The Actuarial Profession
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GIRO Conference and Exhibition 2012

Undertaking-specific parameters (USPs): Latest developments

Richard Bulmer

Undertaking-specific parameters

- Background to USPs
- Discussion of USP methods – advantages / disadvantages
- Supervisory approval process
- Data quality
- Latest developments
- Questions or comments?

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Solvency II Directive and Former CP75

EUROPEAN UNION

THE EUROPEAN PARLIAMENT THE COUNCIL

Brussels, 19 October 2009
(OR. en)

2007/0143 (COD) PE-CONS 3643/1/09
REV 1

SURE 15
ECOFIN 349
CODEC 693

LEGISLATIVE ACTS AND OTHER INSTRUMENTS

Subject: DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the taking-up and pursuit of the business of Insurance and Reinsurance (Solvency II) (recast)

PE-CONS 3643/1/09 REV 1 NC/lllrtns
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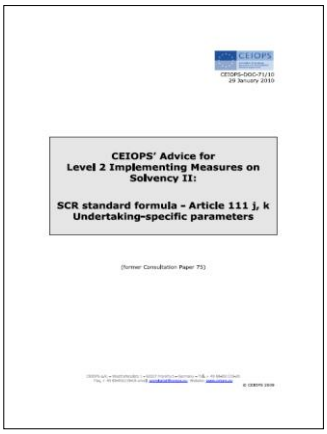


CEIOPS-DOC-71/10
29 January 2010

CEIOPS' Advice for Level 2 Implementing Measures on Solvency II:

SCR standard formula - Article 111 j, k Undertaking-specific parameters

(former Consultation Paper 75)

These will be supplemented by level 2 implementing measures and level 3 guidelines

Article 104(7)

- **Subject to approval** by the supervisory authorities, insurance and reinsurance undertakings **may**, within the design of the standard formula, **replace a subset of its parameters** by parameters **specific to the undertaking** concerned when calculating the life, **non-life** and **health** underwriting modules
- Such parameters shall be calibrated on the basis of the **internal data** of the undertaking concerned, or of **data which is directly relevant** for the operations of that undertaking using standardised methods
- When granting supervisory approval, supervisory authorities shall verify the **completeness, accuracy and appropriateness of the data** used

Article 110 – Significant deviations from the assumptions underlying the standard formula calculation

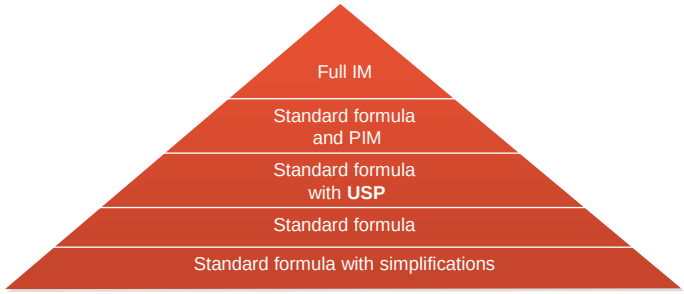
- Where it is **inappropriate** to calculate the Solvency Capital Requirement in accordance with the standard formula … because the **risk profile** of the insurance or reinsurance undertaking concerned **deviates significantly from the assumptions underlying the standard formula calculation**, the supervisory authorities **may**, by means of a decision stating the reasons, **require** the undertaking concerned to **replace a subset of the parameters** used in the standard formula calculation by parameters **specific to that undertaking** when calculating the life, non-life and health underwriting risk modules, as set out in Article 104(7). Those specific parameters shall be calculated in such a way to ensure that the undertaking complies with Article 101(3).

Article 101(3)

- The Solvency Capital Requirement shall be calibrated so as to ensure that all quantifiable risks to which an insurance or reinsurance undertaking is exposed are taken into account. It shall cover existing business, as well as the new business expected to be written over the following 12 months. With respect to existing business, it shall cover only unexpected losses
- It shall correspond to the **Value-at-Risk of the basic own funds of an insurance or reinsurance undertaking subject to a confidence level of 99.5% over a one-year period**

Different methods to calculate the SCR

- The principle of **proportionality** is intended to support the consistent application of the principles-based solvency requirement to all insurers
- Solvency II provides a **range of methods** to calculate the SCR. This allows undertakings to choose a method which is proportionate to the nature, scale and complexity of the risks that are measured
- Unrealistic to expect the standard formula to be appropriate for over 3,500 insurance / reinsurance undertakings



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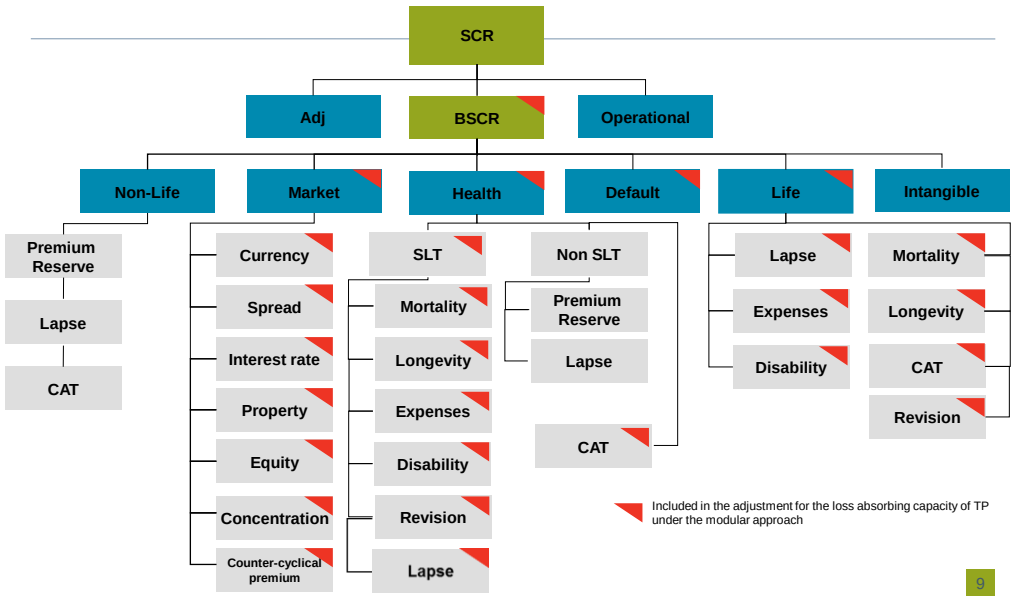
Structure for SCR



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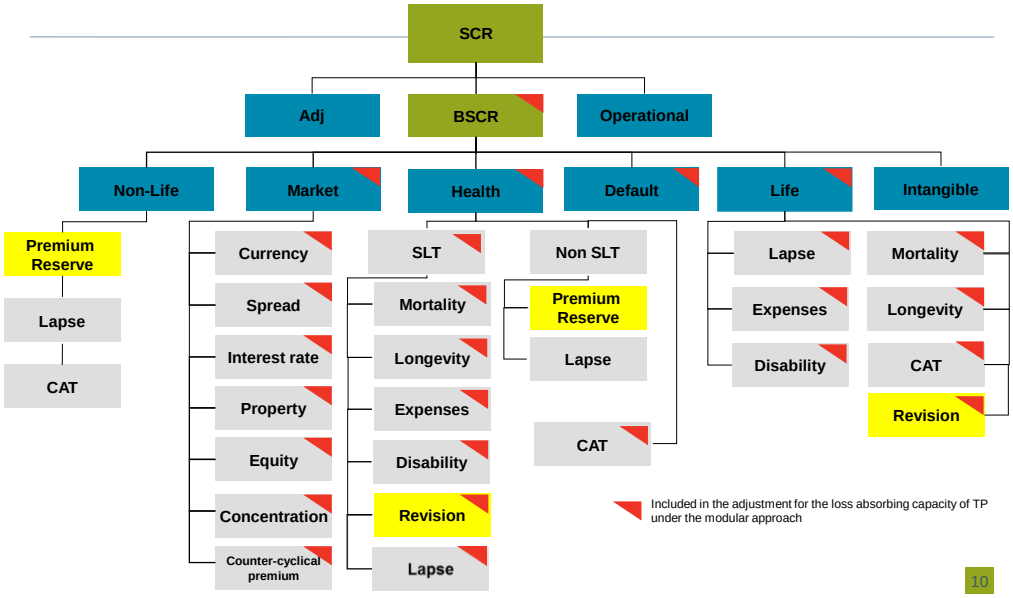
Structure for SCR



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USPs

- Can be based on **undertaking-specific data (net)** or **external data (gross)**
- CP75 specified three **premium risk** and three **reserve risk** methods
- "CEIOPS does not consider one method to be perfect and proposes that undertakings apply a variety of methods to estimate their appropriate volatility" (former CP75)
- "The undertaking shall provide the results for at least two of the methods included below" (former CP75)
- "Where the insurance or reinsurance undertaking is not able to demonstrate the accuracy of the results of one method over the others, the method providing the most conservative result shall be used"
- Weighted average of standard formula factors and USPs - weighting dependent on period of time covered by data

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Weightings given to USPs (CP75)

	Internal data		External data	
Number of years of data	Motor vehicle liability, general liability, credit	Other classes	Motor vehicle liability, general liability, credit	Other classes
5	34%	34%	30%	30%
6	43%	51%	34%	38%
7	51%	67%	38%	46%
8	59%	81%	42%	53%
9	67%	92%	46%	58%
10	74%	100%	50%	63%
11	81%		53%	
12	87%		56%	
13	92%		58%	
14	96%		61%	
15	100%		63%	

Usefulness of USPs

- Alternative to standard formula factors:
  - Different profile
  - Use of external data
- Alternative to partial internal model if unable to obtain approval
- Input to ORSA
  - "That assessment shall include … the overall solvency needs taking into account the specific risk profile, approved risk tolerance limits and the business strategy of the undertaking" (Article 45)
- Could form a part of the validation of results emerging from internal model

Undertaking-specific parameters

- Background to USPs
- Discussion of USP methods – advantages / disadvantages
  - Premium risk (CP75)
  - Reserve risk (CP75)
  - Non-proportional reinsurance adjustment factor
- Supervisory approval process
- Data quality
- Latest developments
- Questions or comments?

Premium risk method 1

- Applied to each line of business separately
- Involves comparing earned premiums and the estimated ultimate claims at the end of development year 1
- Assumptions – for the particular undertaking, any accident year and any line of business:
  - The expected loss is proportional to the earned premium
  - The company has a constant expected loss ratio (i.e. no allowance for premium rate changes)
  - The variance of the loss is proportionate to the earned premium
  - The least squares fitting technique is appropriate

Premium risk method 1

	(1)	(2)	(1)/(2)
Accident year ending	Ultimate claims at end of first year	Earned premiums	Ultimate loss ratio
1997	7,000	10,000	70%
1998	5,500	10,500	52%
1999	8,500	11,000	77%
2000	6,250	11,500	54%
2001	7,500	12,000	63%
2002	8,500	11,500	74%
2003	7,500	11,000	68%
2004	8,500	10,500	81%
2005	7,750	10,500	74%
2006	7,500	11,000	68%
2007	8,500	11,500	74%
2008	7,500	12,000	63%
2009	9,500	12,000	79%
2010	8,500	12,500	68%
2011	9,750	13,000	75%

μ_{lob} 69%

$\sigma_{(U,prem,lob)}$ 7.68%

Premium risk method 1

– Standard formula factor = 10%, USP factor = 7.7%

Accident year	Base case	High loss ratio in 2011	Level premiums	Higher loss ratios	Level premiums +100% in 2005
1997	70%	70%	70%	80%	70%
1998	52%	52%	52%	62%	52%
1999	77%	77%	77%	87%	77%
2000	54%	54%	54%	64%	54%
2001	63%	63%	63%	73%	63%
2002	74%	74%	74%	84%	74%
2003	68%	68%	68%	78%	68%
2004	81%	81%	81%	91%	81%
2005	74%	74%	74%	84%	74%
2006	68%	68%	68%	78%	68%
2007	74%	74%	74%	84%	74%
2008	63%	63%	63%	73%	63%
2009	79%	79%	79%	89%	79%
2010	68%	68%	68%	78%	68%
2011	75%	100%	75%	85%	75%
USP factor	**7.68%**	**10.87%**	**7.27%**	**7.68%**	**7.99%**

Premium risk method 1

- Premium risk method 1 tends to produce a **higher** USP factor when:
  - Total **premiums vary significantly** between different accident years
  - **Individual** claims ratios are relatively high
  - The experienced **claims ratios have varied relatively substantially** over the period over which the USPs have been calculated
  - The **undertaking is relatively small** (greater volatility)
  - The undertaking has purchased **relatively little reinsurance** (greater volatility)

Premium risk method 2

- Same as method 1 except:
  - Claims are assumed to follow a lognormal distribution
  - Premium risk USPs are calculated using a maximum likelihood fitting approach rather than a least squares approach
- The results from method 2 are usually slightly lower than the results from method 1
- Would a supervisor consider methods 1 and 2 to be different?

Premium risk method 3

- Separate analysis of numbers of claims and claims severity
- Data requirements are demanding and include:
  - The estimate that would have been made at the end of each past financial year of the number of claims expected to be reported during the following financial year
  - An estimate of the ultimate claims amounts in respect of each individual claim
- Experience suggests that many companies struggle to provide the required information for this method
- No clear pattern to results

Reserve risk method 1

- Reserve risk method 1 essentially involves reviewing the run-off of the claims provisions, based only on the **undertaking's own view** of its claims provisions
- In summary, the claims provision for an accident year at the start of a financial year is compared with the sum of the undertaking's own claims provision at the end of the financial year plus claims paid during the financial year
- Reserve risk method 1 tends to produce a higher USP factor when the actual run-off of claims is different from that initially expected
- A **favourable** reserve run-off produces the same reserve risk factor as an **unfavourable** reserve run-off

Reserve risk method 2

- Relatively complex method based on the mean squared error of prediction of the claims development result over a one year time horizon using the Merz-Wüthrich method:
  - Based on net paid claims development triangles
  - Cumulative claims payments $C_{i,j}$ in different accident years (i) are assumed to be independent
  - Cumulative claims payments $C_{i,j}$ in each accident year are assumed to be Markov processes and constants f_j and σ_j are assumed to exist such that: $E[C_{i,j} / C_{i,j-1}] = f_{j-1} C_{i,j-1}$ and $Var[C_{i,j} / C_{i,j-1}] = \sigma^2_{j-1} C_{i,j-1}$
- The square root of the calculated mean squared error is divided by the undertaking's own claims provision to calculate the reserve risk factor
- $\sigma_{(U,res,lob)} = \sqrt{MSEP} / PCO_{lob}$ where PCO_{lob} is the undertaking's own claims provision (on a best estimate basis)
- Additional model error factor (methods 2 and 3)?
- Adjustments permitted to mechanistic application of Merz-Wüthrich method?

Reserve risk method 3

- Identical to reserve risk method 2 except that the square root of the calculated mean squared error is divided by the outstanding claims reserve estimated using a mechanistic chain-ladder projection method, applied to net paid claims developments
- $\sigma_{(U,res,lob)} = \sqrt{MSEP} / CLPCO_{lob}$ where $CLPCO_{lob}$ is the best estimate of outstanding claims estimated using the chain ladder method applied to paid claims developments
- Reserve risk method 3 often produces a higher risk factor than reserve risk method 2. This is because the undertaking's own claims provision is higher for many undertakings than the provision implied by a mechanistic chain-ladder projection applied to net paid claims developments
- Adjustments permitted to mechanistic chain-ladder?

Premium risk factors: Adjustment for non-proportional reinsurance (QIS5)

$$\frac{NCR_i}{GCR_i} = \sqrt{\frac{1+\left(\Omega_{lob}^{net}/M_{lob}^{net}\right)^2}{1+\left(\Omega_{lob}^{gross}/M_{lob}^{gross}\right)^2}}$$

where

$$M_{lob}^{net} = M_{lob}^{gross}.\left[1-F_{m+\sigma^2,\sigma}\left(\frac{a}{b}+b\right)\right]+F_{m+\sigma^2,\sigma}\left(\frac{a}{b}\right)+a.\left[F_{m,\sigma}\left(\frac{a}{b}+b\right)-F_{m,\sigma}\left(\frac{a}{b}\right)\right]-b.\left[1-F_{m,\sigma}\left(\frac{a}{b}+b\right)\right]$$

$$\Omega_{lob}^{net} = \left(\begin{array}{l}\left(\Omega_{lob}^{gross\,2}+M_{lob}^{gross\,2}\right).\left[1-F_{m+2\sigma^2,\sigma}\left(\frac{a}{b}+b\right)\right]+F_{m+2\sigma^2,\sigma}\left(\frac{a}{b}\right)+a^2.\left[F_{m,\sigma}\left(\frac{a}{b}+b\right)-F_{m,\sigma}\left(\frac{a}{b}\right)\right]\\ -2b.M_{lob}^{gross}.\left[1-F_{m+\sigma^2,\sigma}\left(\frac{a}{b}+b\right)\right]+b^2.\left[1-F_{m,\sigma}\left(\frac{a}{b}+b\right)\right]-M_{lob}^{net\,2}\end{array}\right)^{1/2}$$

$$\sigma = \sqrt{\ln\left(1+\left(\frac{\Omega_{lob}^{gross}}{M_{lob}^{gross}}\right)^2\right)} \qquad m = \ln M_{lob}^{gross} - \frac{\sigma^2}{2}$$

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Undertaking-specific parameters

- Background to USPs
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Supervisory approval process

- Undertakings will need to demonstrate that the calibration of the standard formula parameters does not appropriately reflect their risk profile and that the use of USPs leads to a more appropriate result
- Calibration of the USPs should be carried out at least annually
- Undertakings require supervisory approval to use USPs. Undertakings would then need supervisory approval to move back to using the standard formula
- It is not entirely clear from the CEIOPS final advice whether or not it would be possible for undertakings to use USPs to calculate reserve risk factors and the standard formula to calculate premium risk factors (or vice versa).
- It is also not clear from the CEIOPS final advice precisely how consistency in the calculation of USPs would be achieved from year to year. For example:
  - If last year's calculation of USPs was based on 10 years of data, should this year's calculation be based on 10 years or 11 years of data?
  - What happens if a relatively volatile year falls out of the data and is replaced by a favourable year of data, or vice versa?
- No “cherry-picking”

Undertakings shall submit as a minimum…

- A justification of the **inappropriateness** of the standard formula parameter
- Evidence that data used fulfils the requirements
- The standardised method or combination of methods to be used and the USPs obtained by using this method or methods
- A justification that the method or combination of methods to be used **better reflects the risk profile** of the undertaking and provides a **more appropriate** result

Undertaking-specific parameters

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Data considerations – internal data (net)

- Same overall data, validation and documentation requirements as for the calculation of technical provisions
- Data are consistent with the assumptions underlying the standardised methods
- Data are capable of being incorporated into the standardised methods
- Data properly reflects the underlying risks
- Data should reflect the current reinsurance arrangements of the undertaking and the expected conditions in the following year
- Data can be adjusted, where appropriate and justified:
  - To remove sources of volatility which are not representative of expected conditions in the following year
  - To allow for trends which can be identified on a prudent, reliable and objective basis
  - If this increases the level of appropriateness of the data
  - To reflect the current reinsurance arrangements
- Expert judgment can be used to complement internal data, where appropriate and justified
- Catastrophes claims to be excluded

Data considerations – external data

- The process for collecting data is transparent, auditable and known by the undertaking
- Where data from different sources are used, the data provided by different companies needs to be “sufficiently comparable”
- External data should comprise undertakings with similar business nature and risk profiles to the undertaking
- The external data should be gross of reinsurance
- An individual undertaking will need to adjust the calculated USPs, based on external data, to allow for:
  - The size of risk exposures of the undertaking
  - The application of the undertaking’s own reinsurance programme

Undertaking-specific parameters

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Latest and future developments

- Level 2 implementing measures
- Level 3 guidelines
- Closed list or open list?
- Number of available standardised methods
- Number of calculation methods to be used by an undertaking
- Inclusion of expenses?
- Non-proportional reinsurance adjustment factor
- FSA pilot study

QIS5 results and recalibrated parameters – premium risk

Line of business	QIS5 Standard formula parameter	QIS5 Median of USPs	QIS5 USP sample size	Recalibrated parameters
Health – medical expenses	4%	4.1%	77	5.0%
Health - income protection	8.5%	7.3%	76	8.5%
Motor vehicle liability	10%	7.7%	106	9.6%
Motor other classes	7%	6.8%	99	8.2%
MAT	17%	13%	60	14.9%
Fire	10%	8.4%	116	8.2%
Third party liability	15%	10.7%	105	13.9%
Credit	21.5%	20.0%	30	11.7%
Legal expenses	6.5%	4.9%	46	6.5%
Assistance	5%	6.0%	22	9.3%
Miscellaneous	13%	9.8%	40	12.8%

QIS5 results and recalibrated parameters – reserve risk

Line of business	QIS5 Standard formula parameter	QIS5 Median of USPs	QIS5 USP Sample size	Recalibrated parameters
Health – medical expenses	10%	11.6%	59	5.3%
Health - income protection	14%	12.0%	61	13.9%
Motor vehicle liability	9.5%	7.4%	89	8.9%
Motor other classes	10%	10.2%	75	8.0%
MAT	14%	13.3%	44	11.0%
Fire	11%	10%	87	10.2%
Third party liability	11%	8.4%	86	11.0%
Credit	19%	18.9%	26	N/A
Legal expenses	9%	6.5%	34	12.3%
Assistance	11%	12.4%	14	N/A
Miscellaneous	15%	18.2%	22	20.0%

Questions or comments?

Expressions of individual views by members of The Actuarial Profession and its staff are encouraged.

The views expressed in this presentation are those of the presenter.