Konzultační materiály CEIOPS

Částečné interní modely (č. 65)

Seminář z aktuárských věd, 30.4.2010

Vladimíra Unzeitigová

Agenda

- Legal Basis – Level 1
- Scope of partial internal models
- Major business units
- Specific provisions for the approval of PIMs
  - Justification of the PIM‘s limited scope
  - Better reflection of the risk profile
  - Integration of PIM results into the standard formula results
- Transitional plans to extend the PIM’s scope
- Policy options regarding the integration of PIMs
- Examples of techniques to integrate PIMs
- Adaptations to standards
- Risks not covered in the standard formula

Legal Basis I

Level 1 Text for internal models: Articles 112 – 127 of Directive

Article 112 (General provisions for the approval)

- (Re)insurance undertakings may calculate their SCR by a full or partial internal model
- Partial internal models can be used for:
  - One or more risk modules, sub-modules
  - Operational risk
  - Adjustment for the loss-absorbing capacity of technical provisions and deferred taxes
- Applied to:
  - The whole business
  - One or more major business units
- Undertakings have to provide documentary evidence that the internal model meets all requirements (A 120-125)

Legal Basis II

Article 112 (cont´d)

- Supervisory authority shall decide within six months
- Supervisory authority shall give approval only if satisfied
- A decision to reject the application shall state the reasons
- After approval supervisory authority may require SCR estimate according to standard formula

Article 113 (Specific provisions for the approval)

- Proper justification for limited scope of model
- Resulting SCR reflects more appropriately risk profile
- Consistent with basic principles (Subsection 1) to allow full integration to SCR standard formula
- Transitional plan to extend scope of model may be required

Legal Basis III

- Subsection 1 Article 101 (Calculation of SCR)
  - Going concern principle
  - All quantifiable risks have to be taken into account
  - Unexpected losses of existing business and new business of next 12 months
  - Corresponds to VaR of basic own funds (confidence level of 99.5% over 1y)
  - Shall cover at least L, NL and health underwriting risk, market, credit and operational risk
  - Taking account of risk mitigation techniques

Legal Basis IV

Article 115-119

- Policy for changing the model part of the approval process
- Administrative, management or supervisory bodies
  - approve the application
  - approve any subsequent major changes
  - have responsibility for putting in place systems ensuring that IM operates properly on a continuous basis
- Reversion back to the standard formula
- Undertaking cease to comply with requirements (A 120-125)
  - have to present a plan of restoration or demonstrate immateriality
  - when fails implement the plan, may be required to revert to standard formula
- Significant deviations from the assumptions underlying tha standard formula
  - authority may require to use IM

Legal Basis V

Article 120-126

- Use test
- Statistical quality standards
- Calibration standards
- Profit and loss attribution
- Validation standards
- Documentation standards
- External models and data

Legal Basis VI

Legal basis for the Level 2 implementing measures

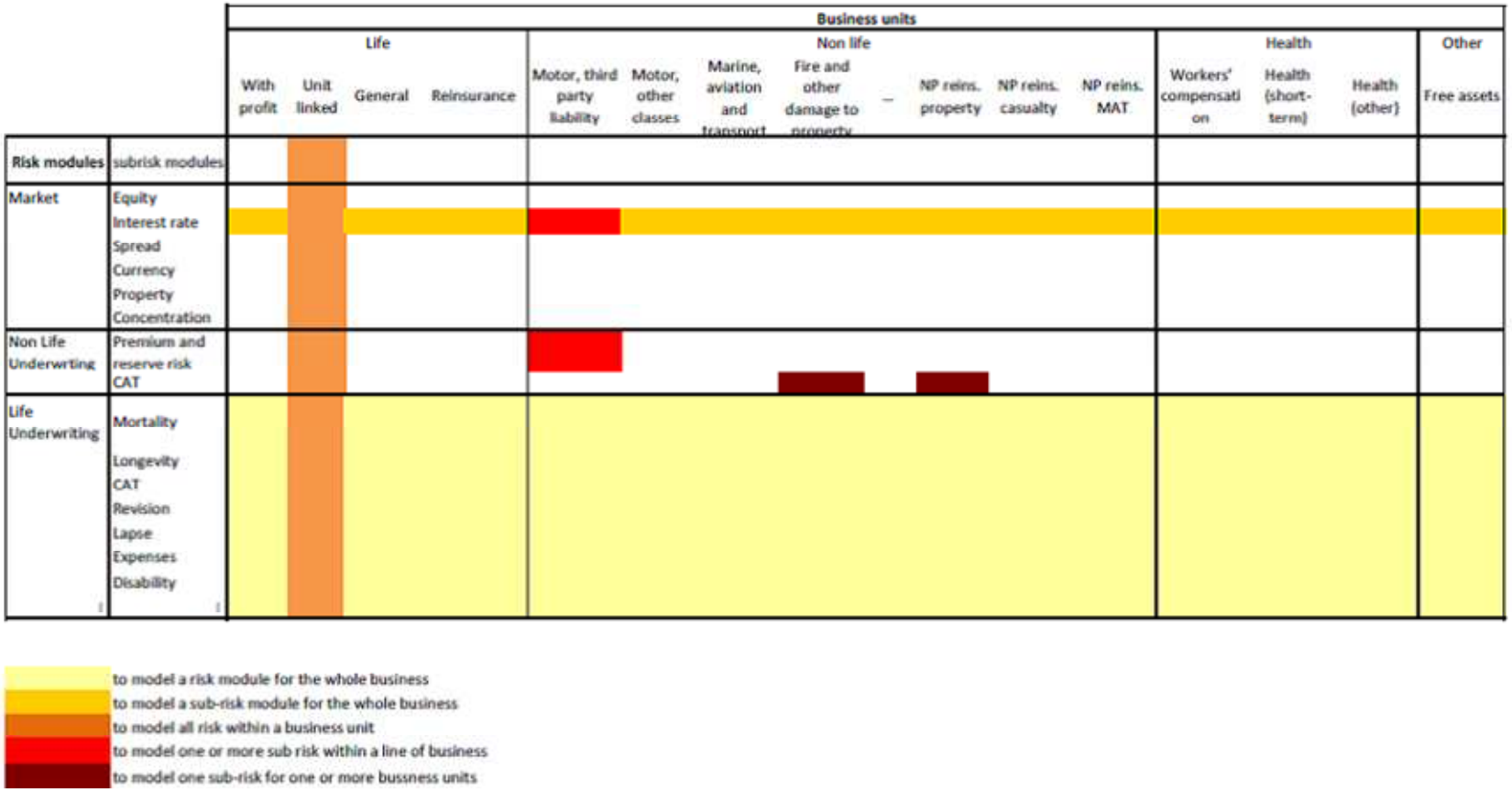
- Article 114 and 127 (Implementing measures)
  - Set out procedure for approval of internal models
  - Adaptations to standards to take account of the limited scope of application of PIMs

Scope of partial internal models I

- Undertakings may use the PIM to model:
  - One or more risk modules for the whole business
  - One or more risk modules for one or more major business units
  - One or more risk sub-modules for the whole business
  - One or more risk sub-modules, in the same or different risk modules, for one or more major business units
  - The adjustment for the loss-absorbing capacity of tech. prov. and deferred taxes for the whole business or for one or more major business units
  - The capital requirement for operational risk for the whole business or for one or more major business units

Scope of partial internal models II

- Taking as an example the risk modules and business units as expressed in the standard formula, there are different levels of granularity to which PIMs can be applicable:



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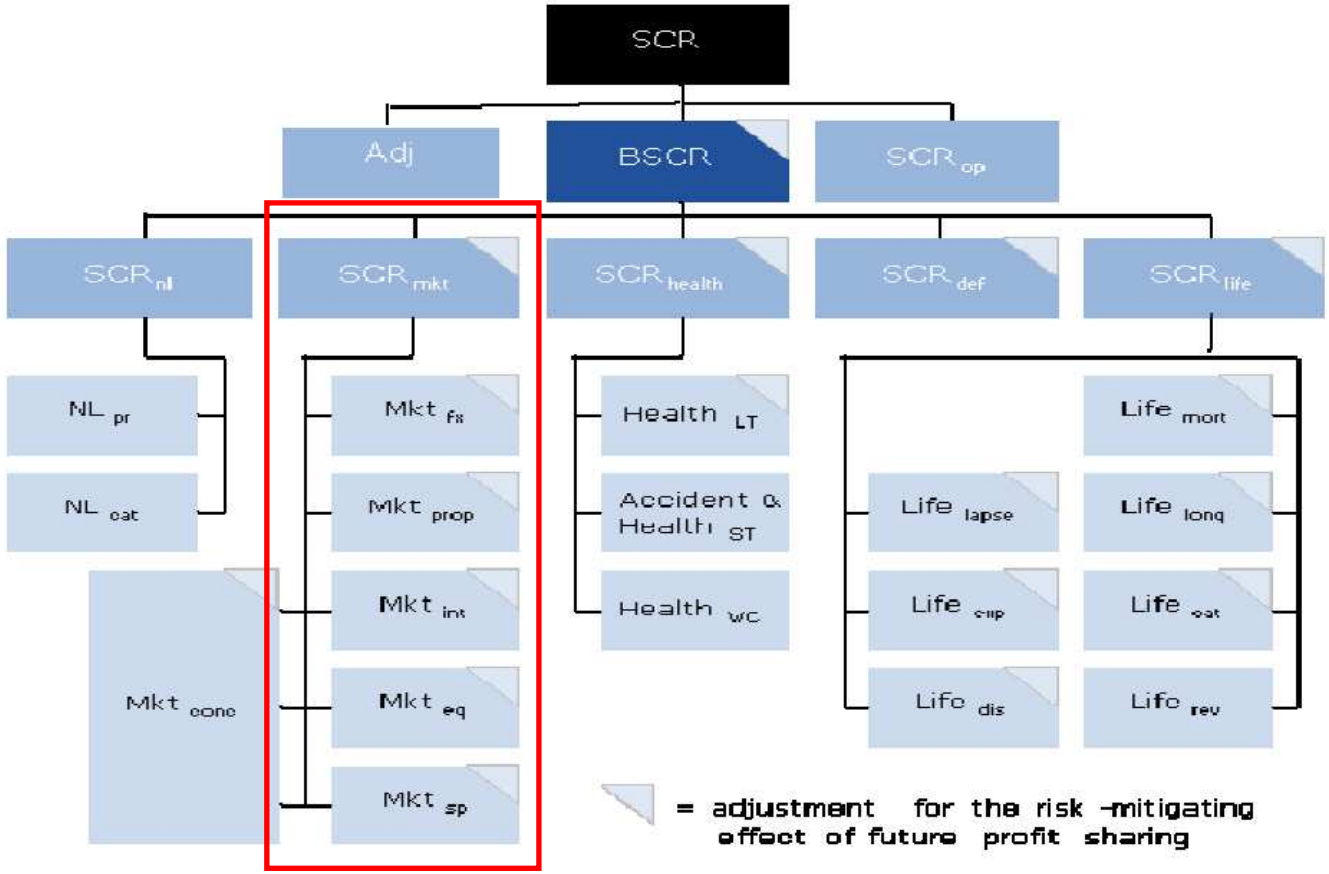
Scope of partial internal models III

- Undertakings may use different risk categorizations than in the standard formula e.g.
  - Modeling risks not covered by the standard formula
  - Using a different time period or risk measure
  - Not following a modular structure
- Some examples of PIMs are given in the following slides

1a) Modeling one risk module

1a
1b1
1b2
1c2
2a
2b1
2b2
2c1
2c2
3a1
3b1
4
5
6
7
8
10
18
19



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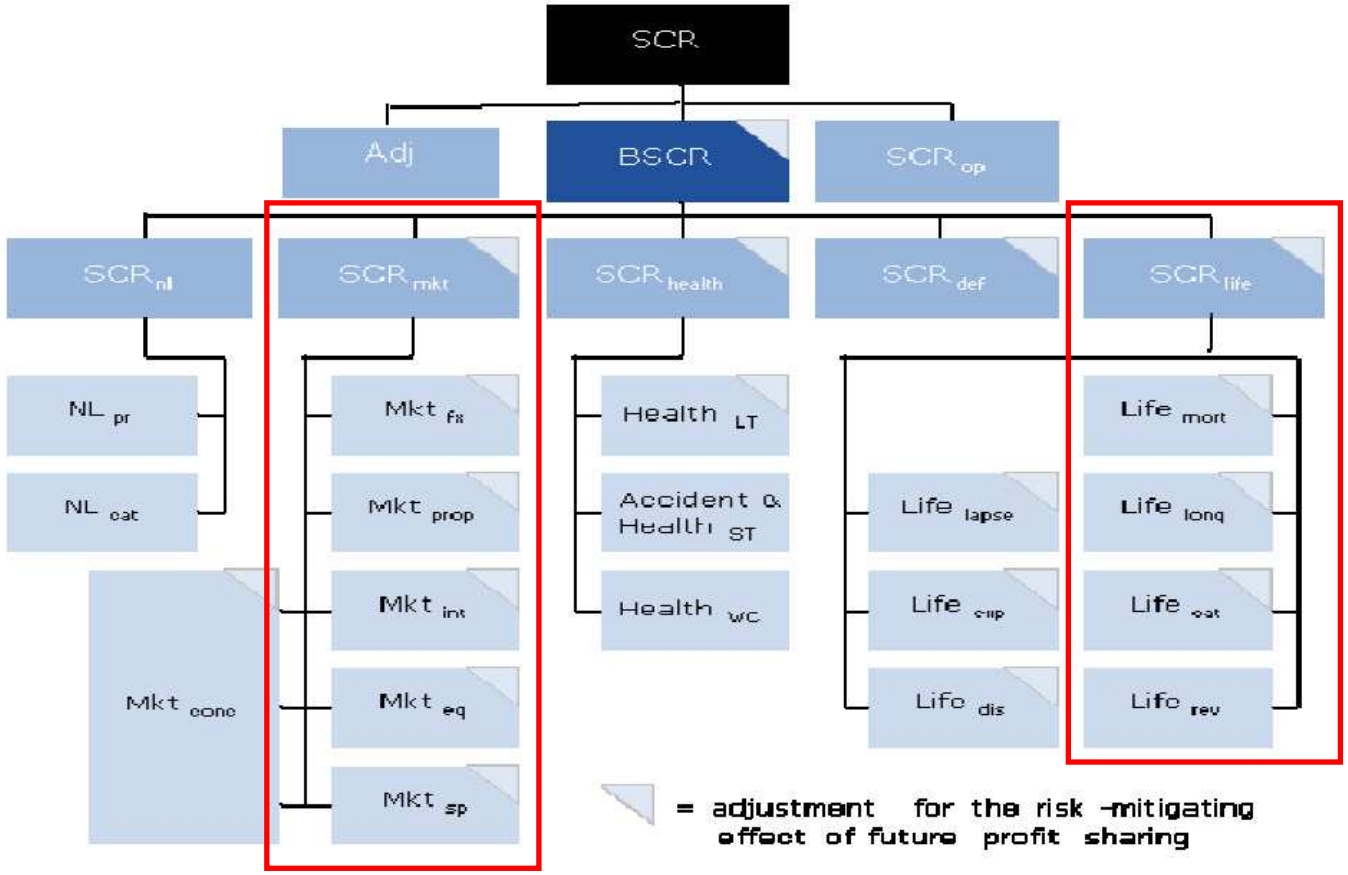
1b1) Modeling two (or more) risk modules separately

1a
1b1
1b2
1c2
2a
2b1
2b2
2c1
2c2
3a1
3b1
4
5
6
7
8
10
18
19



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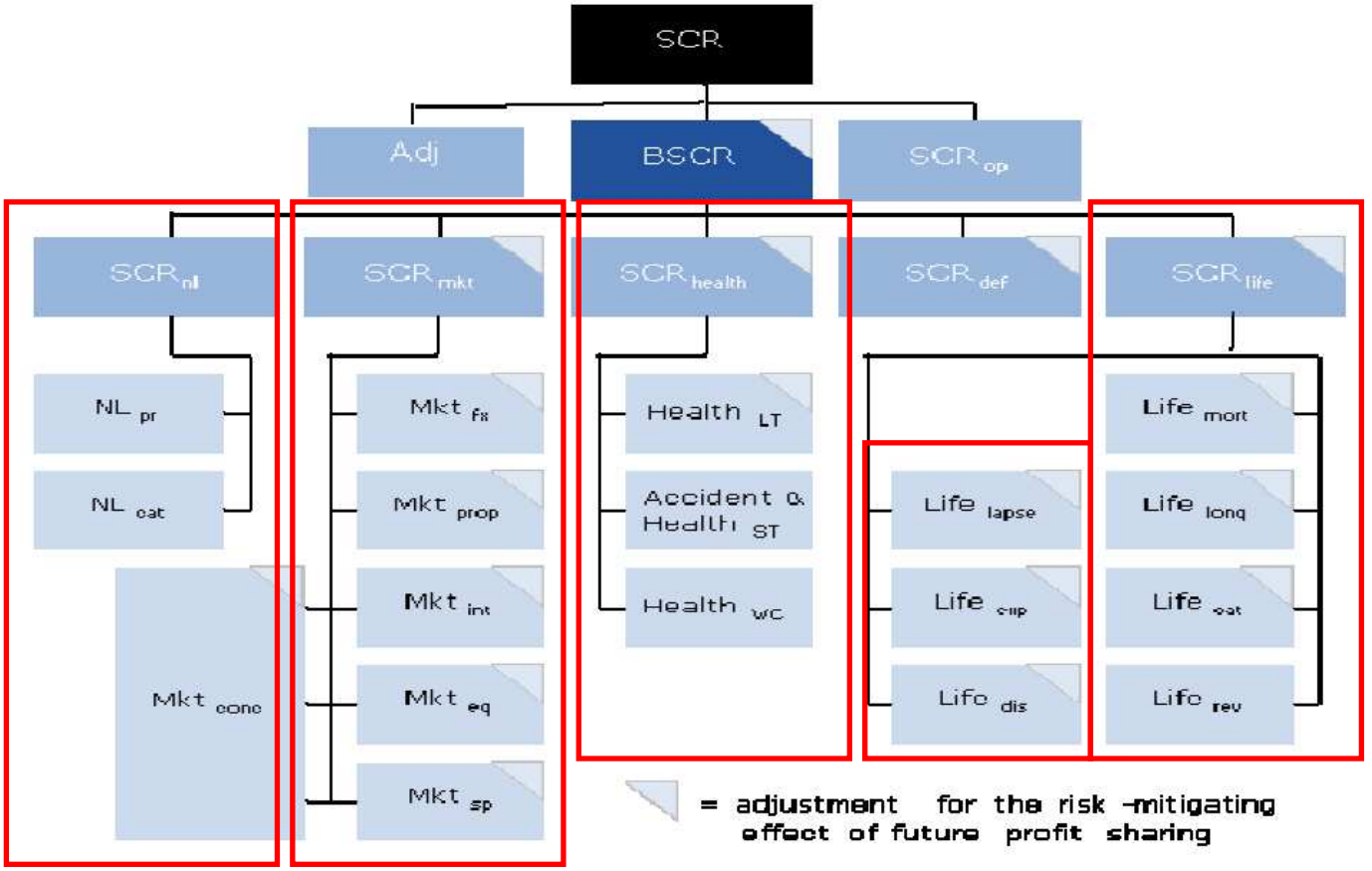
1b2) Modeling two (or more) risk modules separately

1a
1b1
1b2
1c2
2a
2b1
2b2
2c1
2c2
3a1
3b1
4
5
6
7
8
10
18
19



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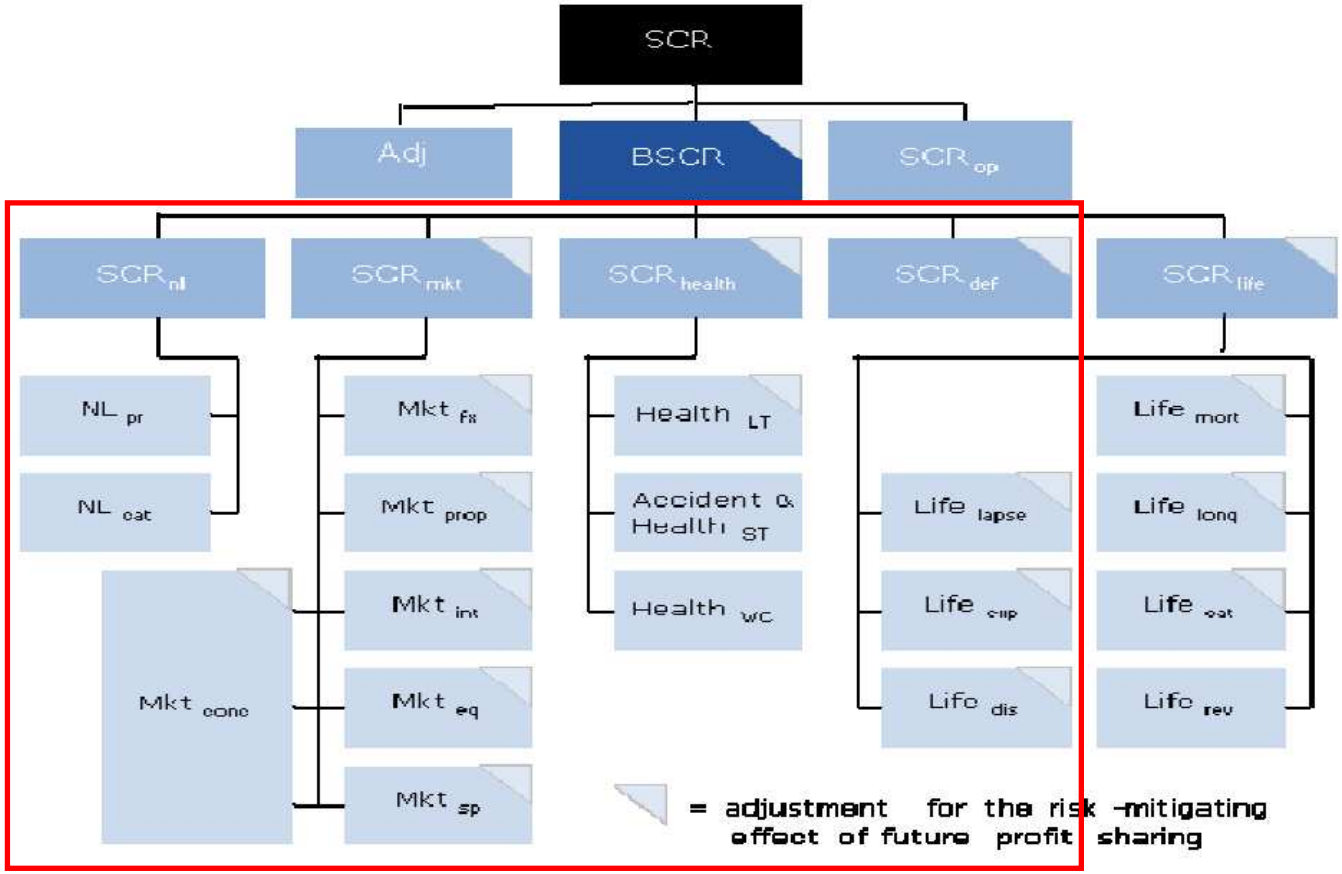
1c2) Modeling two (or more) risk modules jointly

1a
1b1
1b2
1c2
2a
2b1
2b2
2c1
2c2
3a1
3b1
4
5
6
7
8
10
18
19



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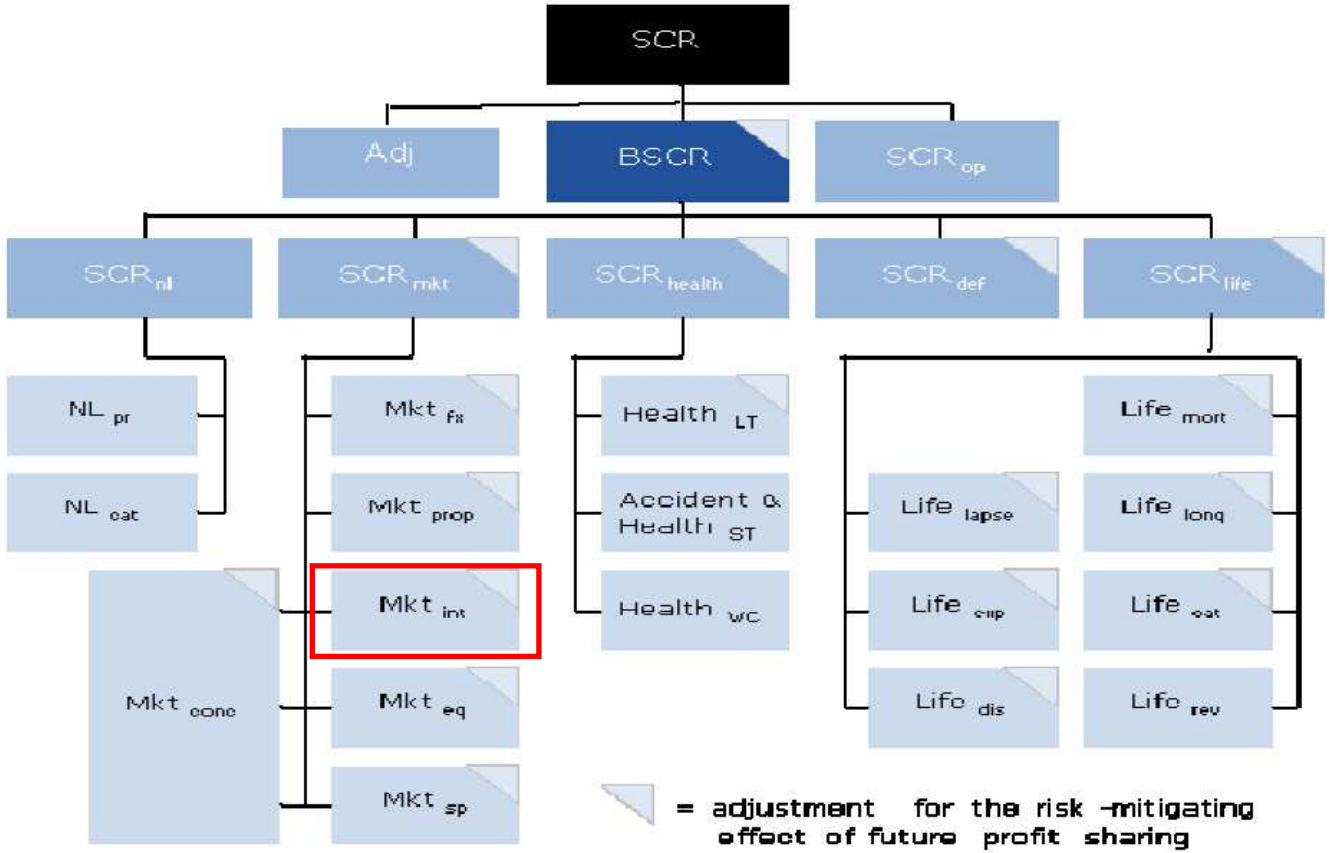
2a) Modeling one risk sub-module

1a
1b1
1b2
1c2
2a
2b1
2b2
2c1
2c2
3a1
3b1
4
5
6
7
8
10
18
19



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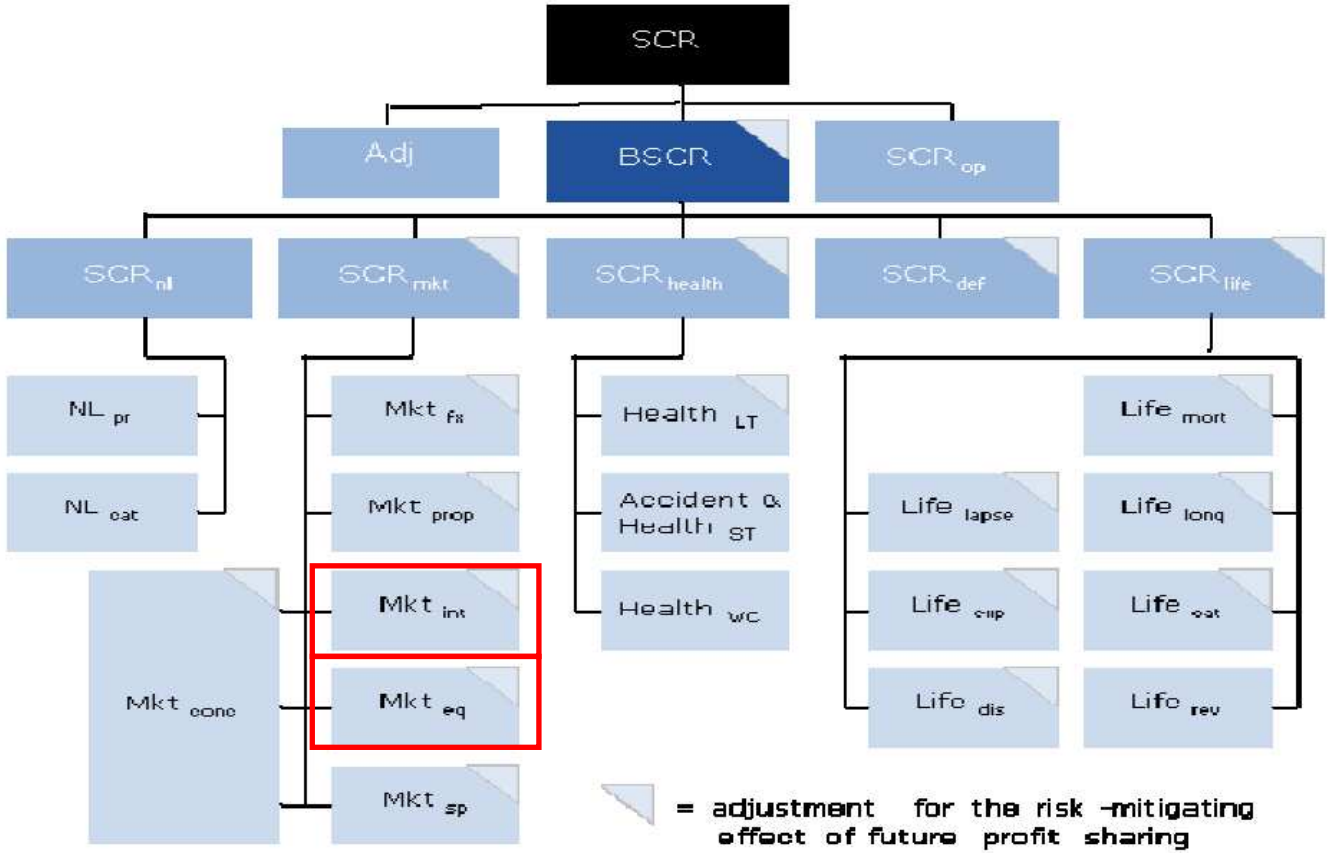
2b1) Modeling two (or more) risk sub-modules within the same risk module separately

1a
1b1
1b2
1c2
2a
2b1
2b2
2c1
2c2
3a1
3b1
4
5
6
7
8
10
18
19



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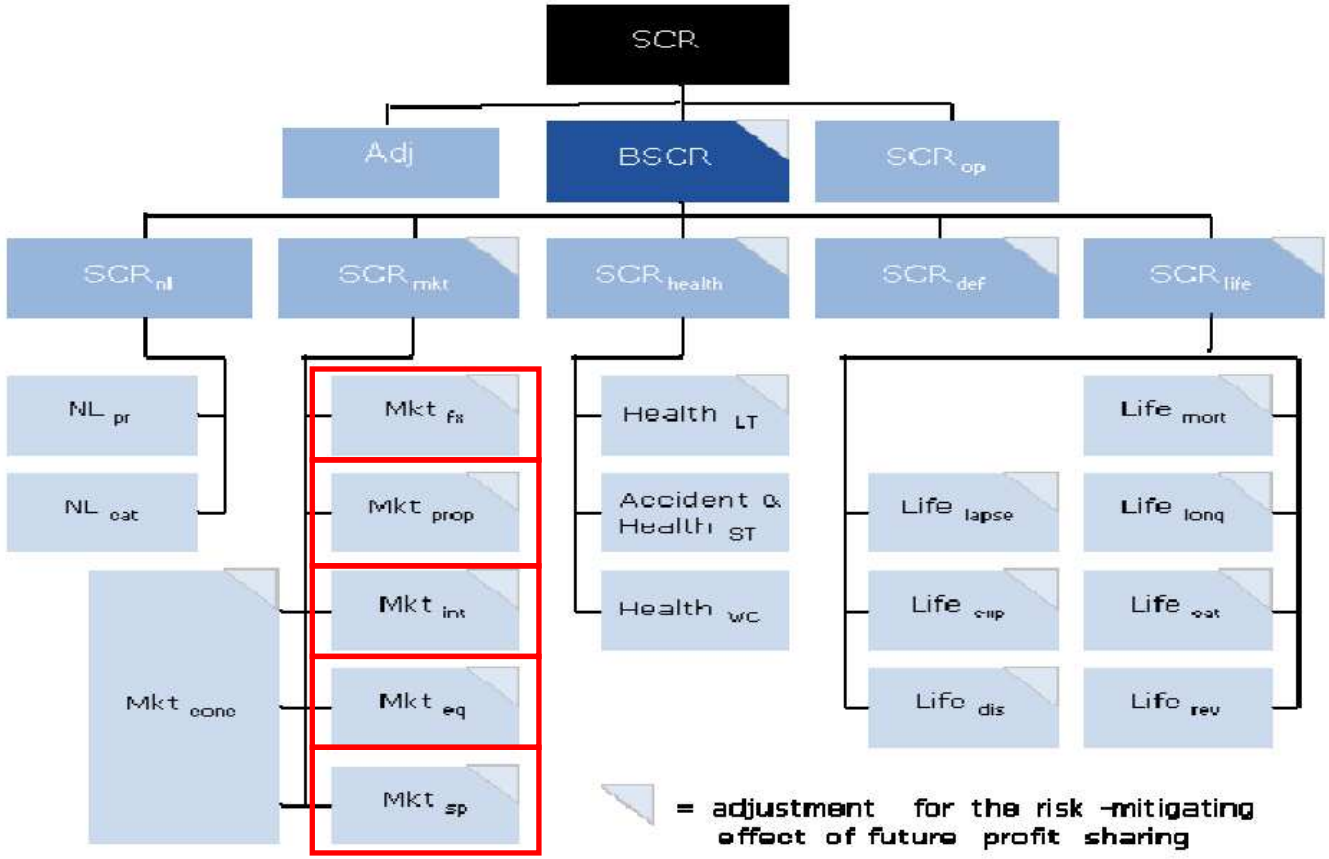
2b2) Modeling two (or more) risk sub-modules within the same risk module separately

1a
1b1
1b2
1c2
2a
2b1
2b2
2c1
2c2
3a1
3b1
4
5
6
7
8
10
18
19



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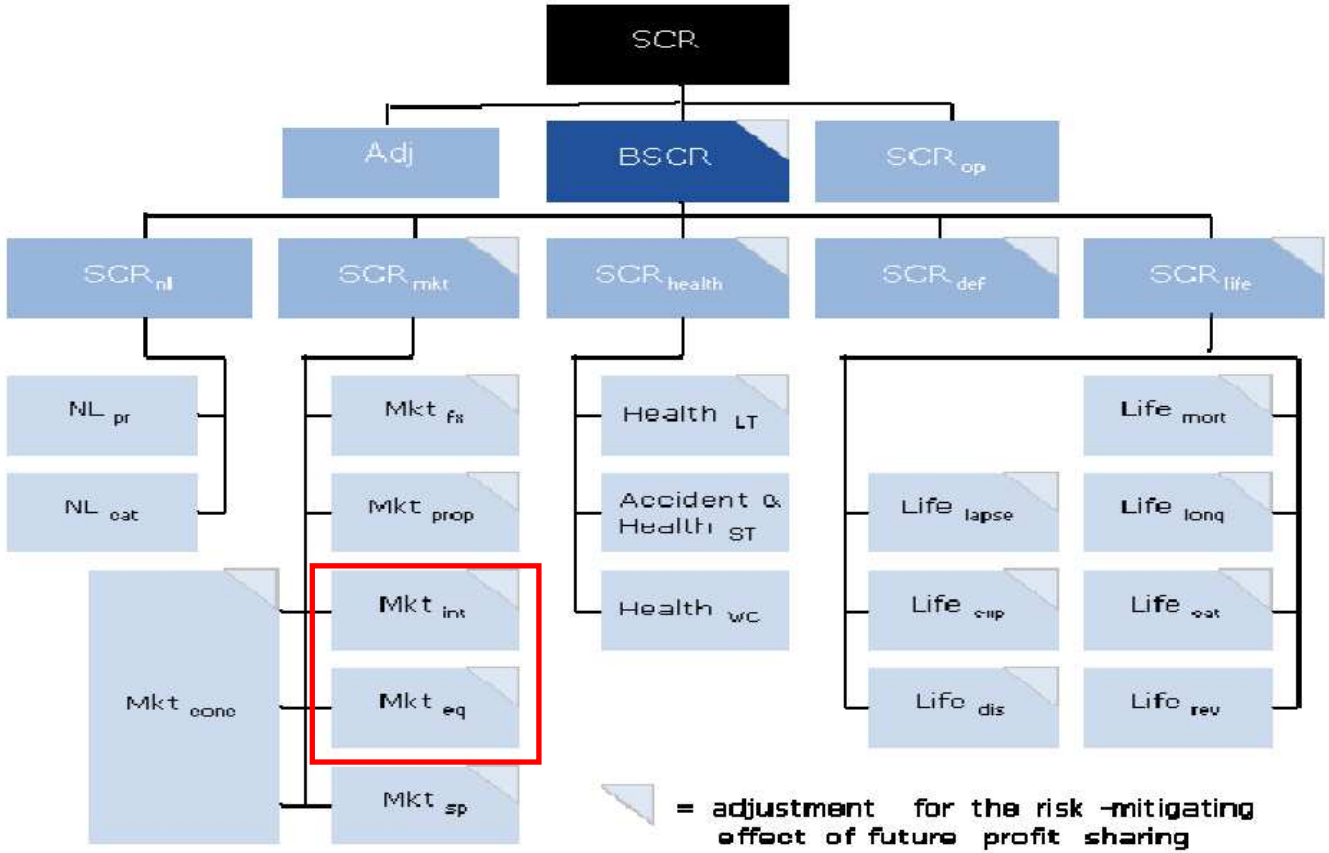
2c1) Modeling two (or more) risk sub-modules within the same risk module jointly

1a
1b1
1b2
1c2
2a
2b1
2b2
2c1
2c2
3a1
3b1
4
5
6
7
8
10
18
19



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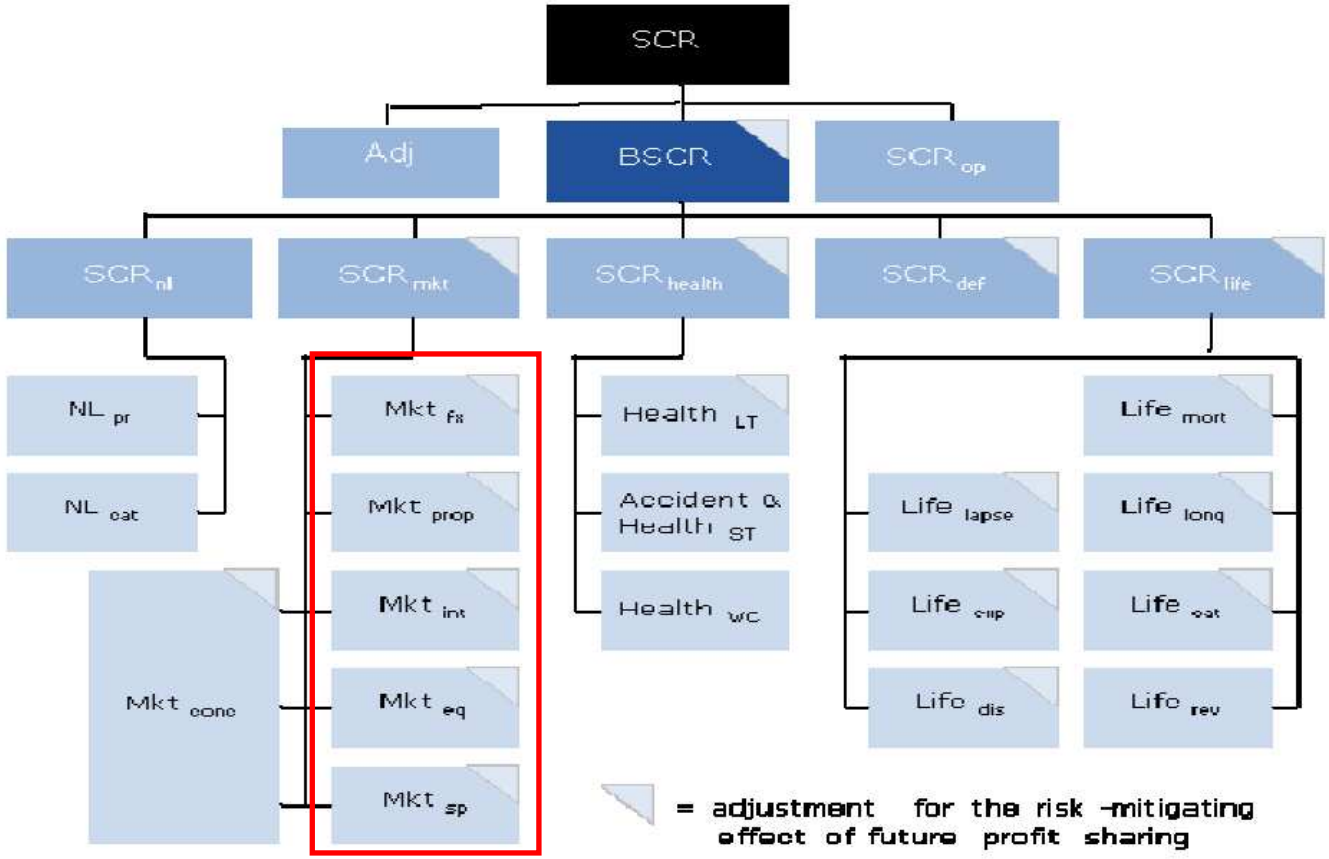
2c2) Modeling two (or more) risk sub-modules within the same risk module jointly

1a
1b1
1b2
1c2
2a
2b1
2b2
2c1
2c2
3a1
3b1
4
5
6
7
8
10
18
19



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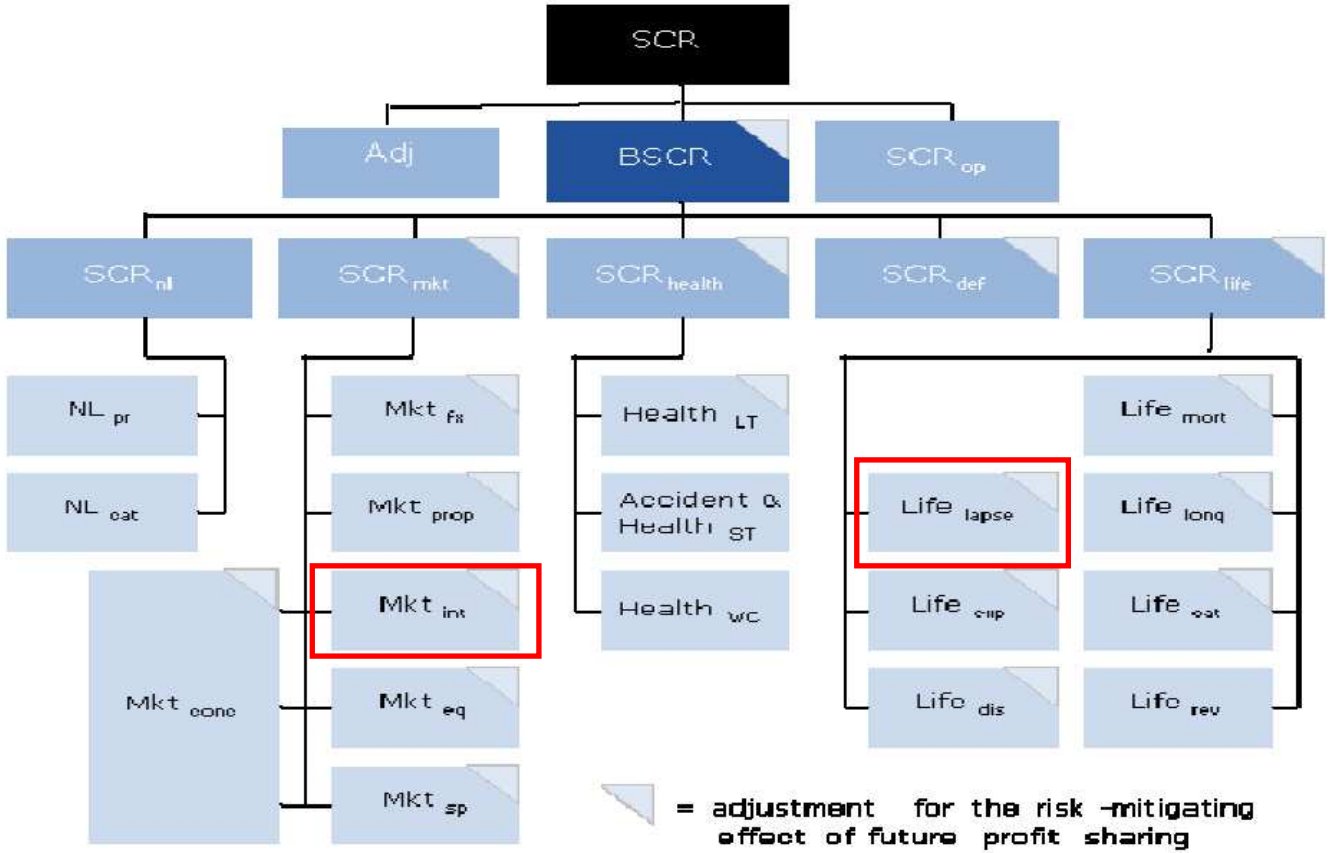
3a1) Modeling two (or more) risk sub-modules from different risk modules separately

1a
1b1
1b2
1c2
2a
2b1
2b2
2c1
2c2
3a1
3b1
4
5
6
7
8
10
18
19



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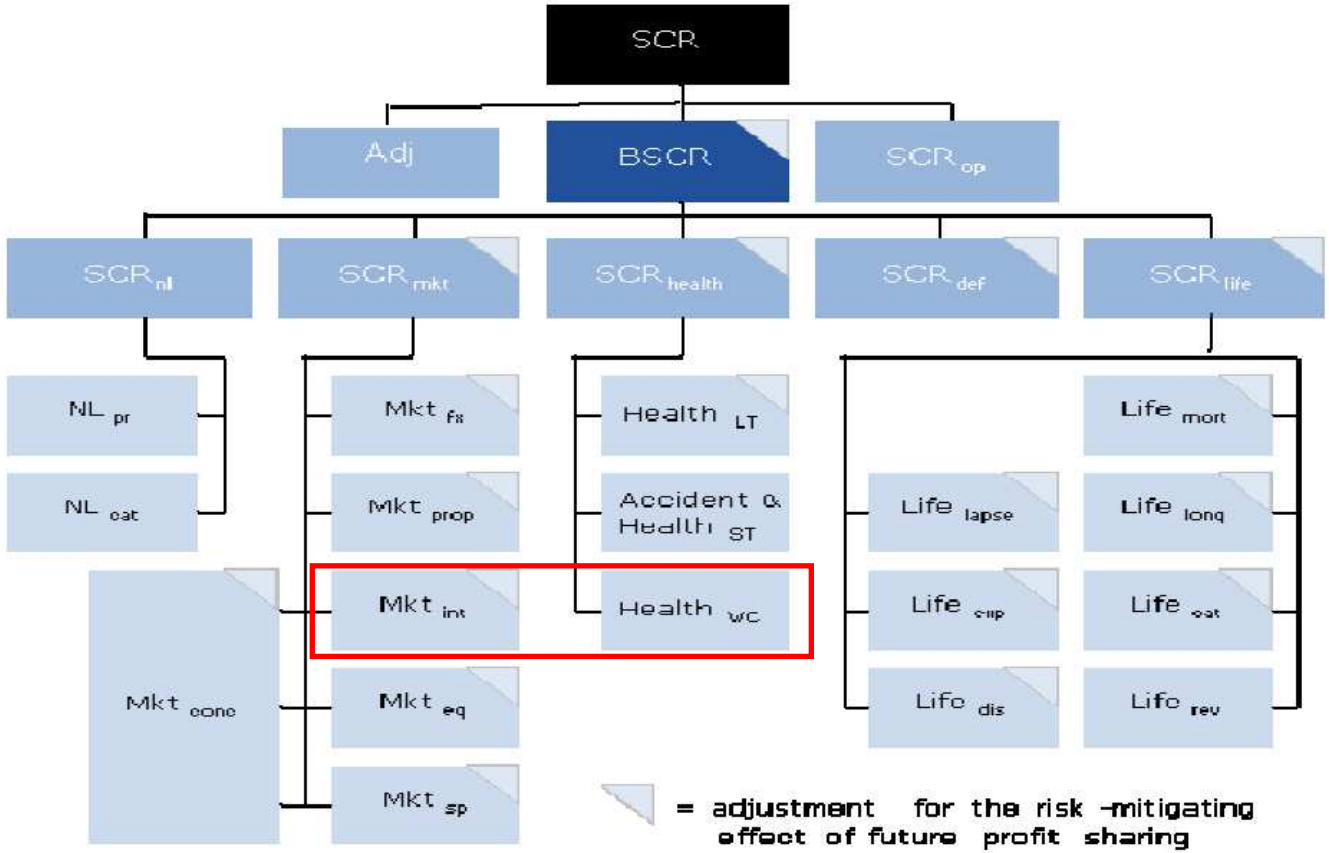
3b1) Modeling two (or more) risk sub-modules from different risk modules jointly

1a
1b1
1b2
1c2
2a
2b1
2b2
2c1
2c2
3a1
3b1
4
5
6
7
8
10
18
19



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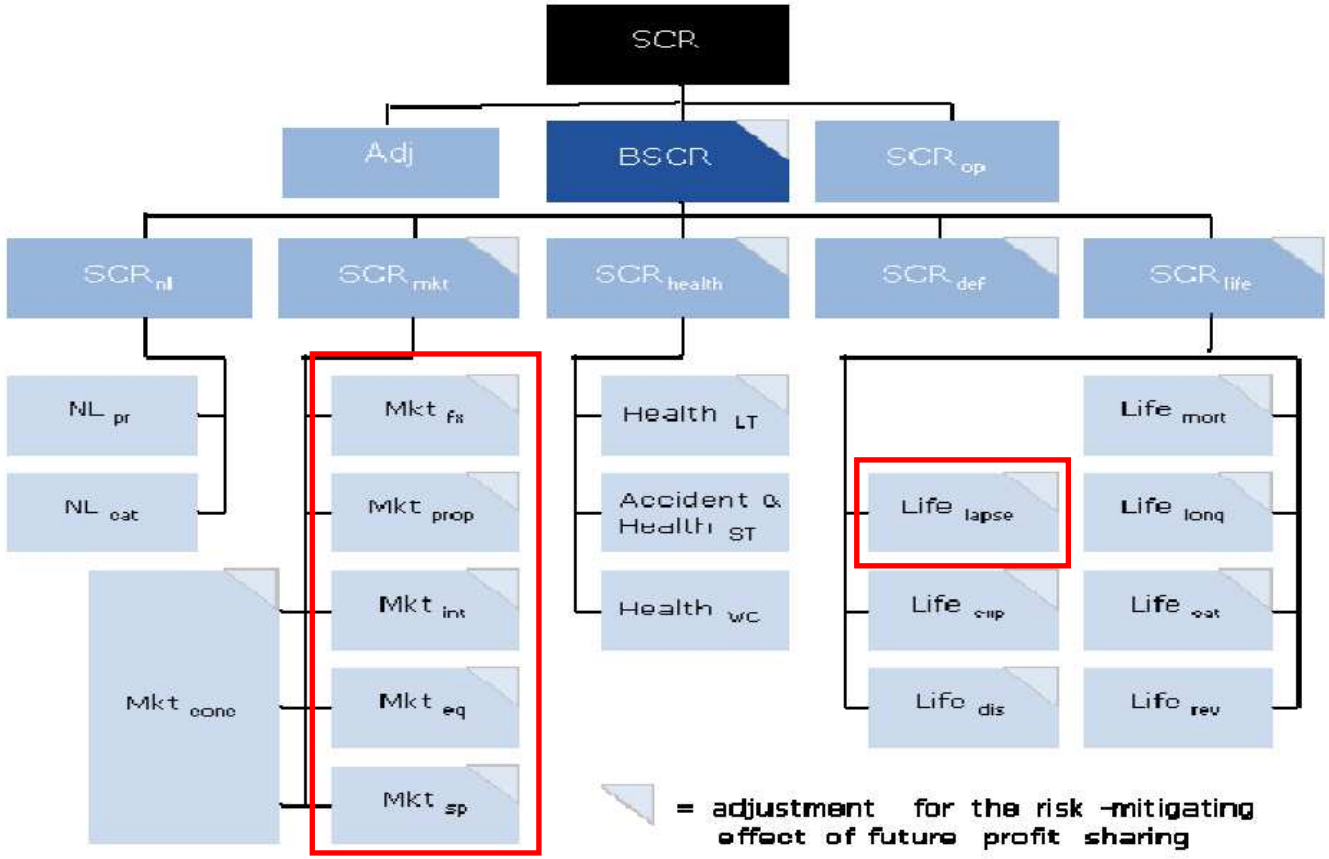
4) Modeling one (or more) risk module and one (or more) risk sub-module from a different module

1a
1b1
1b2
1c2
2a
2b1
2b2
2c1
2c2
3a1
3b1
4
5
6
7
8
10
18
19



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5) Different risk categorization either modules/sub-modules from the same/different risk module (e.g. credit risk = counterparty default + spread risk +migration risk)

1a
1b1
1b2
1c2
2a
2b1
2b2
2c1
2c2
3a1
3b1
4
5
6
7
8
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18
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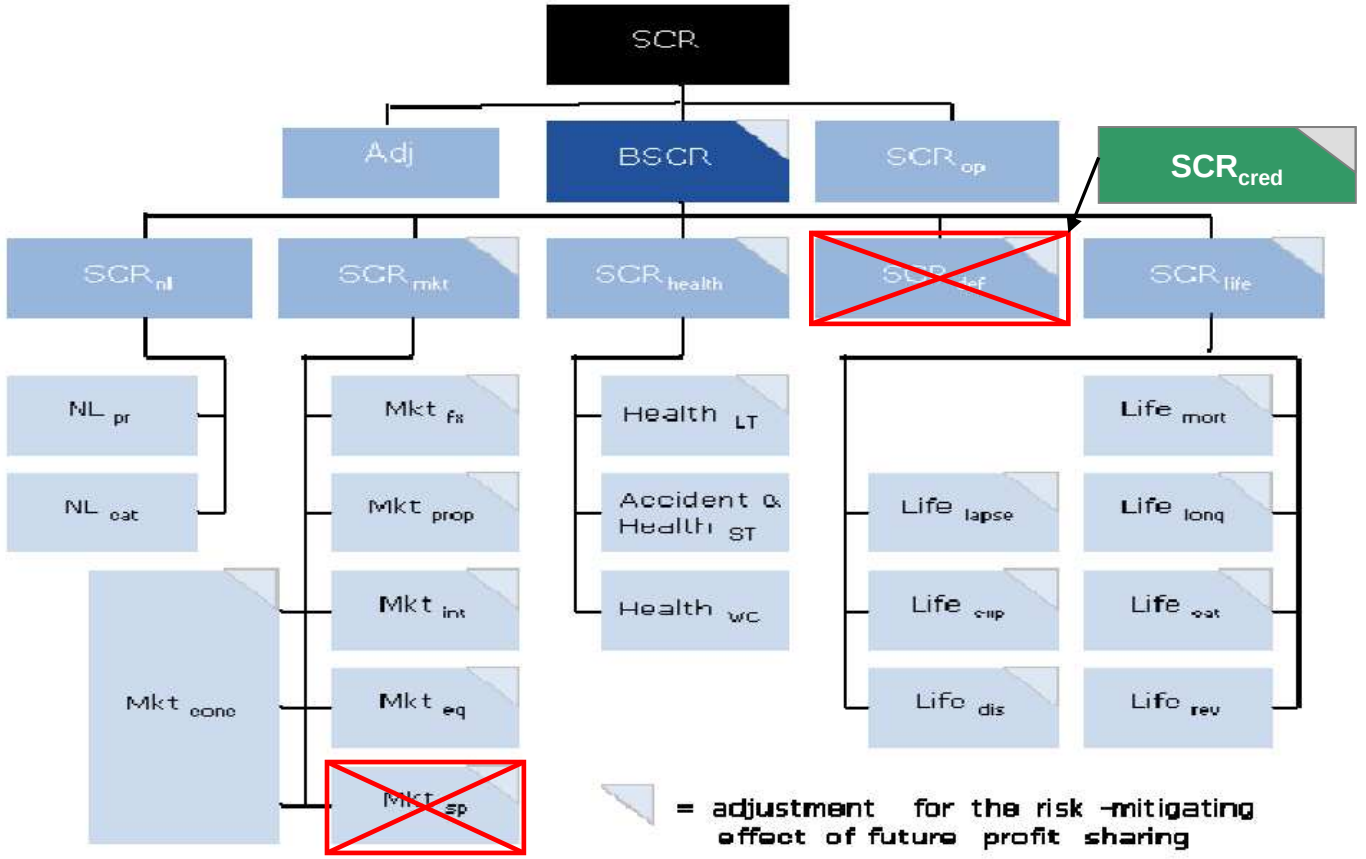

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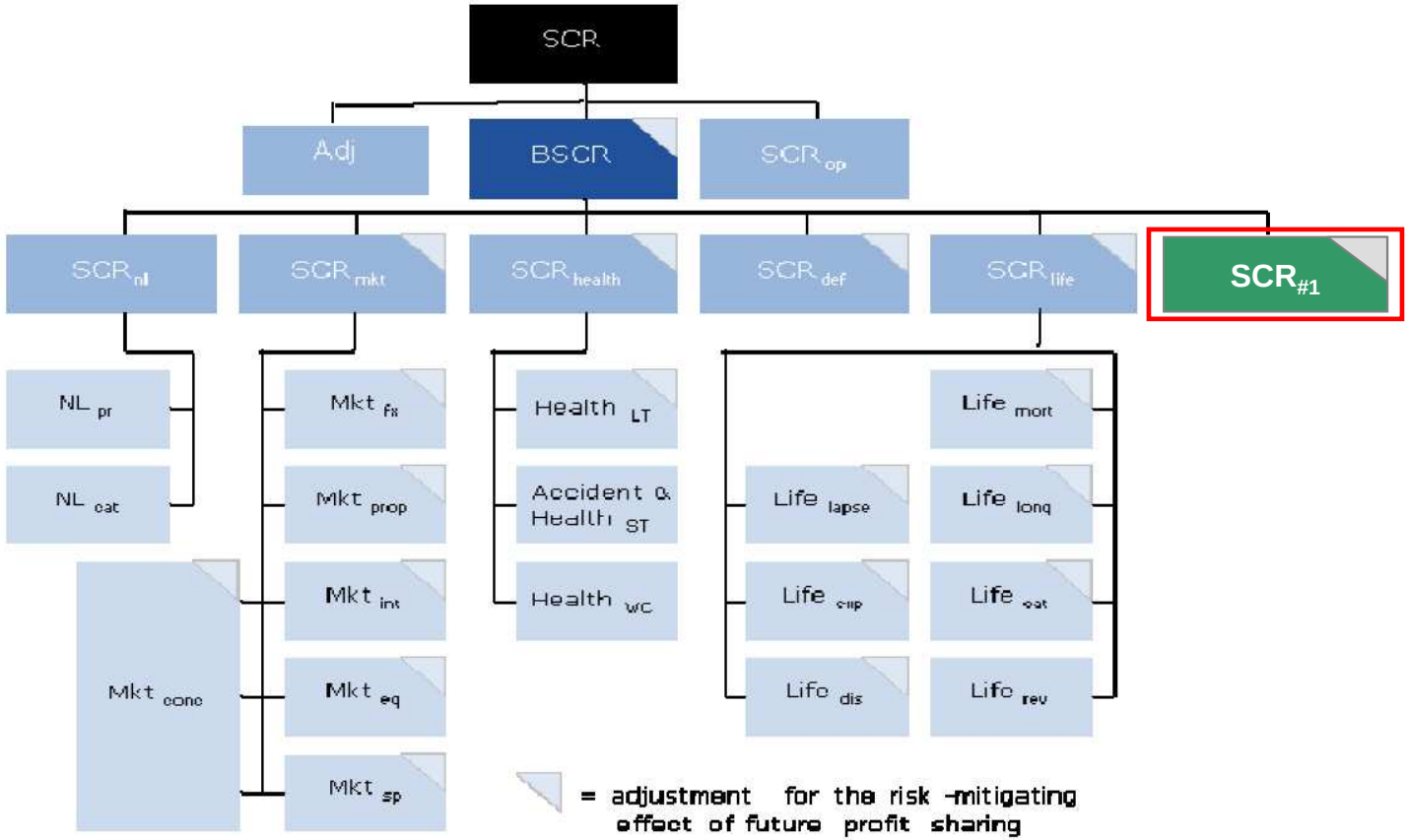
6) Risks not modeled in the standard formula (e.g. risk nr. 1)

1a
1b1
1b2
1c2
2a
2b1
2b2
2c1
2c2
3a1
3b1
4
5
6
7
8
10
18
19



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7) Non modular model (holistic model for the BSCR)

1a
1b1
1b2
1c2
2a
2b1
2b2
2c1
2c2
3a1
3b1
4
5
6
7
8
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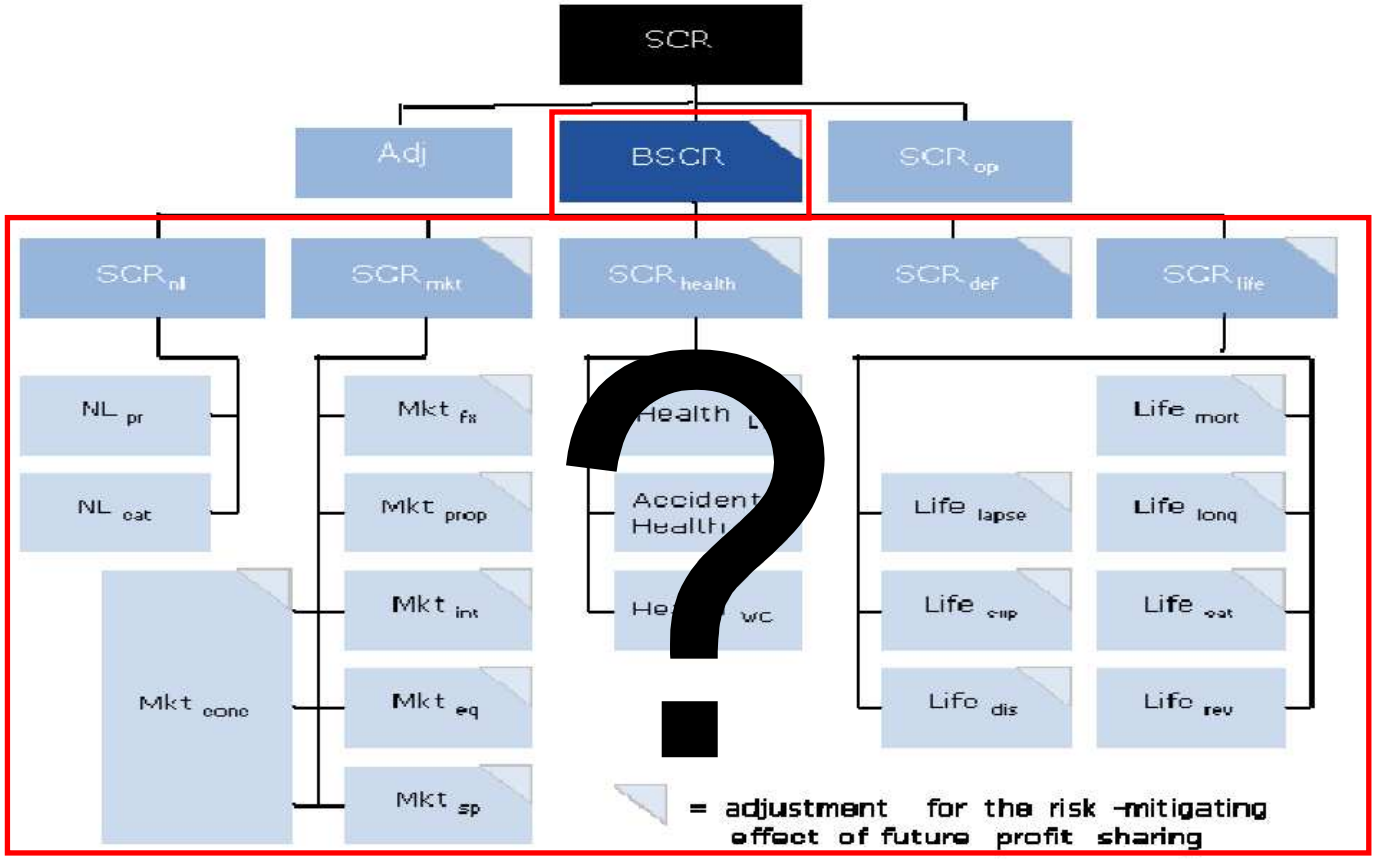
18
19



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8) Different risk calibration either modules/submodules from the same/different risk module (NL underwriting TailVaR 99% ↔ VaR 99,5%

1a
1b1
1b2
1c2
2a
2b1
2b2
2c1
2c2
3a1
3b1
4
5
6
7
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18
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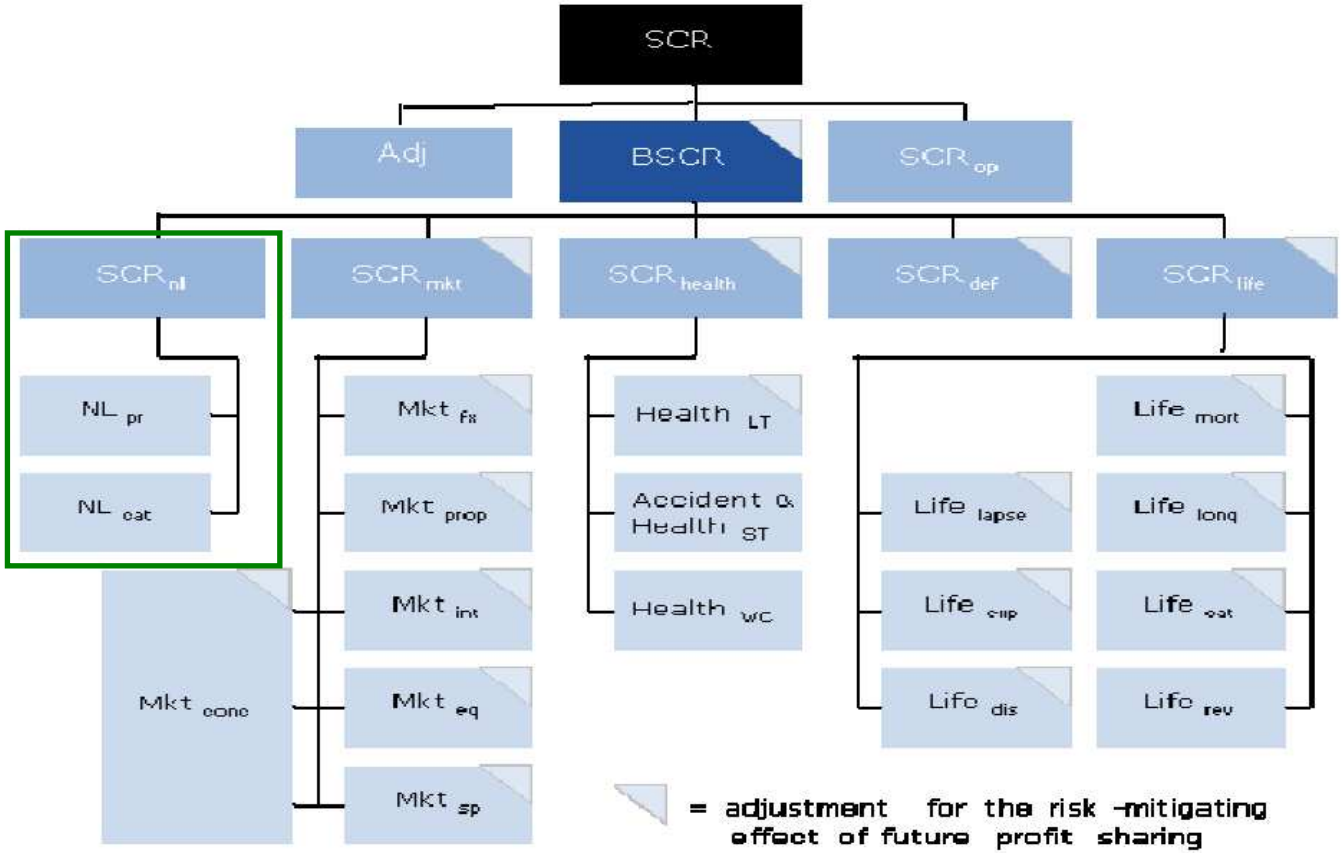
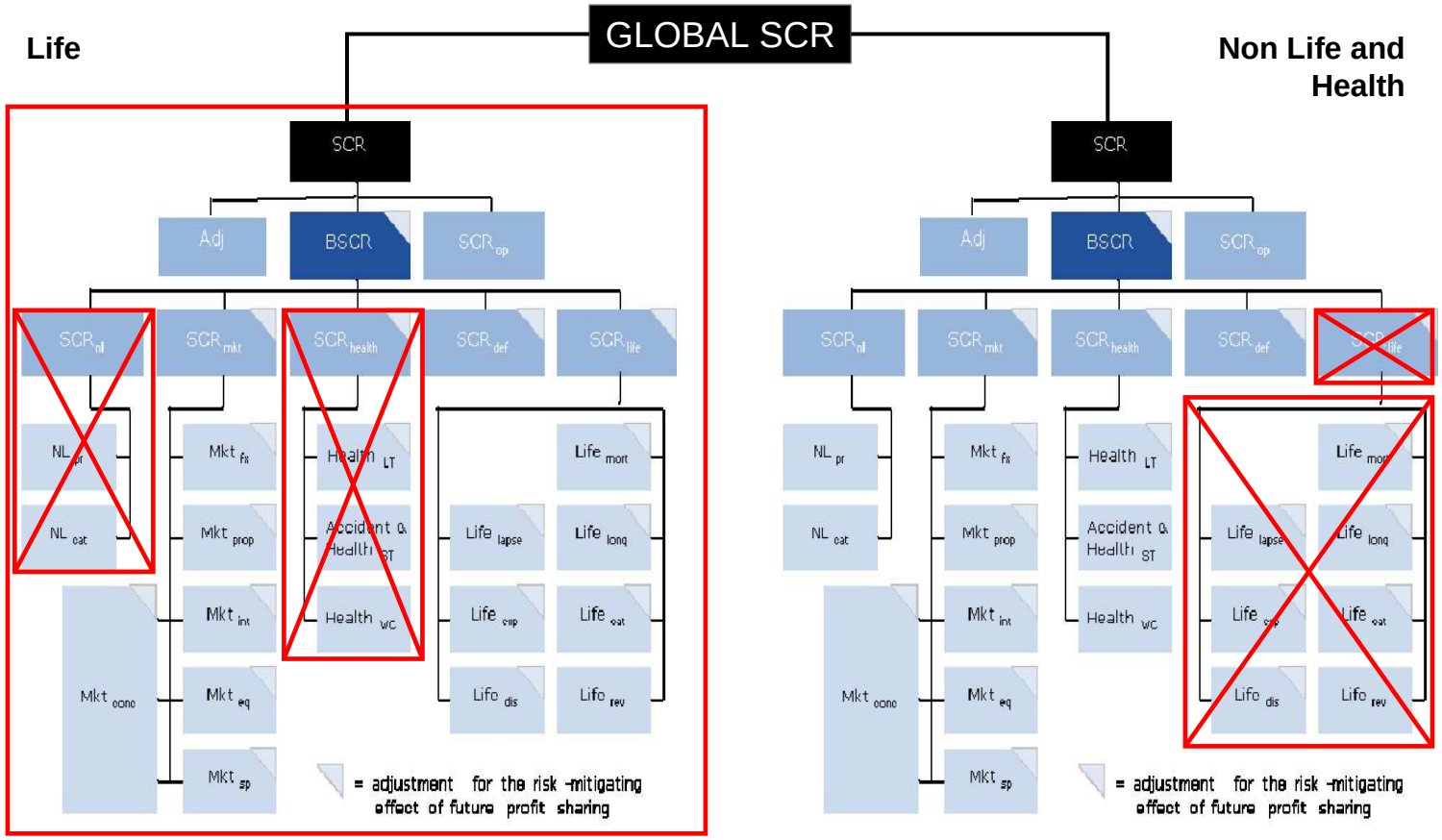


10) Modeling all risks for 1 or more lines of business (e.g. composite: all risks for the life business are internally modeled)

1a
1b1
1b2
1c2
2a
2b1
2b2
2c1
2c2
3a1
3b1
4
5
6
7
8
10
18
19



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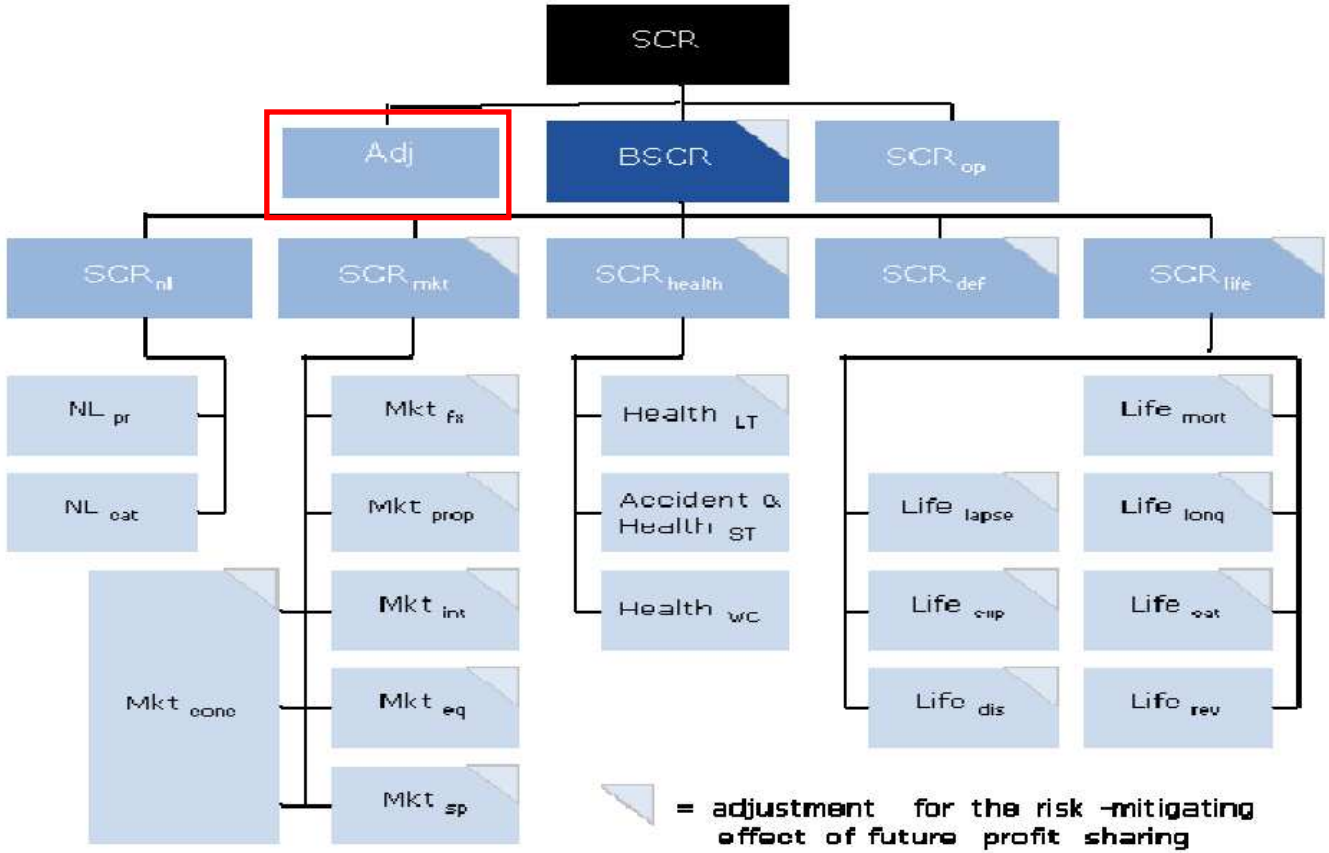
18) Modeling the adjustment for the loss-absorbing capacity of technical provisions and deferred taxes

1a
1b1
1b2
1c2
2a
2b1
2b2
2c1
2c2
3a1
3b1
4
5
6
7
8
10
18
19



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19) Modeling the capital charge for operational risk

1a
1b1
1b2
1c2
2a
2b1
2b2
2c1
2c2
3a1
3b1
4
5
6
7
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18
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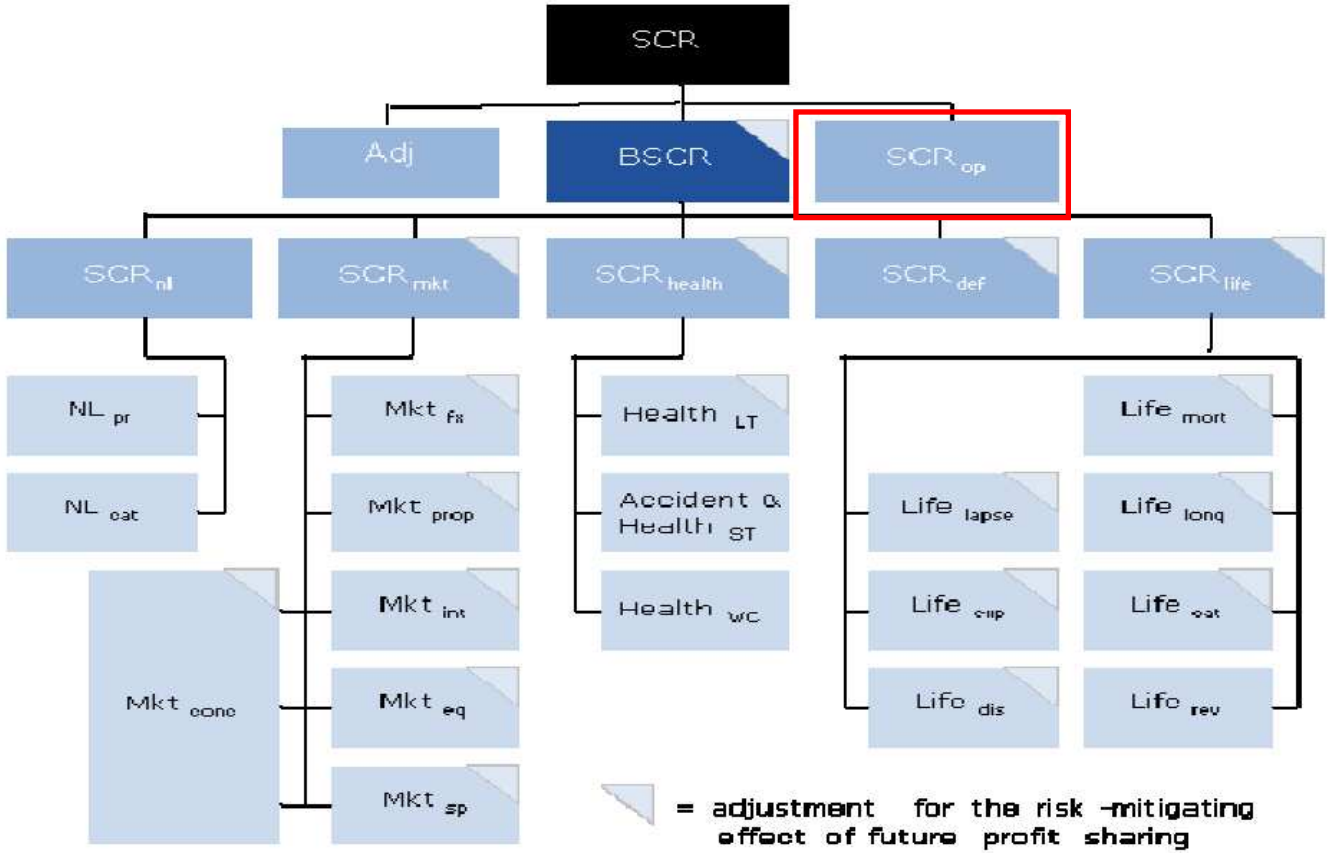

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Major business units I

- Business unit is not defined in the Level 1 text
- An MBU shall be defined as a functional unit in an undertaking which
  - is managed with independence and with dedicated governance processes
  - it makes sense to calculate
    - P&L
    - capital charge for a risk modules, sub-modules
    - capital requirement for operational risk
    - capital charge for the adjustment for the loss-absorbing capacity of tech. provisions and deferred taxes
    - and/or capital charge for any other material quantifiable risk
- Artificially defined business units are not acceptable as MBUs
- MBUs have to be materially significant for SCR calculation

Major business units II

- Definition must be consistent and stable
  - (Change in MBU definition -> extension / restriction / major change of PIM)
- Scope has to be clearly defined - no “cherry picking”
- Examples for MBUs:
  - Ring fenced funds
  - Branches
  - L or NL business (for composite undertakings)
  - Liabilities from specified lines of business
  - Geographical regions
  - Departments defined by type of customer
  - Departments defined by distribution channel
- Definitions of MBUs have to be approved by supervisory authorities
- In groups a MBU typically is a legal entity (but not necessarily has to be)

Specific provisions for the approval of PIMs I

Justification of the PIM‘s limited scope

- Examples of reasons for a limited scope:
  - PIM represents a transitory step towards full internal model
  - Lack of reliable information to model other risks/business lines
  - Modeling of other risks/business lines disproportionate to risk inherent in the business
  - PIM may encourages innovation and specialization to certain business areas
  - Mergers and acquisitions
- Scope has to be clearly defined - no “cherry picking”
- Plausible reasons for excluding legal entities:
  - Materiality of the legal entity
  - Disproportionality to risk inherent in the business
  - Unmanageable number of parameters for timely calculation
  - Lack of reliable information
  - Standard formula captures adequately risk profile

Specific provisions for the approval of PIMs II

Justification of the PIM‘s limited scope

- Scope of PIM is subject to a supervisory authority approval - onus to demonstrate that the limited scope is properly justified lies with the undertaking
- Supervisory authority takes into account
  - Use test
  - Profit and loss attribution
  - Validation standards
  - Nature, scale and complexity of the risk inherent in the business
  - Strategy of undertaking
  - Existence of a transition plan
  - Findings from the ORSA process
- Supervisory authority can
  - Disagree with scope and reject model
  - Approve it with conditions
  - Require a transitional plan to extend the scope
  - When dissatisfied with the justification, require undertakings to perform specific exercises, if applicable and practicable

Specific provisions for the approval of PIMs III

Better reflection of the risk profile

- Resulting SCR of PIM shall reflect risk profile more appropriately
- SCR has to meet principles of Article 101
  - Going concern principle
  - All quantifiable risks have to be taken into account
  - Unexpected losses of existing business and new business of next 12 months
  - Corresponds to VaR of basic own funds (confidence level of 99.5% over 1y)
  - Shall cover at least L, NL and health underwriting risk, market, credit and operational risk
  - Taking account of risk mitigation techniques
- PIMs do not necessarily need to cover to the full extent of those risks

Transitional plans to extend the scope of PIMs

- Transitional plans CAN be requested by supervisory authorities.
- Supervisory authorities may approve PIM as a permanent solution if:
  - The limited scope of the PIM is properly justified
  - The resulting SCR reflects the risk profile more appropriately
  - PIMs design consistent with principles
  - The design allows for the PIM to be fully integrated into the SCR standard formula
- Supervisory authorities may require transitional plans if:
  - The limited scope of the PIM is not properly justified
  - Some risks/business units, which are outside the scope are not appropriately reflected by the standard formula
- If supervisory authorities require transitional plans they have to explain the reasons and set a minimum scope.

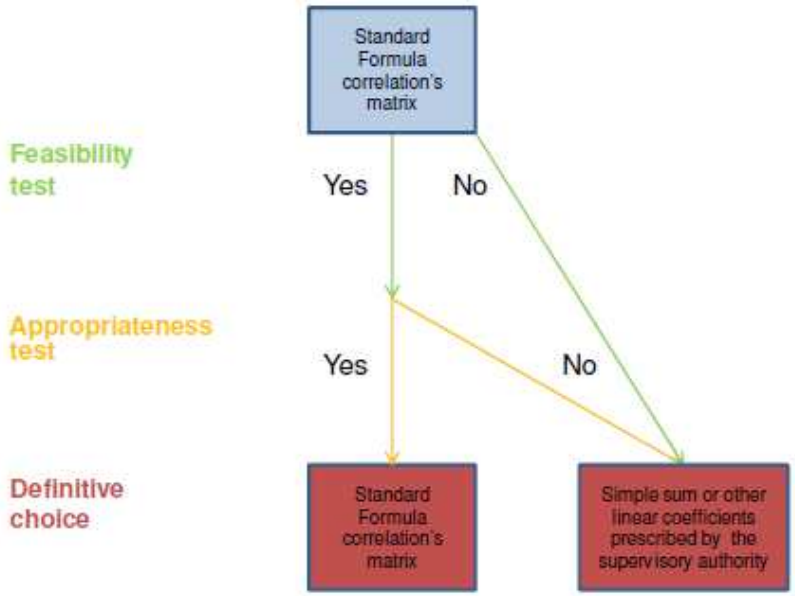
Policy options regarding the integration of PIMs I

- The standard formula correlation matrix coefficients shall be used whenever
  - its possible (feasibility test)
  - its appropriate (appropriateness test)

- Feasibility test
  - Testing possibility of integrating PIM with standard formula
- Appropriateness test
  - No strong evidence that it is inappropriate to integrate the PIM‘s results into standard formula‘s results
  - Appropriateness has to be given at least in some or all of the following:
    - Equivalence of SCR (VaR 99.5% over 1y)
    - Risk profile
    - Data
    - Use Test

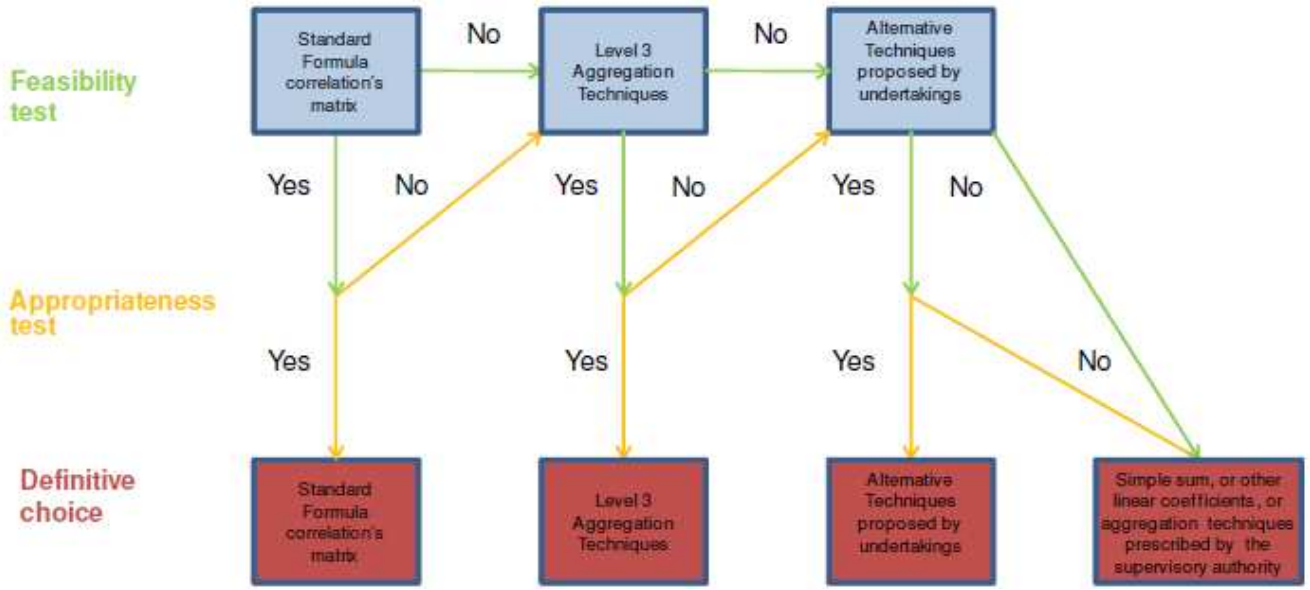
Policy options regarding the integration of PIMs II

- Option 1: Using only coefficients prescribed by supervisory authorities
  - Used test not applicable to the integration technique prescribed by the supervisory authority



Policy options regarding the integration of PIMs III

- Option 2: Using techniques provided by supervisory authorities or, if not feasible or appropriate, dependency structures and parameters provided by undertaking
  - List of techniques by CEIOPS in Level 3 guidance



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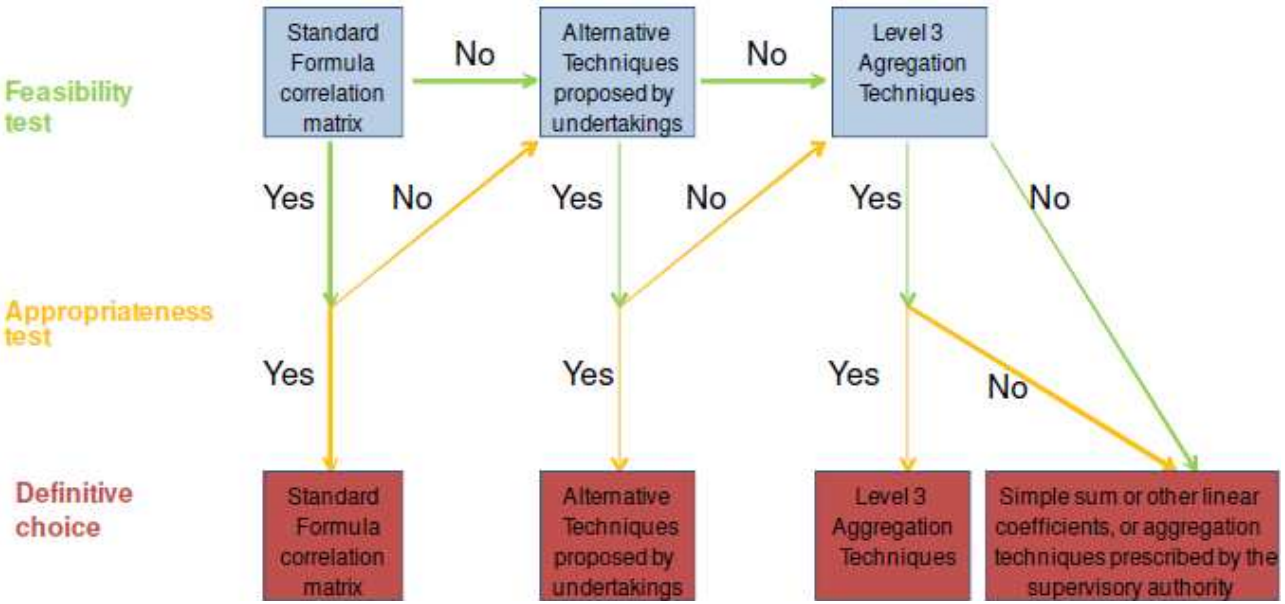
Policy options regarding the integration of PIMs IV

- Level 3 list of the integration techniques
  - Reviewed annually
  - Removing techniques
  - Adding techniques proposed by an undertaking
    - New technique or derivation of technique already listed
    - How extensively the technique is used, could be widely used
    - Effectiveness in producing an appropriately calibrated, risk reflecting result
    - Data requirements, need for expert judgement
    - Quality of the academic and actuarial references
  - List content
    - Name of the technique
    - Brief outline (data requirements, areas needing expert judgement, calculation method)
    - References to literature
    - Advantages, disadvantages
    - Circumstances when inappropriate

Policy options regarding the integration of PIMs V

- Option 3: Using dependency structures and parameters provided by undertaking, or if not approved by authorities, techniques provided by supervisory authorities



Policy options regarding the integration of PIMs VI

- Industry – Option 3
  - GC: The recommendation of Option 2 by CEIOPS seems to be too strict. When the concept of feasibility and appropritness tests are set and described appropriately by the L2 measures, Option 3 could be a valid solution.
  - CRO Forum, GDV, Assosiation of British Insurers, Lloyd‘s, Munich RE, KPMG
  - Deloitte, CEA no comment
  - PWC: The decision tree is a very clear exposition of the process being proposed.

- CEIOPS – Option 2

Policy Option	Relevant objectives								Additional quality indicators	
	Introduce risk-sensitive harmonized solvency standards		Harmonise supervisory powers, methods and tools		Introduce proportionate requirements for small undertakings		Ensure efficient supervision of insurance groups and financial conglomerates		sustainability	consistency
	Effectiveness (0/+/++)	Efficiency (0/+/++)	Effectiveness (0/+/++)	Efficiency (0/+/++)	Effectiveness (0/+/++)	Efficiency (0/+/++)	Effectiveness (0/+/++)	Efficiency (0/+/++)	(0/+/++)	(0/+/++)
Option 1	0	0	0	+	0	+	0	+	0	+
Option 2	+	+	++	++	++	++	+	+	+	+
Option 3	+	+	+	+	++	+	+	+	+	+

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Examples of Techniques to Integrate PIMs I

- Two world scenario
- Consistent standard formula replication (implicit correlations)
- Standard formula integration technique (indirect application)
- Other techniques
- Mixture of other techniques

Examples of Techniques to Integrate PIMs II

- **Two world scenario**
  - Results internally modeled are added up to the standard formula results
  - Assuming no diversification benefits
  - Advantages
    - Simple, straight forward technique
    - No modelling costs
    - Prudent in most cases
    - May encourage the development of full internal models
    - Applicable to all cases of PIMs
  - Disadvantages
    - Not risk sensitive
    - Not likely to reflect risk profile
    - Can discourage development of PIMs
    - Not always prudent

Examples of Techniques to Integrate PIMs III

- **Two world scenario (cont'd)**
  - Conditions under which may be appropriate
    - Immaterial diversification benefits
    - Immaterial resulting part of the SCR calculated using the standard formula
    - Developing of other techniques disproportionate
    - Not enough knowledge/information for applying any other technique

Examples of Techniques to Integrate PIMs IV

- **Consistent standard formula replication (implicit correlations)**
  - When the standard formula cannot be directly applied, it will be replicated in a way that ensures that results will be the same and internal models can be integrated.
  - There are two distinct approaches:
    1. Standard formula aggregation approach with derivation from the standard formula of any correlations not embedded in PIM and not directly given by the standard formula

$$BSCR = \sqrt{\sum_{r,c} Corr_{r,c} \cdot SCR_r \cdot SCR_c}$$

	Market	Default	Life	Health	Non-life
Market	1	0.25	0.25	0.25	0.25
Default	0.25	1	0.25	0.25	0.5
Life	0.25	0.25	1	0.25	0
Health	0.25	0.25	0.25	1	0
Non-life	0.25	0.5	0	0	1

    2. Gaussian copula with normal marginal distributions or entity specific

Examples of Techniques to Integrate PIMs V

- **Deriving correlations from the standard formula**
  - Imagine a SF SCR composed of 3 risks with the following capital requirements and correlations under the standard formula

	SCR
Risk A	20
Risk B	15
Risk C	5
SF SCR	30.62

	A	B	C
A	1	0.25	0.5
B	0.25	1	0.25
C	0.5	0.25	1

  - Company developed a PIM to model Risks A & B, with $SCR_{A\&B} = 30$
  - We need to derive a correlation between $SCR_{A\&B}$ and SF SCR_C
  - Applying the standard formula to Risks A & B alone gives SF $SCR_{A\&B} = 27.83$
  - From this and the aggregate SF SCR result of 30.62 we can derive the implied correlation $Corr_{A\&B,C} = 0.495$
  - This correlation can then be used to aggregate the PIM capital required for Risks A & B with the SF figure for Risk C to get the SCR = 32.76

Examples of Techniques to Integrate PIMs VI

- **Consistent standard formula replication (implicit correlations) (cont'd)**
  - Advantages
    - Consistent with standard formula by nature
    - Allows a step by step approach to full internal model
    - More risk based
    - More reflective of risk profile
    - Allows for diversification benefits in the standard formula
    - Allows assessment of impact of different enhancements (calibrations, etc.)
    - Allows supervisory authorities to assess appropriateness
  - Disadvantages
    - Derived correlations may not be always stable
    - Full replication of standard formula has to be made every year
    - Integration reflects risk profile to the extend the standard formula does
    - Approach might yield correlations lower than -1 or higher than 1
    - May not be applicable in all cases (risks not covered by standard formula)

Examples of Techniques to Integrate PIMs VII

- **Consistent standard formula replication (implicit correlations) (cont'd)**
  - Conditions under which may be appropriate
    - Standard formula implicit correlations adequately capture the risk profile
    - Immaterial diversification benefits
    - Immaterial resulting part of the SCR calculated using the standard formula
    - Developing other techniques disproportionate
    - Not enough knowledge/information to apply any other technique

Examples of Techniques to Integrate PIMs VIII

- **Standard formula integration technique (indirect application)**
  - Application of standard formula by performing intermediate steps
    - Allocation of internal model results to modules of standard formula
    - Re-categorization of the internal model results
  - Advantages
    - Consistent wit standard formula by nature
    - More risk based
    - More reflective of risk profile
    - Allows for diversification benefits
    - Less analyzing effort for supervisory authorities
  - Disadvantages
    - Varying mathematical soundness
    - Full replication of standard formula has to be made every year
    - Integration reflects risk profile to the extend the standard formula does
    - May be costly
    - May not be applicable in all cases (risks not covered by standard formula)
  - Conditions under which may be appropriate
    - Standard formula adequately reflects risk profile
    - Allocation/re-categorization is feasible
    - Developing other techniques disproportionate
    - Not enough knowledge/information to apply any other technique

Examples of Techniques to Integrate PIMs IX

- **Other techniques**
  - Historical data analysis and/or expert judgment used to set correlation assumptions, or:
  - Simulation based approaches
  - Advantages
    - Applicable to all situations
    - Flexible
    - More reflective of risk profile
    - Encourages development of PIMs and better risk management
    - Reduced systemic risk
  - Disadvantages
    - Burdensome on supervisory authorities
    - May be costly
    - Compliance with statistical quality standards difficult to justify
  - Conditions under which may be appropriate
    - Standard formula not feasible or appropriate
    - Undertaking proposes appropriate alternative techniques

Examples of Techniques to Integrate PIMs X

- **Mixture of other techniques**
  - Combines two or more different techniques
  - Advantages
    - Captures advantages of different approaches
    - Useful if a single technique may be inadequate
  - Disadvantages
    - Overall approach may lack consistency
    - Can lead to cherry picking
  - Conditions under which may be appropriate
    - When a single technique is inadequate

Adaptations to Standards I

Article 120 (Use test)

- Not apply to integration techniques prescribed by supervisory authority
  - If other integration technique used internally, CEIOPS expects awareness of the different impact and documentation
    - How different results are taken into account during decision making process
    - Reasons for using a different integration technique
- Apply to the techniques selected from the Level 3 list (proportionality)

Article 121 (Statistical quality standards)

- Apply to the limited scope of PIM
- Apply to the integration technique if developed by the undertaking

Article 122 (Calibration standards)

- PIM calibrated to VaR with 99,5% over 1y
- Probability distribution forecast at the topmost level of PIM

Adaptations to Standards II

Article 123 (Profit and loss attribution)

- Apply to the limited scope of PIM
- Definition of MBU

Article 124 (Validation standard)

- Validation of the limited scope of PIM
- Adequacy of the integration technique
  - NOT if prescribed by supervisory authority
  - YES if chosen from Level 3 list issued by CEIOPS

Article 125 (Documentation standard)

- Justification of the limited scope of PIM, integration technique

Article 126 (External models and data)

- Integration technique
- The dependency structure between the risk modules affected by external models and data are part of the validation policy

Risks not Covered in the Standard Formula

- Specific risks not explicitly considered by the standard formula (underwriting cycles risk, commodity, contagion,...)
- If quantifiable, should be taken into account
- Options for PIMs:
  - Assume the specific risks linked to existing risks of the standard formula
  - New risk module
  - Assume the specific risks linked to a specific business unit and build a full model
  - Other method developed by the undertaking

List of Used Literature

- Directive 2009/138/EC on the taking-up and pursuit of the business of Insurance and Reinsurance (Solvency II)
- Consultation paper CEIOPS 65
- CEIOPS´ Advice for Level 2 Implementing Measures on Solvency II: Partial Internal Models
- Summary of Comments on CP 65 - CEIOPS-CP-65/09
- Materials of Internal Models Working Group by Groupe Consultatif
- www.ceiops.eu

Děkuji za pozornost!

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