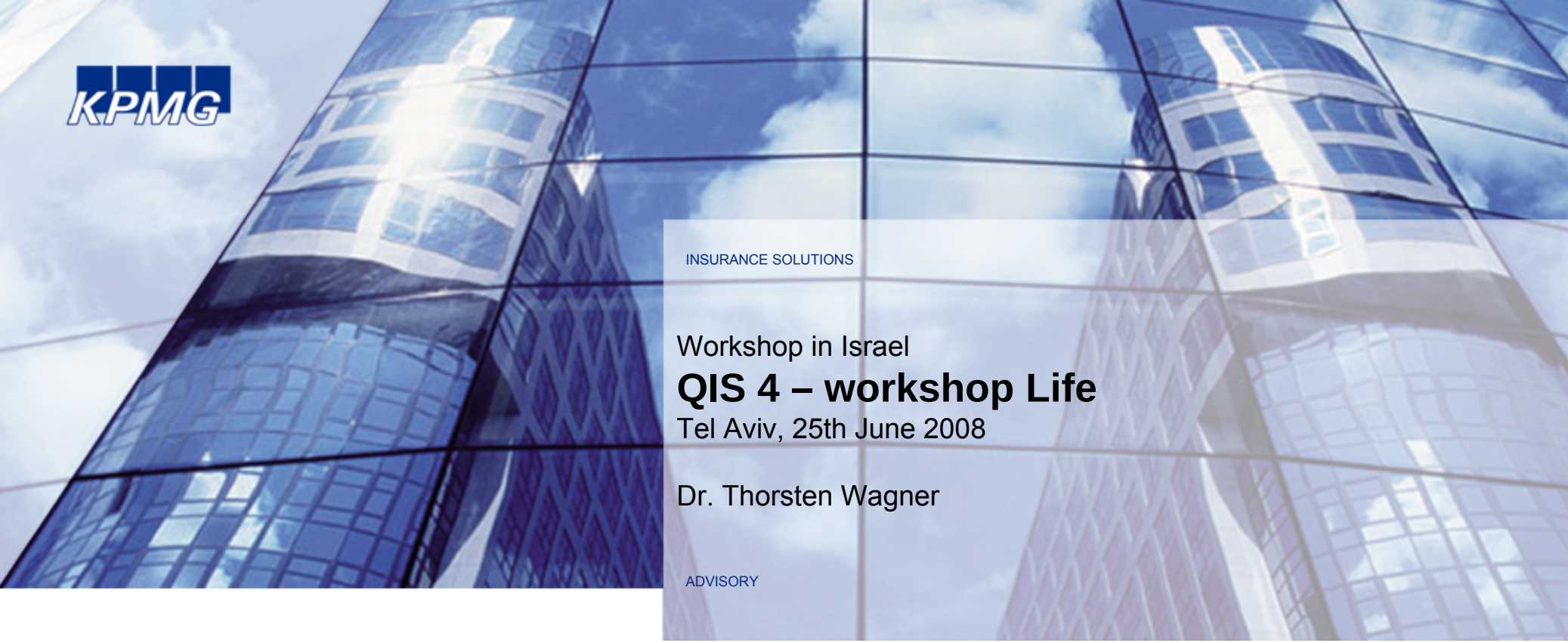


INSURANCE SOLUTIONS

Workshop in Israel

QIS 4 – workshop Life

Tel Aviv, 25th June 2008

Dr. Thorsten Wagner

ADVISORY

Agenda

- *Introduction*
- *Standard model QIS 4: Methods*
  - *Recapitulation: Overview and Basic Solvency Capital Required (BSCR)*
  - *Operational Risk*
  - *Market Risk*
  - *Life Underwriting Risk*
- *Looking at the Excel Spreadsheet*
- *How to deal with the main challenges?*

Introduction

Introduction

Main questions for the Israeli life insurance industry

What are the main risk drivers?

- How are products designed?
  - Profit sharing?
  - Options included for policyholders, e.g. guaranteed surrender value?
- In which kind are benefits dependent on the economy / capital markets?
- Can policyholders' behaviour lead to losses, especially finance-rational behaviour?

Which kind of simplifications may be suitable?

- Which sub-risk may be dealt with on a factor approach or other simplification?
- Which sub-risk is too important to be dealt with simplifications?

=> Have in mind the answers when looking at QIS 4 standard model.

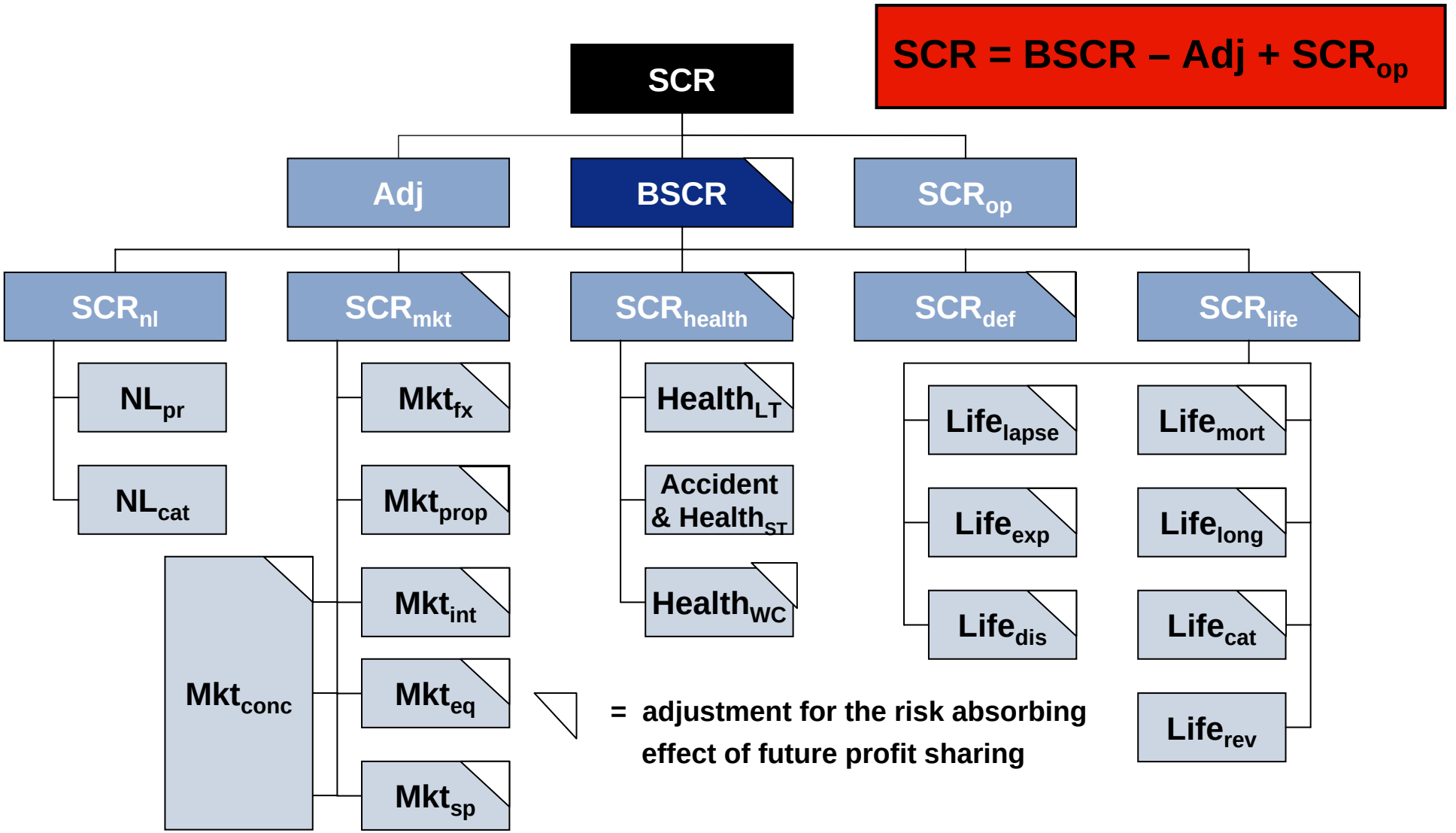
Standard model QIS 4: Methods

Agenda

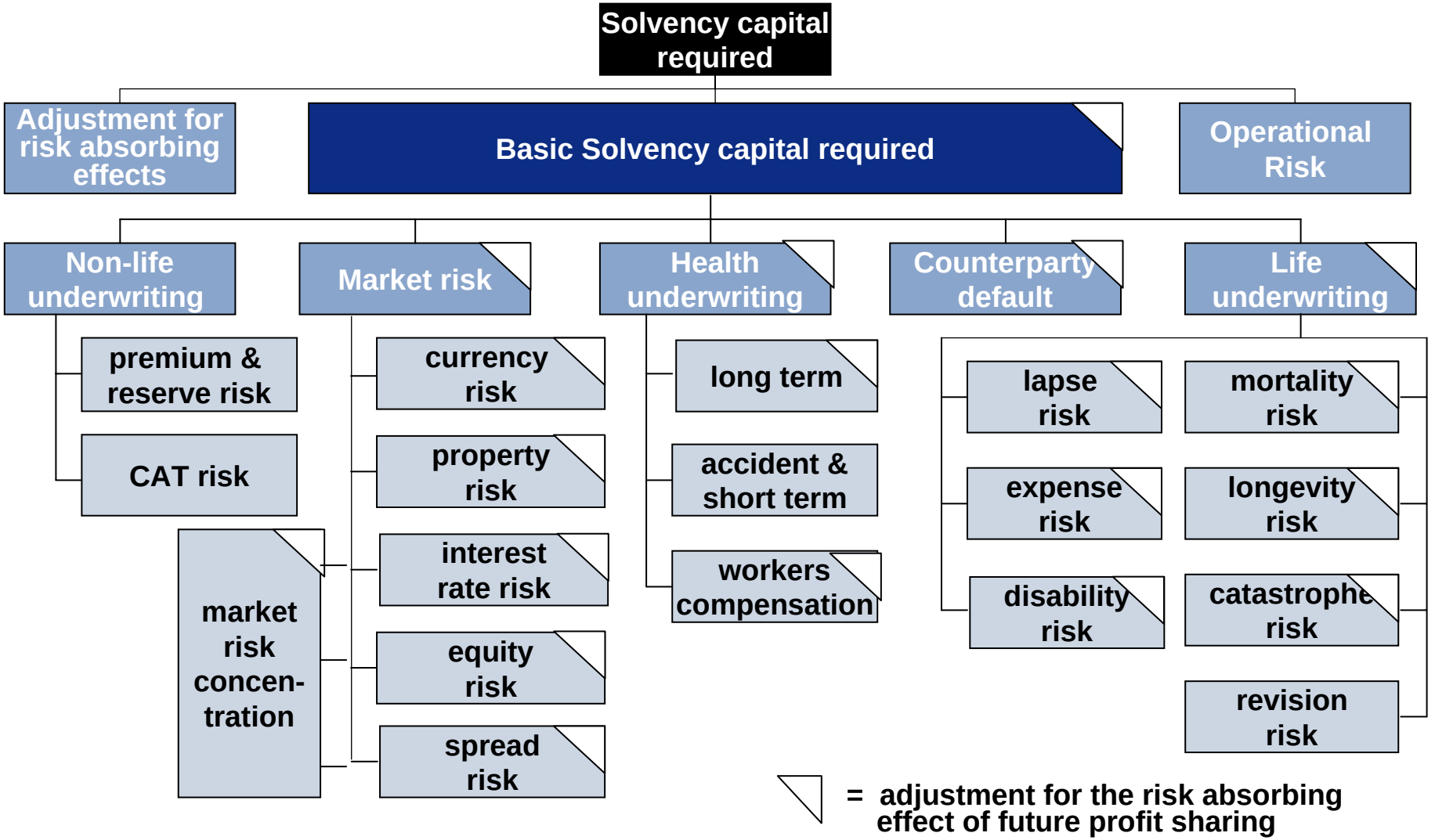
Standard model QIS 4: Methods

- Overview
- BSCR
- SCR_{Op} operational risk
- SCR_{nl} non-life underwriting risk
- SCR_{mkt} market risk
- SCR_{health} health underwriting risk
- SCR_{def} counterparty default risk
- SCR_{life} life underwriting risk

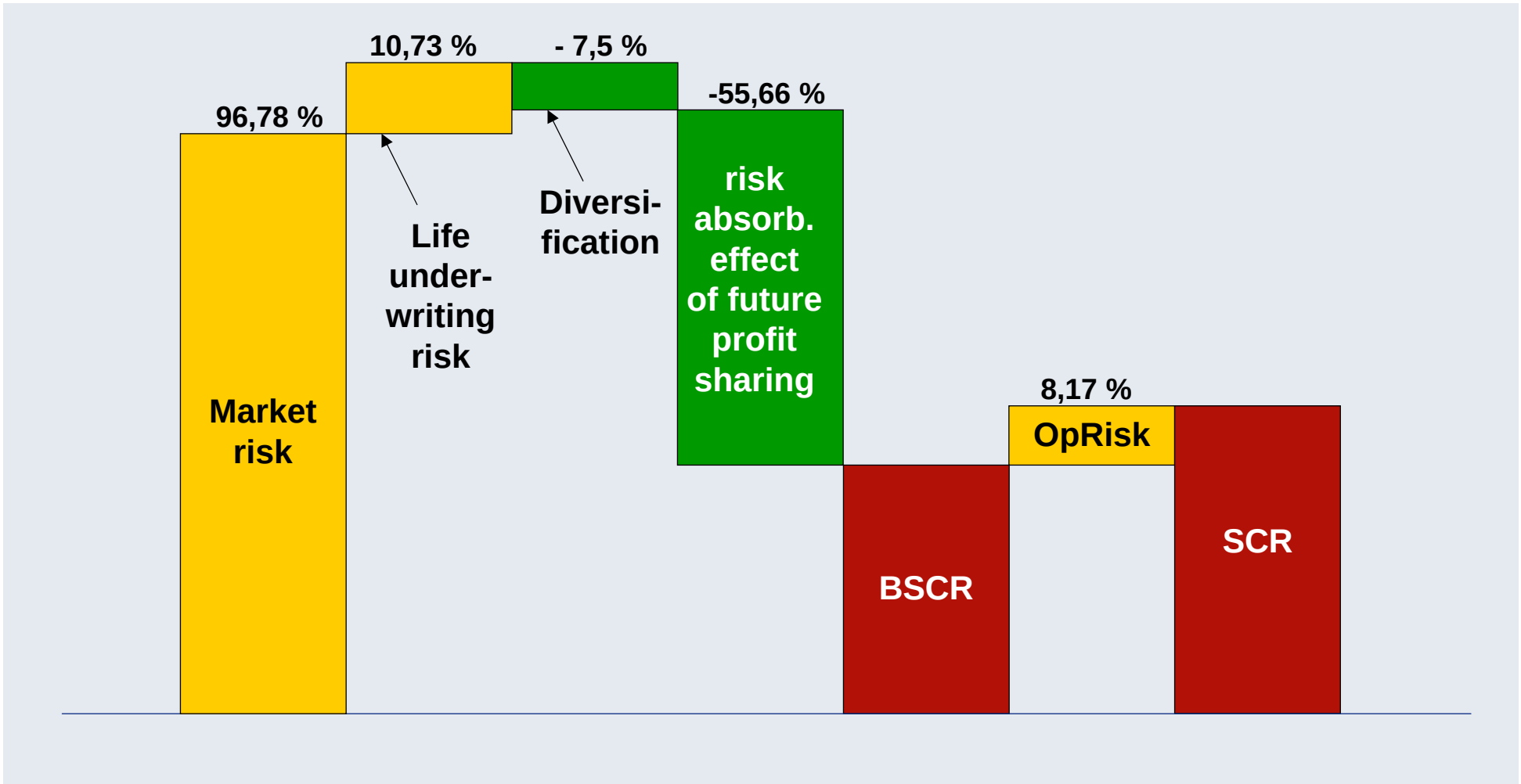
QIS 4 standard model: methodology
Overview of risk categories



QIS 4 standard model: methodology
Overview of risk categories



QIS 4 standard model: methodology
Example, how the SCR may look like



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QIS 4 standard model: methodology
Basic SCR

Input

The model needs the following input data:

SCR_{mkt}	=	Capital charge for market risk
SCR_{def}	=	Capital charge for default risk
SCR_{life}	=	Capital charge for life underwriting risk
SCR_{health}	=	Capital charge for health underwriting risk
SCR_{nl}	=	Capital charge for non-life underwriting risk
FDB	=	Total amount in technical provisions corresponding to future discretionary benefits
$nSCR_{xyz}$	=	Capital charge for XYZ risk including the risk absorbing effect of future profit sharing (XZY = mkt, def, life, health)

Calculation

$$BSCR = \sqrt{\sum_{r \times c} CorrSCR_{r,c} * SCR_r * SCR_c}$$

$$Adj = Adj_{FDB} + Adj_{DT}$$

$$nBSCR = BSCR - Adj_{FDB}$$

$CorrSCR_{r,c}$ = cells of the correlation matrix CorrSCR

SCR_r , SCR_s = Capital charges for the individual SCR risks according to the rows and columns of the correlation matrix CorrSCR

Adj_{FDB} = Adjustment for the risk absorbing effect of future profit sharing

Adj_{DT} = Adjustment for the risk absorbing effect of deferred taxes

Output

BSCR
= Basic Solvency Capital Requirement

Adj
= Adjustment for the risk absorbing effect of future profit sharing and deferred taxes

nBSCR
= net Basic Solvency Capital Requirement

QIS 4 standard model: methodology
Correlation matrix CorrSCR

The correlation matrix CorrSCR is defined as:

$CorrSCR =$	SCR_{mkt}	SCR_{def}	SCR_{life}	SCR_{health}	SCR_{nl}
SCR_{mkt}	1				
SCR_{def}	0,25	1			
SCR_{life}	0,25	0,25	1		
SCR_{health}	0,25	0,25	0,25	1	
SCR_{nl}	0,25	0,5	0	0,25	1

QIS 4 standard model: methodology
Adj: Adjustments for risk absorbing effects

Calculation of Adj

$$Adj = Adj_{FDB} + Adj_{DT}$$

Future profit sharing

Adjustment is defined as:

$$Adj_{FDB} = \min\left(\sqrt{\sum_{r \times c} CorrSCR_{r,c} * SCR_r * SCR_c} - \sqrt{\sum_{r \times c} CorrSCR_{r,c} * nSCR_r * nSCR_c}\ ;\ FDB \right)$$

Deferred taxes

Adjustment is defined as:

$$Adj_{DT} = \Delta DeferredTaxes \,|\, SCRshock$$

i.e. absolute value of reduction in the value of deferred taxes under the scenario SCR shock, where

ΔDeferred Taxes = absolute value of reduction in deferred taxes

SCR shock = immediate loss of basic own funds of the amount of: BSCR – Adj_{FDB} + SCR_{op}

QIS 4 standard model: methodology
Adj: Adjustments for risk absorbing effects

Challenge

nSCR – the capital charges for individual SCR risk including the risk absorbing effect of future profit sharing – has to calculated for all sub-risk SCRs.

Alternative Method

The single equivalent scenario:

- Calculate all SCRs (with unchanged future bonus rates)
- The spreadsheet calculates weightings in accordance to the relative importance of each sub-risk (on overall SCR)
- Defining management actions referring to this single equivalent scenario
- Assume that all shocks making up the single equivalent scenario occur simultaneously, and also a operational risk loss equal to the operational SCR occurs (to reflect also Adjustments on deferred taxes)

Formula

$$Adj = BSCR + SCR_{op} - SCR_{net}$$

SCR_{net} is the change in the undertaking‘s net asset value in the face of the equivalent scenario calculated with the alternative method

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QIS 4 standard model: methodology
SCR_{Op}

Input

The model needs the following input data:

TP_{life}	= Total of life insurance technical provisions (gross of reinsurance)
$TP_{life\text{-}ul}$	= Total life insurance technical provisions for unit-linked business (gross)
TP_{nl}	= Total non-life technical provisions (gross)
TP_{h}	= Total health insurance technical provisions (gross)
$Earn_{life}$	= Total earned life premium (gross)
$Earn_{life\text{-}ul}$	= Total earned life premium for unit-linked business (gross)
$Earn_{h}$	= Total earned health insurance premium (gross)
$Earn_{nl}$	= Total earned non-life insurance premium (gross)
BSCR	= Basic SCR

Calculation

Capital charge is calculated as follows:

$$SCR_{op} = \min\left\{0.30 * BSCR\,;\, Op_{\text{lnul}}\right\} + 0.25 * Exp_{ul}$$

with Op_{lnul} as capital charge for all business other than unit-linked (gross) determined as:

$$Op_{nlul} = \max\left\{\begin{array}{c} 0,03*(Earn_{life} - Earn_{life-ul}) + 0,02*Earn_{nl} + 0,02*Earn_{h}\,; \\ 0,003*(TP_{life} - TP_{life-ul}) + 0,02*TP_{nl} + 0,002*TP_{h} \end{array}\right\}$$

Output

SCR_{Op}

Remark:

The capital charge for operational risk is the sum of:

Capital charge for all business other than unit-linked is restricted to 30% of the Basic SCR.

Capital charge of 25% of the amount of annual expenses (gross) incurred in respect of unit-linked business.

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QIS 4 standard model: methodology
SCR_{mkt}: market risk

Calculation

Market risk comprises all risks arising from the level or volatility of market prices.

The market risk subdivided into:

- interest rate risk
- equity risk
- property risk
- currency risk
- spread risk
- market risk concentrations

1. Capital charge calculation for each sub-risk
2. Aggregation to SCR_{mkt} with a correlation matrix

- Interest, equity, property and currency risk are modelled based on scenarios
- Factorial approach for spread and concentration risk

- For each sub risk two capital charges have to be calculated:
  - a capital charge disregarding the risk absorbing effect of future profit sharing (=Mkt)
  - a capital charge regarding the risk absorbing effect of future profit sharing (=nMkt)

QIS 4 standard model: methodology
SCR_{mkt}: market risk

Input

- Mkt_{eq} = Capital charge for equity risk
- Mkt_{sp} = Capital charge for spread risk
- Mkt_{int} = Capital charge for interest rate risk
- Mkt_{prop} = Capital charge for property risk
- Mkt_{fx} = Capital charge for currency risk
- Mkt_{conc} = Capital charge for market risk concentration
- $nMkt_{eq}$ = Capital charge for equity risk including the risk absorbing effect of future profit sharing
- $nMkt_{sp}$ = Capital charge for spread risk including the risk absorbing effect of future profit sharing
- $nMkt_{int}$ = Capital charge for interest rate risk including the risk absorbing effect of future profit sharing
- $nMkt_{prop}$ = Capital charge for property risk including the risk absorbing effect of future profit sharing
- $nMkt_{conc}$ = Capital charge for market risk concentration including the risk absorbing effect of future profit sharing
- $nMkt_{fx}$ = Capital charge for currency risk including the risk absorbing effect of future profit sharing

Calculation

$$SCR_{mkt} = \sqrt{\sum_{rxc} CorrMkt^{rxc} \bullet Mkt_r \bullet Mkt_c}$$

$$\mathbf{nSCR_{mkt}} = \sqrt{\sum_{rxc} \mathbf{CorrMkt^{rxc}} \bullet \mathbf{nMkt_r} \bullet \mathbf{nMkt_c}}$$

with:

SCR_{mkt} = capital charge for market risk

$CorrMkt^{rxc}$ = cells of the correlation matrix

Mkt_r , Mkt_c = capital charges for individual market risks according to correlation matrix CorrMkt

prefix "**n**": inclusion of the risk absorbing effect of future profit sharing

Output

SCR_{mkt}

= capital charge for market risk

$nSCR_{mkt}$

= capital charge for market risk including the risk absorbing effect of future profit sharing

QIS 4 standard model: methodology
SCR_{mkt}: market risk

The correlation matrix for the market risk SCR_{mkt} is defined as:

CorrMkt =	Mkt_{int}	Mkt_{eq}	Mkt_{prop}	Mkt_{sp}	Mkt_{conc}	Mkt_{fx}
Mkt_{int}	1					
Mkt_{eq}	0	1				
Mkt_{prop}	0,5	0,75	1			
Mkt_{sp}	0,25	0,25	0,25	1		
Mkt_{conc}	0	0	0	0	1	
Mkt_{fx}	0,25	0,25	0,25	0,25	0	1

QIS 4 standard model: methodology
Mkt_{int}: interest rate risk

Input

Δ NAV = Change in net asset value for the scenario “interest upward shock” and “interest downward shock”; i.e. change in net value of assets minus liabilities

Calculation

• Change of net asset values Δ NAV due to a pre-defined interest rate increase and decrease.
• The capital charge is the higher value of capital charge of the upward and downward shock for the calculation also regarding the risk absorbing effect of future profit sharing.

$$Mkt_{\text{int}}^{Up} = \Delta NAV\Big|_{upwardshock}$$

$$Mkt_{\text{int}}^{Down} = \Delta NAV\Big|_{downwardshock}$$

Output

Mkt $_{int}$

= capital charge for interest rate risk

nMkt $_{int}$

= capital charge for interest rate risk including the risk absorbing effect of future profit sharing

QIS 4 standard model: methodology
Mkt_{int}: upward and downward shock for interest rate risk

The altered term structures are derived by multiplying the current interest rate curve by $(1+s_{up})$ and $(1+s_{down})$.

The upward stress $s_{up}(t)$ and the downward stress $s_{down}(t)$ for individual maturities are as follows:

Maturity t (years)	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
Relative change $s_{up}(t)$	0.94	0.77	0.69	0.62	0.56	0.52	0.49	0.46	0.44	0.42
Relative change $s_{down}(t)$	-0.51	-0.47	-0.44	-0.42	-0.40	-0.38	-0.37	-0.35	-0.34	-0.34

Maturity t (years)	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20+*
Relative change $s_{up}(t)$	0.42	0.42	0.42	0.42	0.42	0.41	0.40	0.39	0.38	0.37
Relative change $s_{down}(t)$	-0.34	-0.34	-0.34	-0.34	-0.34	-0.33	-0.33	-0.32	-0.31	-0.31

QIS 4 standard model: methodology
Mkt_{eq}: equity risk

Calculation

Capital charge is determined with a stress scenario on equities. Again, the risk absorbing effect of future profit sharing is also regarded in an additional calculation.

Two classes of equities:

- Global: equity listed in EEA and OECD
- Other: equity listed in emerging markets, non-listed equity, hedge funds and other alternative investments.

- The shock scenario is specified as follows:

Index	*Equity shock*
Global	32%
Other	45%

- Result: change in net asset values for stress on Global (ΔMW1) as well as on Other (ΔMW2) taking into account hedge mechanism.
- Capital charge is determined as aggregated changes in net asset values:

$$\Delta NAV = \sqrt{\Delta MW_1^2 + 2 * 0,75 * \Delta MW_1 * \Delta MW_2 + \Delta MW_2^2}$$

Output

Mkt_{eq}

= capital charge for equity risk

$nMkt_{eq}$

= capital charge for equity risk including the risk absorbing effect of future profit sharing

QIS 4 standard model: methodology
Mkt_{prop}: property risk

Calculation

Capital charge is determined with a stress scenario on properties.

<u>Δ NAV:</u>

- The capital charge equals to the change in net asset values, i.e. change in the value of assets minus liabilities
- The expected stress is a 20% decrease of market value of (direct and indirect) exposures to property prices.
- Hedge mechanism should be taken into account.

Output

Mkt_{prop}

= capital charge of property risk

$nMkt_{prop}$

= capital charge for property risk including the risk absorbing effect of future profit sharing

QIS 4 standard model: methodology
Mkt_{fx}: currency risk

Calculation

Δ NAV:

Two pre-defined scenarios have to be calculated:
- Rise of 20% of all other currencies against local currency.
- Fall of 20% of all other currencies against local currency.

$$Mkt_{Fx}^{Up} = \Delta NAV \Big| fx_{upwardshock}$$

$$Mkt_{Fx}^{Down} = \Delta NAV \Big| fx_{downwardshock}$$

Δ NAV is determined as change in net asset value (i.e. market value of assets minus liabilities) immediately after balance sheet date..

The capital charge is determined as the higher capital charge based on the two scenarios including the risk absorbing effect of future profit sharing.

Output

Mkt_{fx}

= capital charge for currency risk

$nMkt_{fx}$

= capital charge for currency risk including the risk absorbing effect of future profit sharing

QIS 4 standard model: methodology
Mkt_{sp}: spread risk

Calculation

Spread risk =
Spread risk is the part of risk originating from financial instruments that is explained by the volatility of credit spreads over the risk-free interest rate term structure.

Input:
MV_i = Market value of the credit risk exposure i
dur_i = modified duration of credit risk exposure i
$rating_i$ = external rating of the credit risk exposure i

- Spread risk of a bond depends on rating and effective duration.
- Division into seven rating classes (AAA, AA, A, BBB, BB, B, CCC or lower) or to the class "unrated"
- Calculation of the following sum for each rating class:

$$Mkt_{sp}^{bonds} = \sum_i MV_i * m(dur_i) * F(rating_i) + \Delta Liab_{ul} \quad , \left(Mkt_{sp}^{bonds} - \text{for bonds}\right)$$

$$Mkt_{sp}^{struct} = \sum_i MV_i * n(dur_i) * G(rating_i) \quad , \left(Mkt_{sp}^{struct} - \text{for structured credit products}\right)$$

Mkt_{sp}^{cd} = (for credit derivatives) Change in market value of the derivative for the one of the following two scenarios, which has a higher impact:
a) widening of the spread by 300% or b) narrowing of spreads by 75%

The total capital charge is defined as:

$$Mkt = Mkt_{sp}^{bonds} + Mkt_{sp}^{struct} + Mkt_{sp}^{cd}$$

Output

Mkt_{sp}

= capital charge for spread risk

$nMkt_{sp}$

= capital charge for spread risk including the risk absorbing effect of future profit sharing

QIS 4 standard model: methodology
Mkt_{sp}: spread risk

Calculation

• The functions F ($Rating_i$) and G ($Rating_i$) are defined as follows:

Rating	F (Rating $_i$)	G (Rating $_i$)
AAA	0,25%	2,13%
AA	0,25%	2,55%
A	1,03%	2,91%
BBB	1,25%	4,11%
BB	3,39%	8,42%
B	5,60%	13,35%
CCC or lower	11,20%	29,71%
unrated	2,00%	100,00%

• Furthermore, the functions m(dur) and n(dur) are defined as follows:

$$m(dur_i) = \begin{cases} \max(\min(dur_i;8);1) & \text{for rating BB;} \\ \max(\min(dur_i;6);1) & \text{for rating B;} \\ \max(\min(dur_i;4);1) & \text{for rating CCC or lower or unrated;} \\ \max(dur_i;1) & \text{otherwise} \end{cases}$$

$$n(dur_i) = \begin{cases} \max(\min(dur_i;5);1) & \text{for rating BB;} \\ \max(\min(dur_i;4);1) & \text{for rating B;} \\ \max(\min(dur_i;2.5);1) & \text{for rating CCC or lower;} \\ 1 & \text{unrated;} \\ \max(dur_i;1) & \text{otherwise} \end{cases}$$

QIS 4 standard model: methodology
Mkt_{conc}: market risk concentration

Input

E_i	=	Net exposure at default to counterparty i
$Assets_{xl}$	=	Amount of total assets excluding those where the policyholder bears the investment risk
$rating_i$	=	External rating of counterparty i

Calculation

The risk concentration charge per counterparty I is calculated as:

$$Conc_i = Assets_{xl} * XS_i * g_i + \Delta Liab_{ul}$$

The parameter g und CT are defined depending on the credit rating of the counterparty:

$Rating_i$	Credit quality step	g	CT
AAA, AA	1	0,15	5%
A	2	0,18	5%
BBB	3	0,30	3%
BB or lower, unrated	4-6	0,73	3%

The excess exposure is as follows:

$$XS_i = \max\left(0; \frac{E_i}{Assets_{xl}} - CT\right)$$

The total capital requirement is determined assuming independence between the requirements for each counterparty – i.e. the square root of the sum of squares of all individual capital requirements.

Output

Mkt_{conc}

= capital charge for market risk concentration

$nMkt_{conc}$

= capital charge for market risk concentration including the risk absorbing effect of future profit sharing

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QIS 4 standard model: methodology
SCR_{def}: Counterparty default risk

Input

LGD_i = Loss Given Default of reinsurance, financial derivatives, intermediary or any other credit exposure if counterparty i defaults

PD_i = Probability of default of counterparty i

Further notifications without explicit input necessary:

H_{re} = Herfindahl Index

Def_i = Default risk requirement for exposure i

Calculation

3 step calculation:

1. Calculation of concentration
2. Calculation of the capital charge per exposure i
3. Aggregation

$$R_{re} = 0,05 + 0,05 * H_{re}$$

Def_i is based on Vasicek-distribution, especially for total correlation R = 1:

$$Def_i = LGD_i * \min(100 * PD_i; 1)$$

PD estimate derived from external ratings:

Rating	Credit Quality Step	PD_i
AAA	1	0,002%
AA	1	0,01%
A	2	0,05%
BBB	3	0,24%
BB	4	1,2%
B	5	6,04%
CCC or lower; unrated	6	30,41%

Output

SCR_{def}

= capital charge for default risk

$nSCR_{def}$

= capital charge for default risk including the risk absorbing effect of future profit sharing

QIS 4 standard model: methodology
SCR_{def}: Counterparty default risk

Input

Loss Given Default for Reinsurance:

$$LGD = 50\% \max\left(\text{Recoverables} + SCR_{U/W}^{gross} - SCR_{U/W}^{net} - Collateral^{1)};0\right)$$

$SCR_{U/W}^{net}$ = SCR for underwriting risks calculated according to the standard formula (disregarding the loss absorbing capacity of future bonuses and deferred taxes)

$SCR_{U/W}^{gross}$ = SCR for underwriting risks calculated according to the standard formula, but disregarding the risk mitigation effect of the reinsurance contract of the counterparty (and also disregarding the loss absorbing capacity of future bonuses and deferred taxes)

Loss Given Default for Derivates :

$$LGD = 50\% \max\left(\text{market value} + SCR_{Mkt}^{gross} - SCR_{Mkt}^{net} - Collateral;0\right)$$

SCR_{Mkt}^{net} = SCR for market risk calculated according to the standard formula (disregarding the loss absorbing capacity of future bonuses and deferred taxes)

SCR_{Mkt}^{gross} = SCR for market risk calculated according to the standard formula, but disregarding the risk mitigating effect of the financial derivatives of the counterparty (and also disregarding the loss absorbing capacity of future bonuses and deferred taxes)

1) Collateral = Collateral covering the loss in relation to the counterparty

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QIS 4 standard model: methodology
SCR_{life}: life underwriting risk module

Input

$Life_{lapse}$	=	Capital charge for lapse risk
$Life_{exp}$	=	Capital charge for expense risk
$Life_{dis}$	=	Capital charge for disability risk
$Life_{mort}$	=	Capital charge for mortality risk
$Life_{long}$	=	Capital charge for longevity risk
$Life_{cat}$	=	Capital charge for catastrophe risk
$Life_{rev}$	=	Capital charge for revision risk
$nLife_{lapse}$	=	Capital charge for lapse risk including the risk absorbing effect of future profit sharing
$nLife_{exp}$	=	Capital charge for expense risk including the risk absorbing effect of future profit sharing
$nLife_{dis}$	=	Capital charge for disability risk including the risk absorbing effect of future profit sharing
$nLife_{mort}$	=	Capital charge for mortality risk including the risk absorbing effect of future profit sharing
$nLife_{long}$	=	Capital charge for longevity risk including the risk absorbing effect of future profit sharing
$Life_{cat}$	=	Capital charge for catastrophe risk including the risk absorbing effect of future profit sharing

Calculation

$$SCR_{life} = \sqrt{\sum_{rxc} CorrLife^{rxc} \bullet Life_r \bullet Life_c}$$

$$nSCR_{life} = \sqrt{\sum_{rxc} CorrLife^{rxc} \bullet nLife_r \bullet nLife_c}$$

SCR_{life} = capital charge for life underwriting risk
$nSCR_{life}$ = capital charge for life underwriting risk including the risk absorbing effect of future profit sharing

$CorrLife^{rxc}$ = the cells of the correlation matrix CorrLife

$Life_r$, $Life_s$ = capital charges for individual life underwriting sub-risks according to the rows and columns of correlation matrix CorrLife

Output

SCR_{life}

= capital charge for life underwriting risk

$nSCR_{life}$

= capital charge for life underwriting risk including the risk absorbing effect of future profit sharing

QIS 4 standard model: methodology
SCR_{life}: life underwriting risk module

The correlation matrix is defined as:

CorrLife =	$Life_{mort}$	$Life_{long}$	$Life_{dis}$	$Life_{lapse}$	$Life_{exp}$	$LIfe_{rev}$	$Life_{CAT}$
$Life_{mort}$	1						
$Life_{long}$	-0,25	1					
$Life_{dis}$	0,5	0	1				
$Life_{lapse}$	0	0,25	0	1			
$Life_{exp}$	0,25	0,25	0,5	0,5	1		
$LIfe_{rev}$	0	0,25	0	0	0,25	1	
$Life_{CAT}$	0	0	0	0	0	0	1

QIS 4 standard model: methodology
$Life_{mort}$: mortality risk

Input

No specific input data is required for this module

Calculation

i = denotes each policy where the payment of benefits (either lump sum or multiple payments) is contingent on mortality risk
ΔNAV = the change in the net value of assets minus liabilities
mortshock = a (permanent) 10% increase in mortality rates for each age

The capital charge for mortality risk is defined as the result of:

$$\text{Life}_{\text{mort}} = \sum_{i} \left(\Delta\text{NAV} \middle| \text{mortshock} \right)$$

Output

Life $_{mort}$

= Capital charge for mortality risk

nLife $_{mort}$

= Capital charge for mortality risk including the risk absorbing effect of future profit sharing

QIS 4 standard model: methodology
$Life_{long}$: longevity risk

Input

No specific input data is required for this module

Calculation

i = denotes each policy where the payment of benefits (either lump sum or multiple payments) is contingent on longevity risk
ΔNAV = the change in the net value of assets minus liabilities
longevityshock = a (permanent) 25% decrease in mortality rates for each age

The capital charge for longevity risk is defined as the result of:

$$Life_{long} = \sum_{i} \left(\Delta NAV \middle| longevityshock \right)$$

Output

Life $_{long}$

= Capital charge for longevity risk

nLife $_{long}$

= Capital charge for longevity risk including the risk absorbing effect of future profit sharing

QIS 4 standard model: methodology
$Life_{dis}$: disability risk

Input

No specific input data is required for this module

Calculation

i = denotes each policy where the payment of benefits (either lump sum or multiple payments) is contingent on disability risk

ΔNAV = the change in the net value of assets minus liabilities

disshock = increase of 35% disability rates for the next year, together with a (permanent) 25% increase (over best estimate) in disability rates at each age in following years

The capital charge for longevity risk is defined as the result of:

$$\text{Life}_{\text{dis}} = \sum_{i} \left(\Delta\text{NAV} \middle| \text{disshock} \right)$$

Output

Life $_{dis}$

= Capital charge for disability risk

nLife $_{dis}$

= Capital charge for disability risk including the risk absorbing effect of future profit sharing

QIS 4 standard model: methodology
$Life_{lapse}$: lapse risk

Input

No specific input data is required for this module

Calculation

$$\text{Life}_{\text{lapse}} = \max\left(Lapse_{down}\,;Lapse_{up}\,;Lapse_{mass}\right)$$

Where $\text{Lapse}_{\text{down}}$ = capital charge for the risk of permanent decrease of lapse rates
Lapse_{up} = capital charge for the risk of permanent increase of lapse rates
$\text{Lapse}_{\text{mass}}$ = capital charge for the risk of a mass lapse event

The capital charge for lapse risk is defined as follows:

$\text{Lapse}_{\text{down}}$: lapseshock = Reduction of 50% in the assumed rate of lapsation in all future years for policies where the surrender strain is expected to be negative
Lapse_{up}: lapseshock = Increase by 50% in the assumed rates of lapsation in all future years for policies where the surrender strain is expected to be positive
$\text{Lapse}_{\text{mass}}$: lapseshock = 30% of the sum of surrender strains over the policies where the surrender strain is positive. The result reflects the loss which is incurred in a mass lapse event

Surrender strain = net amount currently payable on surrender – best est. provision

Output

$\text{Life}_{\text{lapse}}$

= Capital charge for lapse risk

$\text{nLife}_{\text{lapse}}$

= Capital charge for lapse risk including the risk absorbing effect of future profit sharing

QIS 4 standard model: methodology
$Life_{exp}$: expense risk

Input

No specific input data is required for this module

Calculation

expshock = increase of 10% in future expenses compared to best estimate anticipations, and increase by 1% per annum of the expense inflation rate compared to anticipations; but for policies with adjustable loadings, 75% of these additional expenses can be recovered from 2 year onwards by increasing the charges payable by policyholders.

The capital charge for expense risk is determined as follows:

$$\mathbf{Life}_{\mathbf{exp}} = (\Delta \mathbf{NAV} \,|\, \mathbf{expshock})$$

Output

$Life_{exp}$

= Capital charge for expense risk

$nLife_{exp}$

= Capital charge for expense risk including the risk absorbing effect of future profit sharing

QIS 4 standard model: methodology
$Life_{rev}$: revision risk

Input

No specific input data is required for this module

Calculation

revshock = increase of 3% in the annual amount payable for annuities exposed to revision risk. The impact should be assessed considering the remaining run-off period.

The capital charge for revision risk is defined as follows:

$$\mathbf{Life}_{\mathbf{rev}} = (\Delta \mathbf{NAV} \mid \mathbf{revshock})$$

Output

$Life_{rev}$

= Capital charge for revision risk

= **nLife rev**

QIS 4 standard model: methodology
$Life_{CAT}$: catastrophe risk

Input

No specific input data is required for this module

Calculation

The capital charge for catastrophe risk is defined as follows:

$$\text{Life}_{CAT} = \Delta NAV \left| \text{life CAT shock} \right.$$

Where $life_{CAT}$ shock is combination of the following events all occurring at the same time:

• an absolute 1,5 ‰ increase in the rate of policyholders experiencing morbidity over the following year. Where appropriate, undertakings should assume that one-third of these policyholders experience morbidity for 6 months, one-third for 12 months and one-third for 24 months from the time at which the policyholder first become sick.

• an absolute 1,5 ‰ increase in the rate of policyholders dying over the following year

Output

$Life_{CAT}$

= Capital charge for catastrophe risk

$nLife_{CAT}$

= Capital charge for catastrophe risk including the risk absorbing effect of future profit sharing

QIS 4 standard model: methodology
SCR_{life}: simplifications: criteria for using it

Participants may use the simplified methods if the criteria outlined in TS.II.A.38 are satisfied or are likely to be met.

[TS.II.A.38.] **Simplified actuarial methods and statistical techniques may be used if:**

1. the types of contracts written for each line of business or homogenous group of risk is not complex.
2. the line of business or homogenous group of risks written is simple by nature of the risk
3. any additional nature and complexity standards set out for each liability are met
4. the liability that is valued is not material in absolute terms, or relative to the overall amount of the total best estimate technical provision.

   => QIS 4 guidance on materiality:

   - **absolute materiality:**

   Sum of all best estimates (determined with simplifications) ≤ 50 Mio. € (for life business)

   Sum of all best estimates (determined with simplifications) ≤ 10 Mio. € (for non-life business)

OR

   - **relative materiality:**

   best estimate for each homogenous risk group of risks (determined with simplifications) ≤10% of the total gross best estimate **AND**

   sum of best estimate (determined with simplifications) ≤30% of the total gross best estimate

If a participant (e.g. a captive (re)insurer) does not meet the threshold indicated, but nevertheless thinks it should be allowed to apply a simplified approach because of the specificities of its situation, it can do so provided that it 1) explains the reasons for this and 2) indicates the criteria it considers relevant in its situation.

QIS 4 standard model: methodology
SCR_{life}: simplifications

According to the proportionality principle, undertakings may use the following simplified methods.
Participants may use these simplified methods
if the criteria outlined in TS.II.A.38 are satisfied or are likely to be met.

$Life_{mort}$ mortality risk

$$Life_{mort} = 0.1 \bullet n \bullet q \bullet 1.1^{((n-1)/2)} Capital\_at\_Risk$$

$Life_{long}$ longevity risk

$$Life_{long} = 0.25 \bullet n \bullet q \bullet 1.1^{((n-1)/2)} \bullet Technical\ Provisions_{long}$$

$Life_{dis}$ disability risk

$$Life_{dis} = 0.35 \bullet n \bullet i \bullet 1.1^{((n-1)/2)} \bullet sum\_at\_Risk$$

n = modified duration of corresponding liability cash-flows
q = expected average death rate over the next year weighted by corresponding sum assured
i = expected movements from healthy to sick over the next year weighted by sum assured/ annual payment

QIS 4 standard model: methodology
SCR_{life}: simplifications

$Life_{lapse}$ lapse risk

$$Lapse_{down} = 0.5 \bullet l_{down} \bullet n_{down} \bullet S_{down}$$

$$Lapse_{up} = 1.5 \bullet l_{up} \bullet n_{up} \bullet S_{up}$$

l_{down}; l_{up} = estimate of the average rate of lapsation of the policies with a negative / positive surrender strain

n_{down}; n_{up} = average period (in years), weighted by surrender strains, over which the policy with a negative / positive surrender strain runs off

S_{down}; S_{up} = sum of negative / positive surrender strains

$Life_{exp}$ expense risk

$$Life_{exp} = (\text{renewal expenses in the 12 months prior to valuation date}) \bullet n(exp) \bullet (0.1 + 0.005 \bullet n(exp))$$

n(exp) = average (in years) period over which risk runs off, weighted by renewal expenses

$Life_{rev}$ revision risk

$$Life_{rev} = 0.03 \bullet TP_{rev}$$

TP_{rev} = Total net technical provisions for annuities exposed to revision risk

QIS 4 standard model: methodology
SCR_{life}: simplifications

$Life_{CAT}$ catastrophe risk

$$\text{Life}_{\text{CAT}} = \sum_i 0,0015 * Capital\_at\_Risk_i$$

$$Capital\_at\_Risk_i = SA_i + AB_i * Annuity\_factor - TP_i$$

TP_i	=	Technical provisions (net of reinsurance) for each policy i
SA_i	=	For each policy i: where benefits are payable as a single lump sum, the Sum Assured (net of reinsurance) on death or disability; otherwise zero
AB_i	=	For each policy i: where benefits are not payable as a single lump sum, the annualised amount of benefit (net of reinsurance) payable on death or disability; otherwise zero
Annuity_factor	=	Average annuity factor for the expected duration over which benefits may be payable in the event of a claim

Looking at the Excel Spreadsheet

Looking at the Excel Spreadsheet

Standard model Excel spreadsheet

How to include results for market risk?

- **Results calculated on a shock scenario approach (via economic balance sheet)**
- **Results calculated with simplifications**

How to include results for life underwriting risk?

- **Are there any shock scenario based results or only “simplification results”?**
- **Results calculated with simplifications**

⇒ What are the main challenges?

How to deal with the main challenges?

How to deal with the main challenges?

What are the main challenges?

How to derive the surrender strains for lapse risk?

- **How to calculate “best estimate of provision held”?**
- **Are all amounts currently payable on surrender available?**

How to calculate the technical provisions (to get the SCR for interest rate risk)?

- **Coping with the asset-liability mismatch?**
- **Reflection of profit sharing?**

What other kinds of challenges may occur due to speciality of the Israeli market?

⇒ What’s your “way of Solvency”?