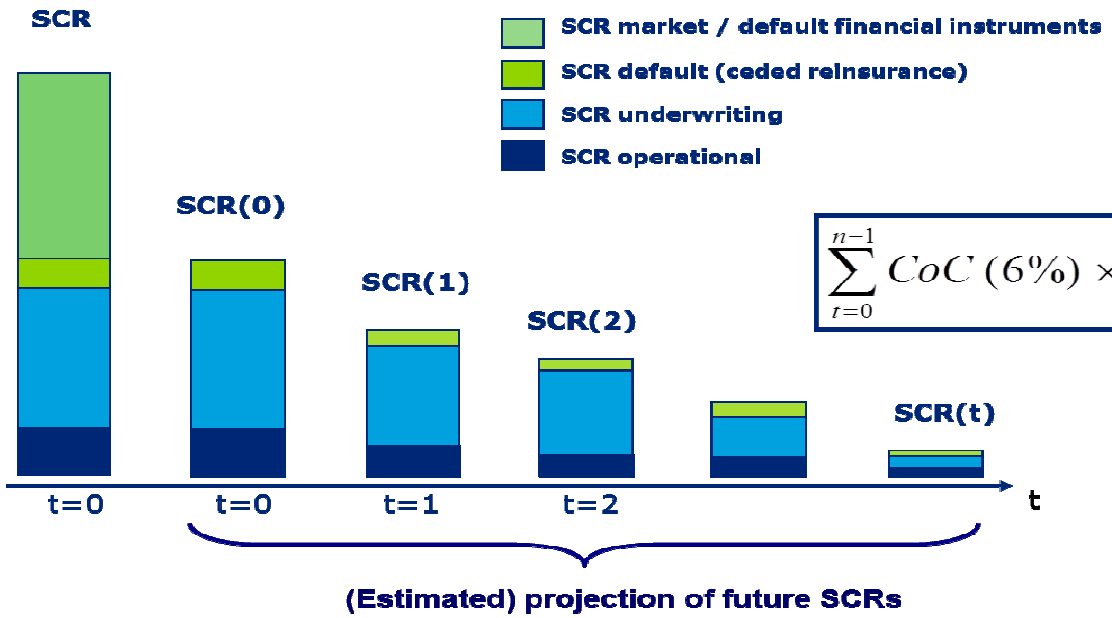
- Part of the actuarial control cycle
- When there is a change in the undertakings' risk profile



Technické rezervy - riziková přirážka



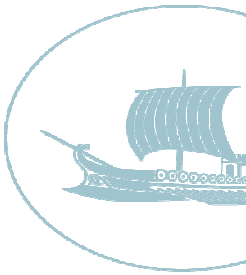
Technické rezervy - riziková přirážka



$$\sum_{t=0}^{n-1} CoC\,(6\%) \times SCR_t \times v^{t+1}$$

- Risk margin should ensure that the amount of technical reserves is equal to the amount, which should be given to another insurance company for taking over the liabilities from the insurance contracts

OBSAH



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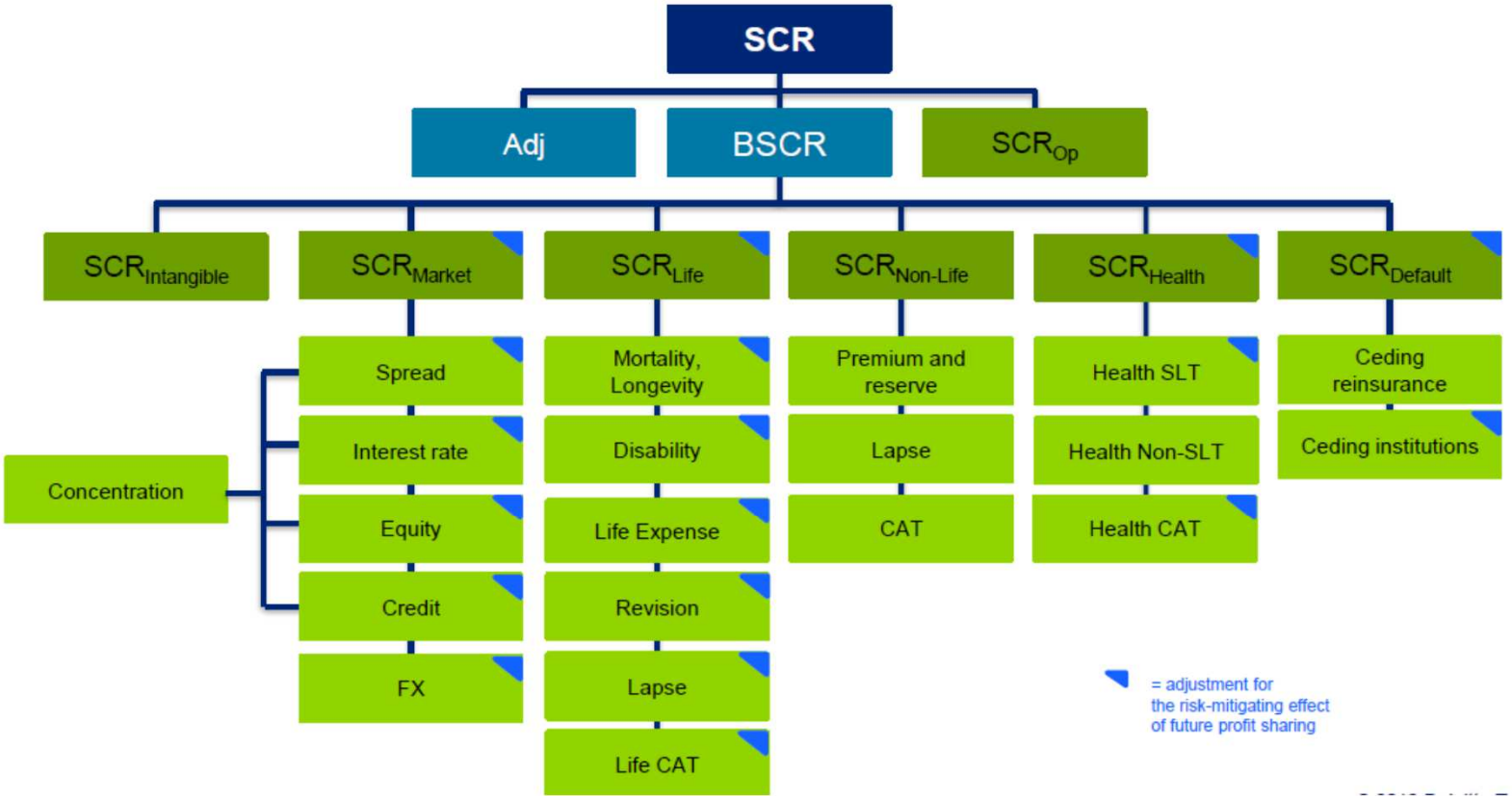
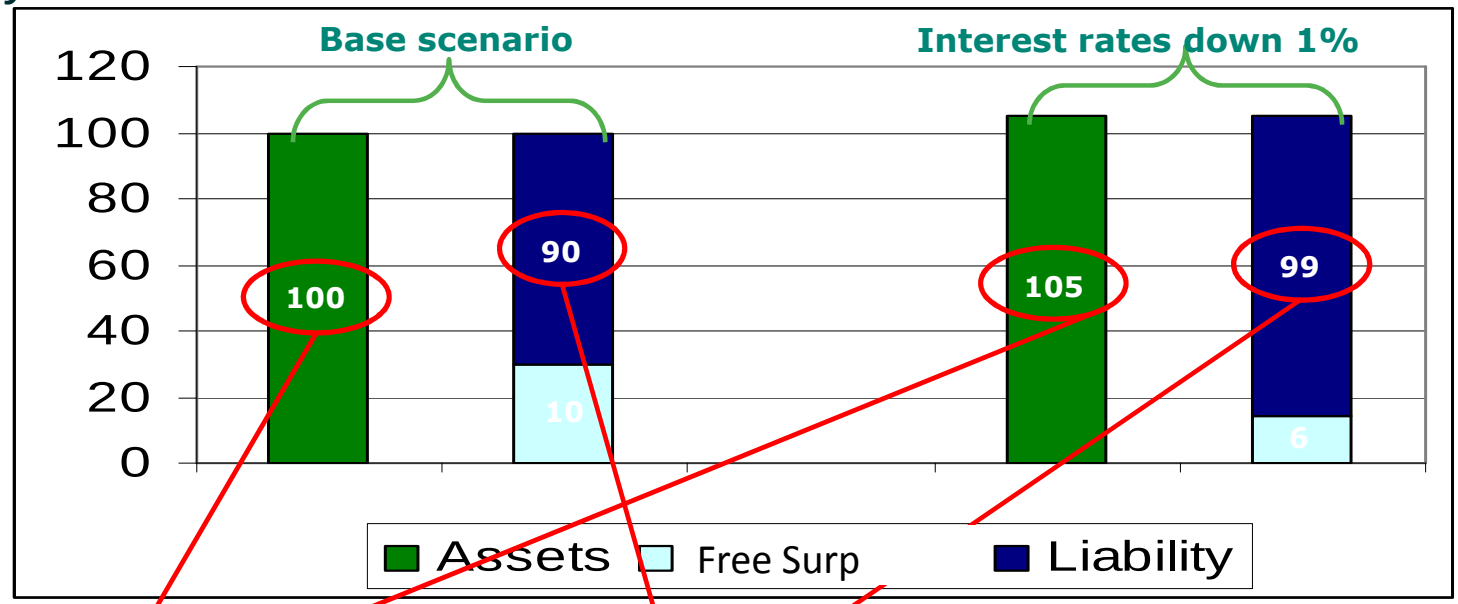
Standardní vzorec SCR - typologie rizik



SCR šoky - Příklad



Asset duration = short
Current MV = 100
Stressed MV = 105

Liab duration = long
Current MV = 90
Stressed MV = 99

Asset increase = 5
Liab increase = 9

Free surplus decrease by 4

SCR
(interest rate fall) =4

SCR – šoky - příklad

Step 1 – Calculate base free surplus:

$$\{\text{free surplus}\}_{base} = \{\text{asset value}\}_{base} - \{\text{technical provision}\}_{base}$$

$$10 = 100 - 90$$

Step 2 – Example: assume that 1 in 200 year event in respect of equity values is a stock market crash of 50%

– Apply this shock to the asset value and the technical provision

– This gives a new (lower) free surplus:

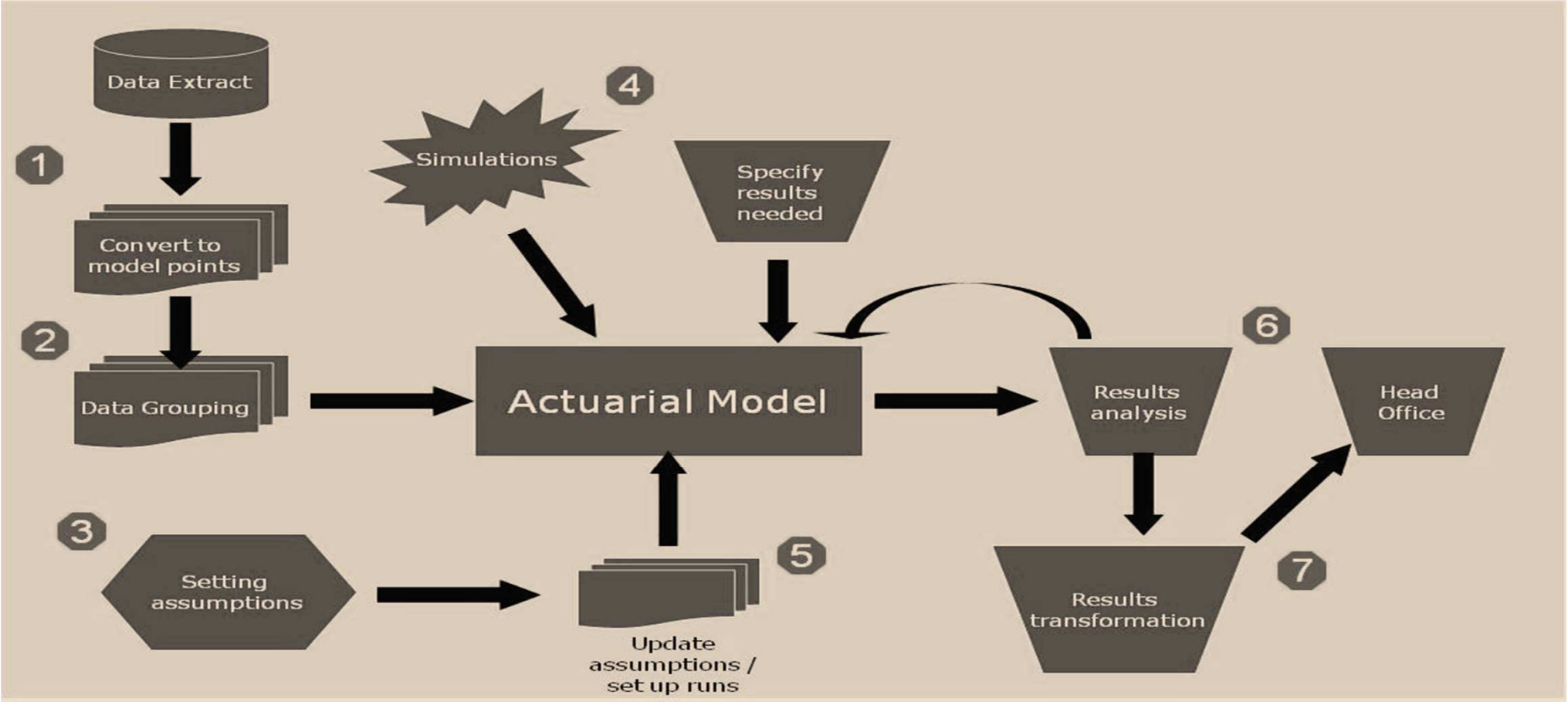
$$\{\text{free surplus}\}_{equity} = \{\text{asset value}\}_{equity} - \{\text{technical provision}\}_{equity}$$

$$7 = 97 - 90$$

Step 3 – $\mathbf{SCR}_{equity} = \{\text{free surplus}\}_{base} - \{\text{free surplus}\}_{equity} = 10 - 7 = 3$

Step 4 – Repeat for each stress test, add up (but some diversification allowed)

Typical Actuarial projection process



Děkuji za pozornost

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