



**The Actuarial Profession**

making financial sense of the future

**GIRO 2008 - Sorrento**

**Theoretical and practical  
aspects of QIS4 (D6)**

**Richard Bulmer**

**25 September 2008**

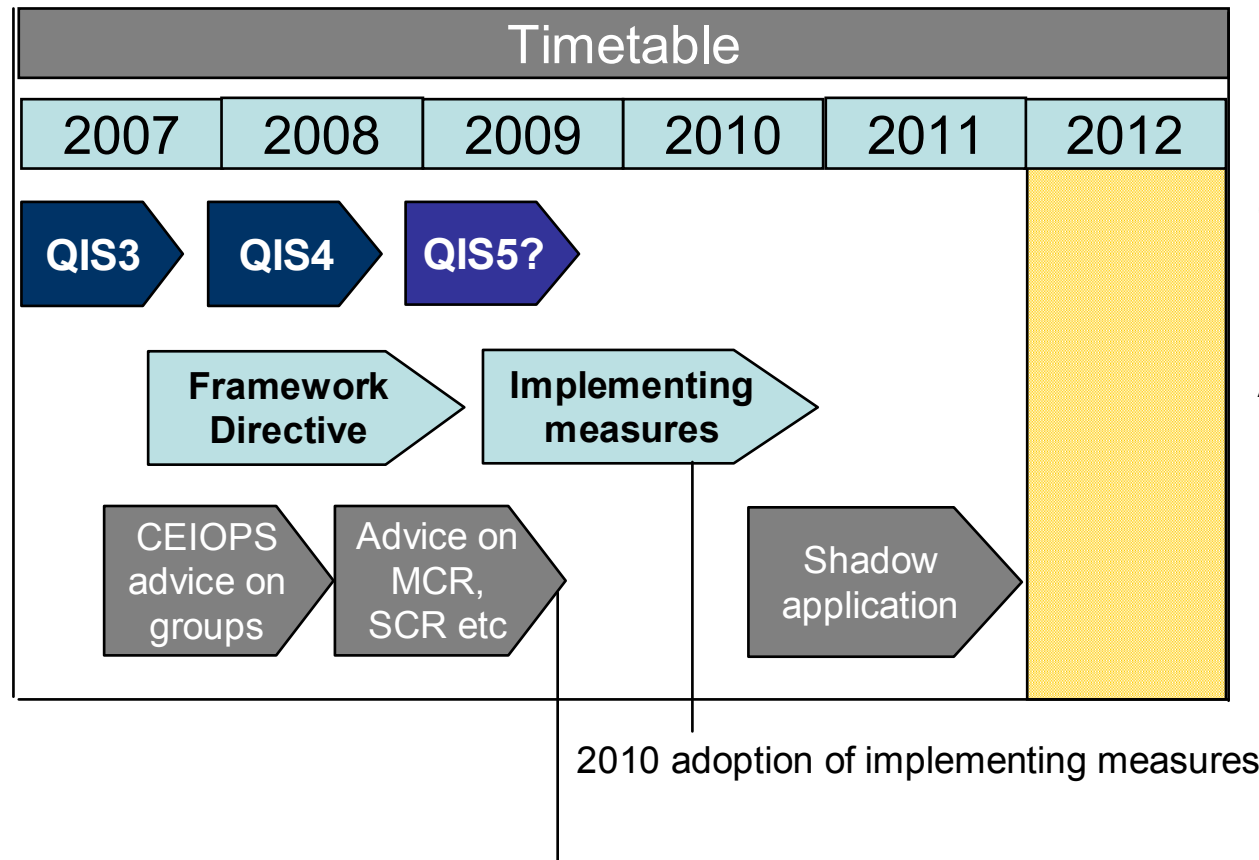
# Theoretical and practical aspects of QIS4

- Brief background to Solvency II
  - Principal features of QIS4
  - Implications of QIS4 specification for insurance companies in UK and continental Europe
  - Early results from QIS4
  - Issues remaining to be addressed by European Commission and CEIOPS
  - Latest Solvency II developments
  - Questions / discussion
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# Current Solvency II timeline



May-August consultation - Advice to EC in October

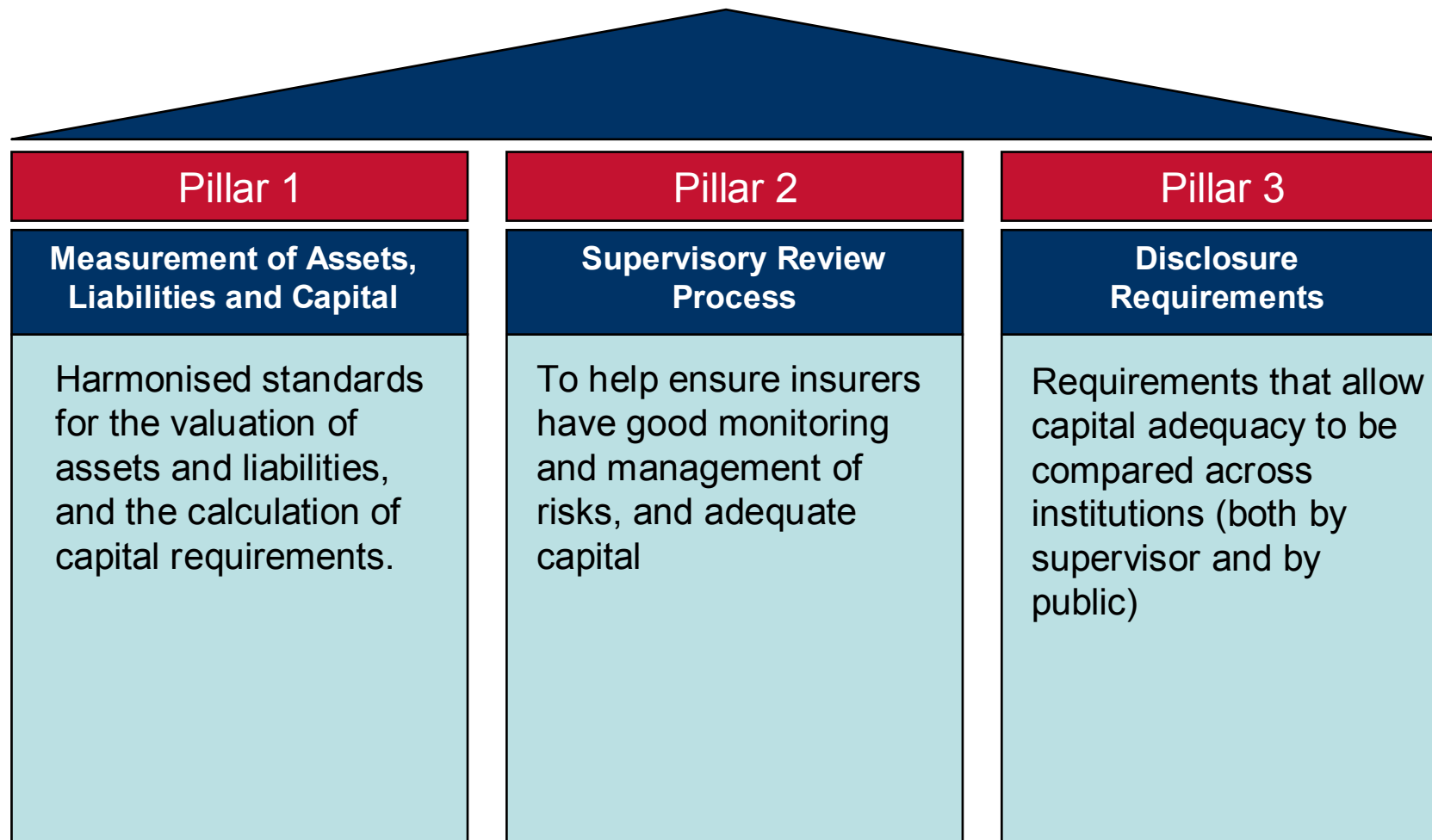
## Recent developments

Draft framework directive published – update likely to be published during Autumn 2008

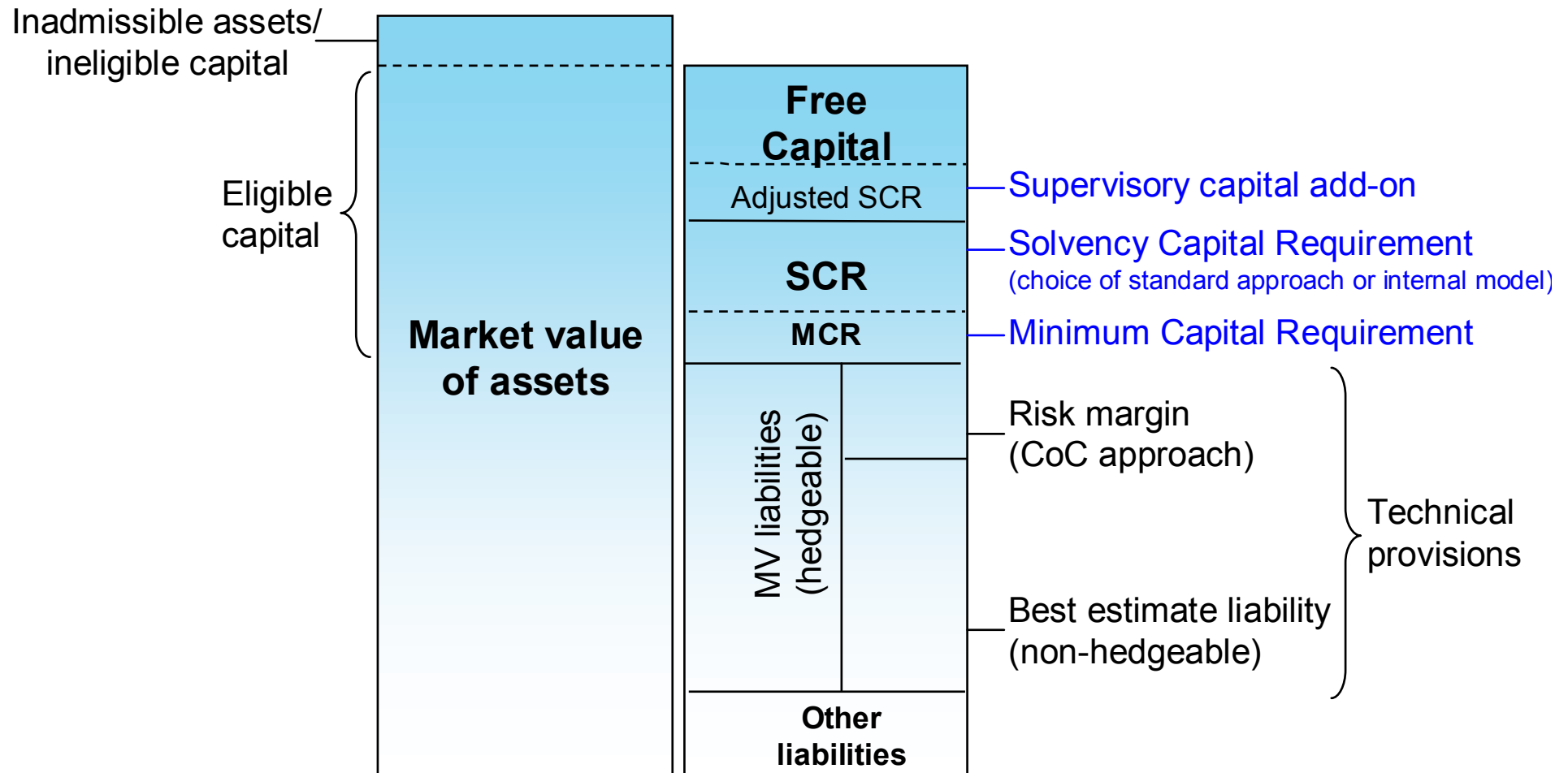
Updated timetable

QIS4 results due in November 2008

# The 3 Pillars of Solvency II

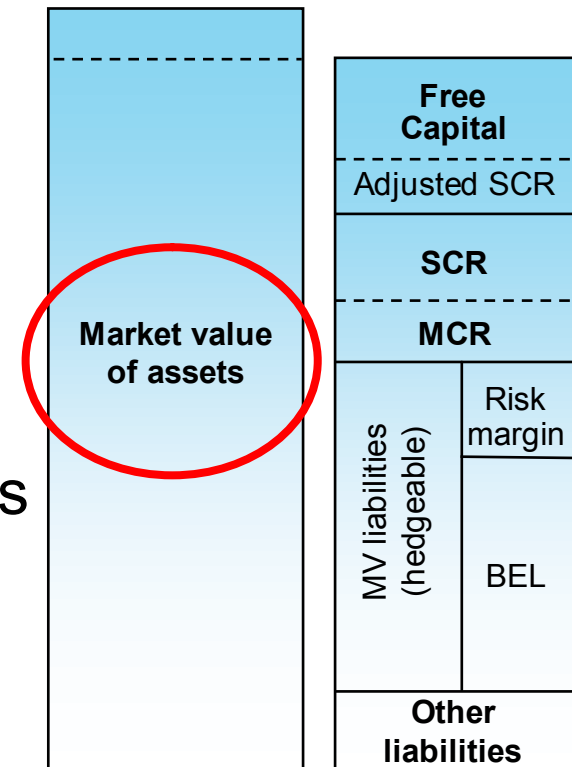


# Pillar 1 – Basic structure



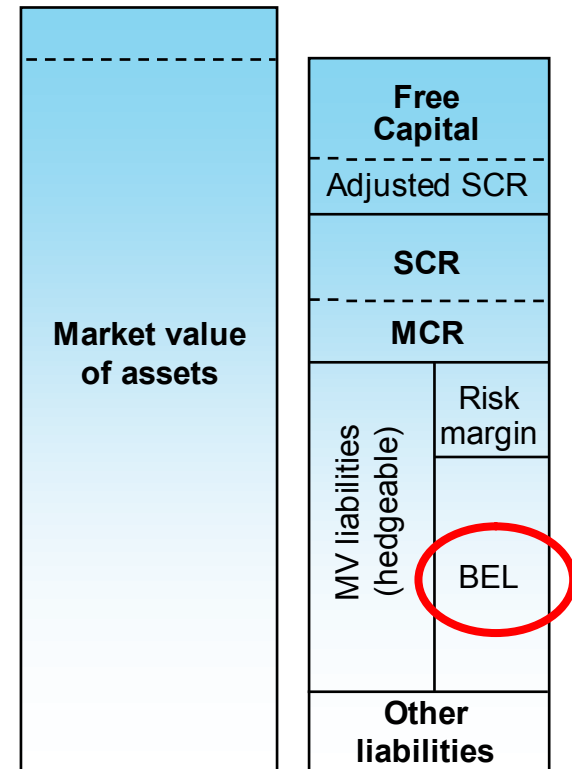
# Solvency II - Asset valuation

- Tradable assets at market value
- Non-tradable assets "valued prudently"
- No limits on which types of assets held (but possible permitted links rules for UL assets)



# Solvency II – Best Estimate Liabilities

- Hedgeable risks valued market consistently
- Non-hedgeable risks valued at discounted best estimate plus risk margin
- Discretionary benefits generally included as a liability
- Stochastic calculation of options and guarantees



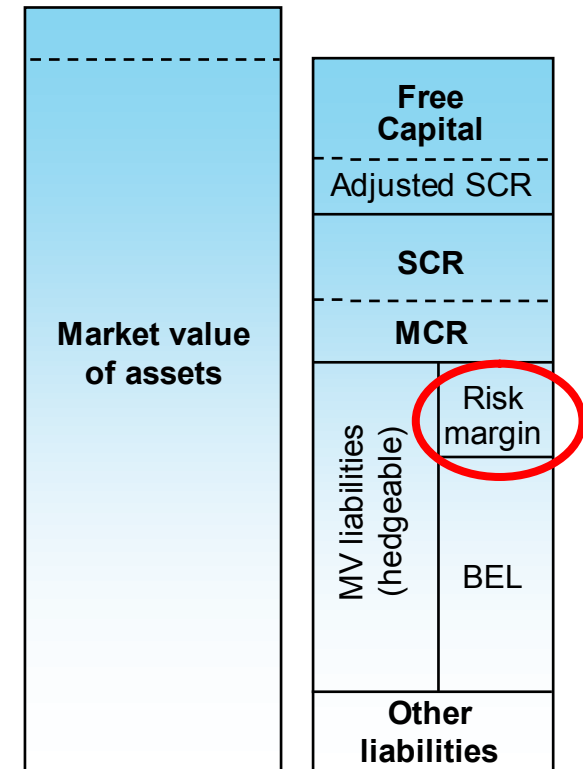


# Solvency II – Risk margins

## Cost of capital approach

Time	$SCR_i$		Cost of Capital		Capital charges		Discount factor
0	$SCR_0$	*	6%	=	$Cap\ charge_0$	*	$D_0$
1	$SCR_1$	*	6%	=	$Cap\ charge_1$	*	$D_1$
2	$SCR_2$	*	6%	=	$Cap\ charge_2$	*	$D_2$
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
$\omega$	$SCR_\omega$	*	6%	=	$Cap\ charge_\omega$	*	$D_\omega$

- Future SCRs exclude market and credit risk, but allow no diversification across different lines of business
- Cost of capital currently set at 6%



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# A bit of history...Quantitative Impact Studies

- CEIOPS was requested by European Commission to prepare advice for new solvency and supervisory standard Solvency II
- Impact studies to assess feasibility and impact:
  - QIS1
    - Focused on the level of prudence in the current technical provisions, impact of best estimate and risk margins
  - QIS2
    - Testing possible options for technical provisions, the SCR standard formula and MCR calculation
    - More focus on structure than calibration
  - QIS3
    - The suitability of the suggested calibrations for the calculation of the SCR, MCR
    - The effect of applying the specifications to insurance groups

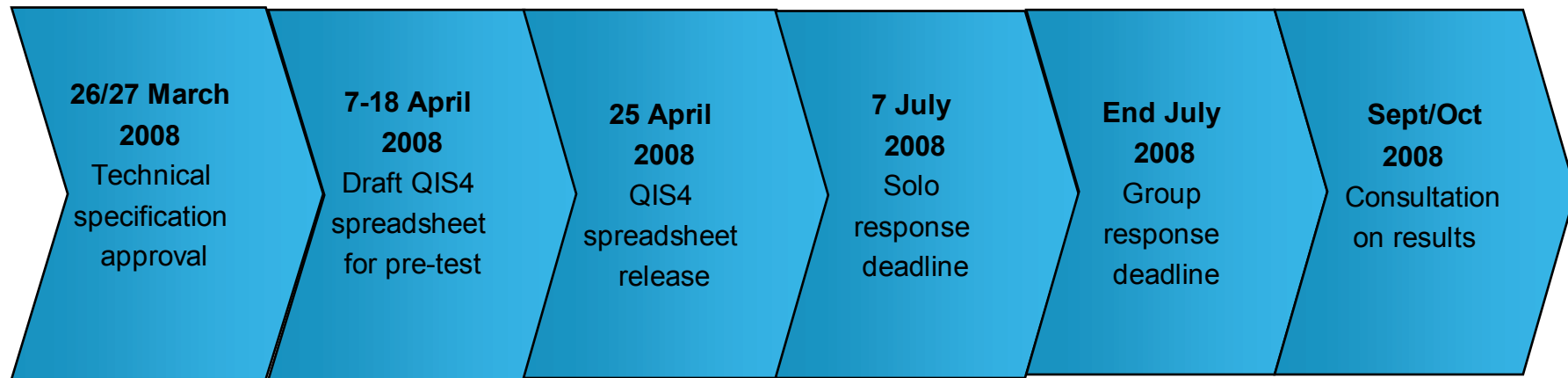
# Aims of QIS4

- QIS4 was drafted on the basis of QIS3, taking into account feedback received from the QIS3 exercise. Its main aims were as follows:

Simplifications	<ul style="list-style-type: none"> <li>Testing practicality of <b>simplified methods</b> proposed for the calculation of technical provisions and the SCR</li> </ul>
MCR:	<ul style="list-style-type: none"> <li>Testing alternative approaches to the MCR calculation</li> </ul>
Groups:	<ul style="list-style-type: none"> <li>To gather more information and detail on:                             <ul style="list-style-type: none"> <li>Diversification effects</li> <li>Impact of non-European operations</li> <li>Use of internal models</li> </ul> </li> </ul>
Internal models:	<ul style="list-style-type: none"> <li>To increase firms' participation with respect to QIS3 (only 13% of total submissions for internal models)</li> <li>Assess firms future intentions regarding internal model use via qualitative questionnaire</li> <li>Collect data to refine SCR standard formula calibration</li> <li>Assess data quality via qualitative questionnaire</li> </ul>

Commission had high target participation rates for QIS4 - 25% stand alone firms, 60% of groups

# QIS4 - Timeline



- Submissions are confidential
- Report expected by end November 2008

# Non-life technical provisions - segmentation

- Classes of business:
  - Accident and health – workers' compensation, health insurance and others
  - Motor, third party liability
  - Motor, other classes
  - Marine, aviation and transport (MAT)
  - Fire and other property damage
  - Third-party liability
  - Credit and suretyship
  - Legal expenses
  - Assistance
  - Miscellaneous
- Proportional reinsurance should be treated as direct insurance
- Non-proportional reinsurance should be split between property, casualty and MAT business

# Proxies (1)

Proxy	Claims Provision	Premium Provision
Market development patterns	✓	
Average severity/frequency	✓	
Bornhuetter-Ferguson	✓	
Case by case	✓	
Expected loss		✓
Simplified application of standard statistical techniques	✓	
Premium based		✓
Claims handling costs	✓	

# Proxies (2)

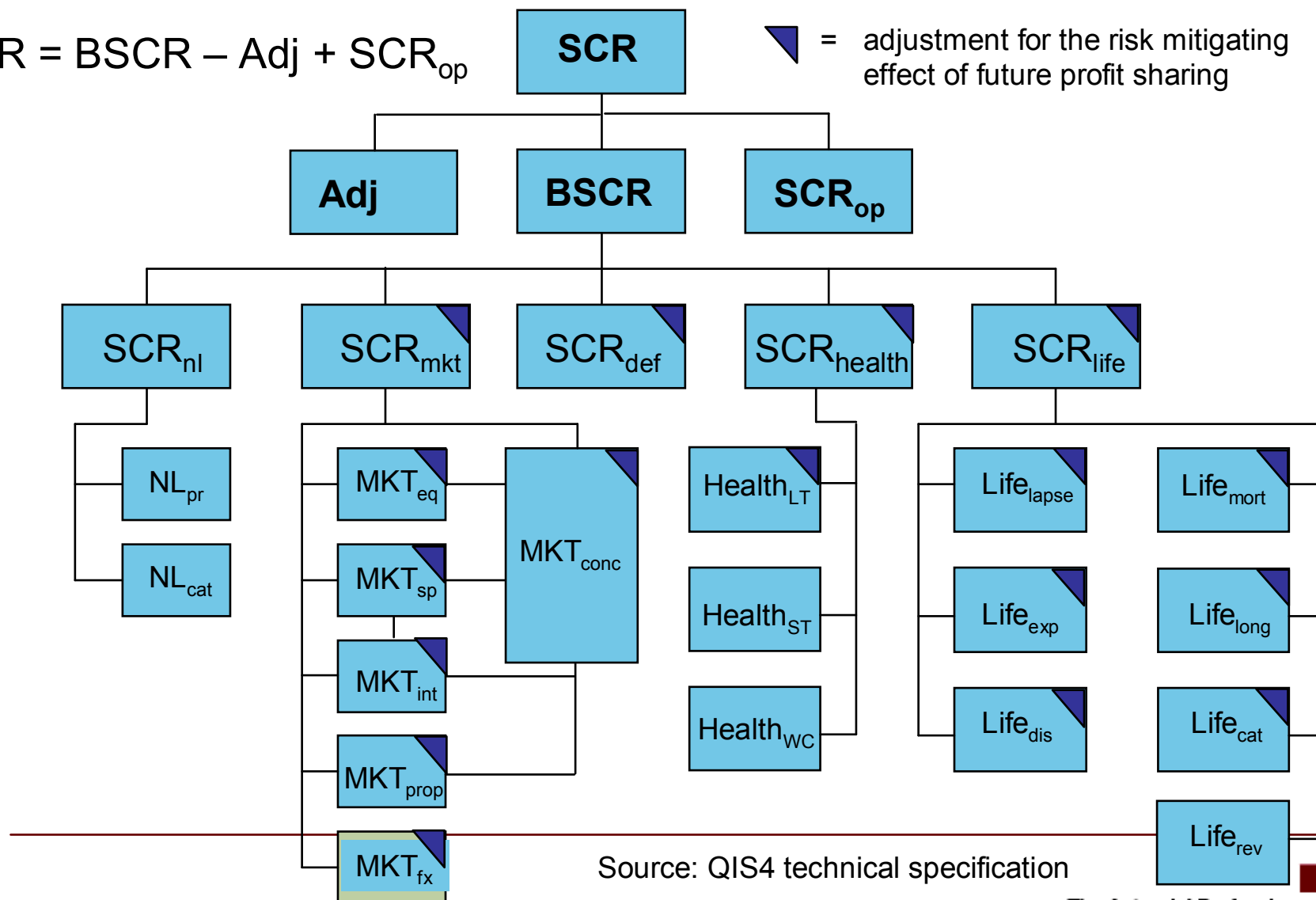
Proxy	Discounting	Gross to net
Market development patterns		✓
Average severity/frequency	✓	✓
Bornhuetter-Ferguson		✓
Case by case	✓	✓
Expected loss		✓
Simplified application of standard statistical techniques		✓
Premium based		
Claims handling costs		



# Solvency Capital Requirement (SCR)

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

**SCR** = adjustment for the risk mitigating effect of future profit sharing



Source: QIS4 technical specification

# Overall SCR calculation

- $SCR = BSCR - Adj + SCR_{op}$
- Correlations

$CorrSCR =$	$SCR_{mkt}$	$SCR_{def}$	$SCR_{life}$	$SCR_{health}$	$SCR_{nl}$
$SCR_{mkt}$	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

# SCR - Operational risk

- $SCR_{op} = \min\{0.30 \times BSCR; Op\}$
- $Op = \max[0.02 \times Earn_{nl}; 0.02 \times Tp_{nl}]$

# Percentage of firms with additional capital needs to meet SCR – QIS3 Results

	Life	Non-life	Composite	Total
Large	18.3	23.7	7.3	17.5
Medium	12.4	20.0	7.1	15.3
Small	10.9	18.0	13.2	15.4
Total	13.1	19.5	8.7	15.7

# Premium risk - standard deviations

Line of business	QIS3 %	QIS4 %
Motor third-party liability	10.0	9.0
Motor other classes	10.0	9.0
MAT	12.5	12.5
Fire and other property damage	10.0	10.0
Third-party liability	10.0	12.5
Credit and suretyship	12.5	15.0
Legal expenses	5.0	5.0
Assistance	7.5	7.5
Miscellaneous	12.5	11.0
Non-prop RI – property	15.0	15.0
Non-prop RI - casualty	15.0	15.0
Non-prop RI - MAT	15.0	15.0

# Reserve risk – standard deviations

Line of business	QIS3 %	QIS4 %
Motor third-party liability	12.5	12.0
Motor other classes	7.5	7.0
MAT	15.0	10.0
Fire and other property damage	10.0	10.0
Third-party liability	15.0	15.0
Credit and suretyship	10.0	15.0
Legal expenses	10.0	10.0
Assistance	10.0	10.0
Miscellaneous	15.0	10.0
Non-prop RI – property	15.0	15.0
Non-prop RI - casualty	20.0	20.0
Non-prop RI - MAT	20.0	20.0

# Entity-specific factors

- Extension of use of undertaking-specific data to reserving risk?
- New rules for weights to be given to market data and undertaking-specific data
- Geographical diversification
- Definition of geographical areas

# SCR – catastrophe risk (non-life)

- Layer 1 – factor based approach if no regional scenarios are available from the local supervisor
- Layer 2 – regional scenarios
- Layer 3 – personalised catastrophe scenarios where the calibration obtained under layer 1 or layer 2 is considered by the firm to be unrepresentative of their cat exposure



# SCR - Market risk correlations

<i>CorrMkt</i>	<i>Mkt<sub>int</sub></i>	<i>Mkt<sub>eq</sub></i>	<i>Mkt<sub>prop</sub></i>	<i>Mkt<sub>sp</sub></i>	<i>Mkt<sub>conc</sub></i>	<i>Mkt<sub>fx</sub></i>
<i>Mkt<sub>int</sub></i>	1					
<i>Mkt<sub>eq</sub></i>	0	1				
<i>Mkt<sub>prop</sub></i>	0.5	0.75	1			
<i>Mkt<sub>sp</sub></i>	0.25	0.25	0.25	1		
<i>Mkt<sub>conc</sub></i>	0	0	0	0	1	
<i>Mkt<sub>fx</sub></i>	0.25	0.25	0.25	0.25	0	1

# SCR - Interest rate risk (1)

- $MKT_{int} = \max\{0, \text{change in NAV (upward shock)}, \text{change in NAV (downward shock)}\}$
- The altered term structures are derived by multiplying the current interest rate curve by  $(1+s^{up})$  and  $(1+s^{down})$
- Applied to bond investments and discounted liabilities

# Interest rate risk (2)

Maturity $t$ (years)	1	2	3	4	5	6	7
Relative changes $s^{up}(t)$	0.94	0.77	0.69	0.62	0.56	0.52	0.49
Relative change $s^{down}(t)$	-0.51	-0.47	-0.44	-0.42	-0.40	-0.38	-0.37

Maturity $t$ (years)	8	9	10	11	12	13	14
Relative changes $s^{up}(t)$	0.46	0.44	0.42	0.42	0.42	0.42	0.42
Relative change $s^{down}(t)$	-0.35	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34

Maturity $t$ (years)	15	16	17	18	19	20+
Relative changes $s^{up}(t)$	0.42	0.41	0.40	0.39	0.38	0.37
Relative change $s^{down}(t)$	-0.34	-0.33	-0.33	-0.32	-0.31	-0.31

# SCR - Equity risk

- |                     | <i>Global</i> | <i>Other</i> |
|---------------------|---------------|--------------|
| <i>Equity shock</i> | 32%           | 45%          |

- | <i>CorrIndex</i> | <i>Global</i> | <i>Other</i> |
|------------------|---------------|--------------|
| <i>Global</i>    | 1             |              |
| <i>Other</i>     | 0.75          | 1            |

- “Other” comprises emerging markets, non-listed equities and alternative investments

# SCR - Property and currency risk

- 20% fall in real estate benchmarks
- 20% change in respect of net currency exposures

# SCR - Counterparty default risk (1)

Rating	Credit Quality Step	PD <sub>i</sub>
AAA	1	0.002%
AA		0.01%
A	2	0.05%
BBB	3	0.24%
BB	4	1.20%
B	5	6.04%
CCC or lower, unrated	6, -	30.41%

- Relatively complex calculation of risk charge

# SCR – Counterparty default risk (2)

- Unrated reinsurers not subject to Solvency II regulation would be treated as rating class 6 (CCC). Unrated reinsurers subject to Solvency II regulation would be treated as rating class 3 (BBB)
- For intragroup reinsurance which does not meet previous requirements, a regulatory rating may be used to determine the probability of default of the intragroup counterparty. The probability of default depends on the solvency ratio (ratio of own funds and SCR) according to a table in the QIS4 specification

Counterparty solvency ratio	PD <sub>i</sub>
> 200%	0.002%
> 160%	0.01%
> 130%	0.05%
> 100%	0.24%
> 70%	1.20%
> 50%	6.40%
≤ 50%	30.41%

# MCR – QIS4

Line of business	Reserve factor	Premium factor
A&H – workers comp	0.13	0.09
A&H - health	0.10	0.04
A&H - other	0.20	0.06
Motor third-party liability	0.16	0.12
Motor other classes	0.09	0.12
MAT	0.13	0.16
Fire and other property damage	0.13	0.13
Third-party liability	0.20	0.16
Credit and suretyship	0.20	0.20
Legal expenses	0.13	0.06
Assistance	0.13	0.10
Miscellaneous	0.13	0.14
Non-prop RI – property	0.20	0.20
Non-prop RI - casualty	0.26	0.20
Non-prop RI - MAT	0.26	0.20



# Group capital calculations

- Regulatory background
  - Want to give credit for benefits of diversification
  - But have concerns over fungibility
- Issues
  - How much credit for diversification e.g. life business and non-EEA subsidiaries?
  - Importance of solo calculations for groups?

# Group specification in QIS4

## Data requirements

- Groups are required to calculate:
  - Required group capital according to the following four methods:

1. Default method: standard SCR on consolidated group position

2. Sum of solo SCRs

3. Sum of solo SCRs adjusting for intra-group transactions

4. Group SCR on group internal model (+ qualitative info)

- Available group capital

A comparison of 1 to 2 and 3 intended to give an indication of diversification benefits

# Group specification in QIS4 (cont')

## Solo entity SCR versus Group SCR

Operational risks	<ul style="list-style-type: none"><li>Sum of solo entities operational risk charges with and without 30% cap</li></ul>
Counterparty risk	<ul style="list-style-type: none"><li>Largely same method as solo entity</li></ul>
Market risks	<ul style="list-style-type: none"><li>Largely same as solo entity level, except interest and currency shocks – max of aggregated up and down value</li></ul>
Non-life risks	<ul style="list-style-type: none"><li>Calculate Herfindahl index for geographical diversification</li><li>Two calculations: EEA and worldwide</li></ul>
Life uw risks	<ul style="list-style-type: none"><li>Same method as solo entity</li></ul>

# Group specification in QIS4 (cont')

- “Group support”
  - $\sum (\text{solo SCR} - \text{solo MCR}) = \text{max “group support”}$
  - $\sum (\text{deficits in solo SCR}) = \text{min “group support”}$
  - Where the sums apply only to EEA members in the group
- Additional information requested e.g. legal and practical barriers to transferability of assets pledged under “group support”
- Group SCR floor =  $\sum$  solo MCRs
- Adjustment to available capital for non-transferability (hybrid/subordinated capital and with-profits surpluses) and minority interests

$$\text{Contr}_j = \text{SCR}_j \times \frac{\text{SCR}}{\sum_{i=1}^n \text{SCR}_i}$$

Clearly much work still required

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# Potential implications of QIS4 specification

- Merger and acquisition activity
- Group restructuring
- Strong incentive for non-life insurers to develop internal models
- Need for early preparation

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# Early results from QIS4 (from FSA)

- Significantly higher participation than QIS3:
  - 63 non-life firms
  - 85% of non-life market by annual premiums
- Practical issues:
  - Counterparty default risk charge
  - Risk margin projections
- SCR/MCR coverage:
  - 89% of non-life firms would cover the SCR
  - 95% of non-life plus life firms would cover the MCR
  - Wide range (5% to 60%) of ratios of MCR to SCR
- SCR internal model results:
  - Significantly lower (60% to 70%) than standard formula for non-life business
  - Significantly higher (130%) than standard formula for life business



# Other comments based on Watson Wyatt experience

- Standard formula SCR has generally reduced to some extent for solo entities:
  - Non-life underwriting risk
  - Counterparty default risk
- MCR has tended to increase to some extent, although reductions for some companies writing business for which non-life SCR underwriting risk factors appear heavy

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# SCR non-life underwriting risk

## - outstanding issues

<b>Point of debate</b>
Level of factors
Granularity
Size factors
Treatment of reinsurance
Geographical diversification
No allowance for the cycle, or for expected profits and losses

# Other SCR calculation issues

– not exhaustive!

Area	Point of debate
Equity shock	32%/45% for all or dependent on term of liabilities?
Equity shock	Dampener to shock?
Counterparty risk	Exposure pre or post other shocks? Intra-group?
Operational risk	Simplistic formula appropriate?

# Group issues

Area	Point of debate
Group capital support	Restrictions, purpose
Non-EEA subsidiaries	Basis of inclusion
Geographical diversification	Should this be recognised in the standard SCR?

# Other issues

Area	Point of debate
Discount rate	Swap curve or Treasury curve?
MCR	Design and calibration
Surplus funds	Liability or capital?
Cost of capital	What should the annual CoC be? Vary by LoB?
Internal model approval	How high to set the standard? The role of expert judgment?
Own Risk Self Assessment	What are the aims for the ORSA? What will be required? How to balance proportionality?

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