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

Standard formula SCR - Article 109 c
Life underwriting risk

(former CP 49)

October 2009

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1. Introduction

1.1. In its letter of 19 July 2007, the European Commission requested CEIOPS to provide final, fully consulted advice on Level 2 implementing measures by October 2009 and recommended CEIOPS to develop Level 3 guidance on certain areas to foster supervisory convergence. On 12 June 2009 the European Commission sent a letter with further guidance regarding the Solvency II project, including the list of implementing measures and timetable until implementation.[1]

1.2. This Paper aims at providing advice with regard to the design, structure and calibration of the life underwriting module for the standard formula for the Solvency Capital Requirement as requested in Article 111 of the Solvency II Level 1 text.[2]

1.3. Correlations between the life underwriting risk sub-modules and between the life underwriting module and other modules are not covered by this draft advice. They have been addressed in the third set of advice released for consultation in November 2009.

1.4. This Paper only covers simplifications to the standard formula with regard to the lapse risk sub-module. CEIOPS has published a further consultation paper covering simplifications in the third set of advice in November 2009.

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[1] See http://www.ceiops.eu/content/view/5/5/
[2] Latest version from 19 October 2009 available at
http://register.consilium.europa.eu/pdf/en/09/st03/st03643-re01.en09.pdf.

2. Extract from Level 1 text

Legal basis for implementing measure

Article 111 - Implementing measures

1.   In order to ensure that the same treatment is applied to all (re)insurance and reinsurance undertakings calculating the Solvency Capital Requirement on the basis of the standard formula, or to take account of market developments, the Commission shall adopt implementing measures laying down the following:

> *(a)   a standard formula in accordance with the provisions of Articles 101 and 103 to 109;*
>
> *(b)   any sub-modules necessary or covering more precisely the risks which fall under the respective risk modules referred to in Article 104 as well as any subsequent updates;*
>
> *(c)   the methods, assumptions and standard parameters to be used, when calculating each of the risk modules or sub-modules of the Basic Solvency Capital Requirement laid down in Articles 104, 105 and 304;*
>
> *(d)   where insurance and reinsurance undertakings use risk mitigation techniques, the methods and assumptions to be used to assess the changes in the risk profile of the undertaking concerned and adjust the calculation of the Solvency Capital Requirement;*

[…]

> *(k)   the simplified calculations provided for specific sub-modules and risk modules, as well as the criteria that insurance and reinsurance undertakings shall be required to meet in order to be entitled to use each of these simplifications, as set out in Article 109;*

Other relevant articles for provisiding background to the advice

Article 105 - Calculation of the Basic Solvency Capital Requirement

[…]

3.   The life underwriting risk module shall reflect the risk arising from the life insurance obligations, in relation to the perils covered and the processes used in the conduct of business.

It shall be calculated, in accordance with point 2 of Appendix IV, as a combination of the capital requirements for at least the following sub-modules:

(a)   the risk of loss, or of adverse change in the value of insurance liabilities, resulting from changes in the level, trend, or volatility of mortality rates, where an increase in the mortality rate leads to an increase in the value of insurance liabilities (mortality risk);

(b)   the risk of loss, or of adverse change in the value of insurance liabilities, resulting from changes in the level, trend, or volatility of mortality rates, where a decrease in the mortality rate leads to an increase in the value of insurance liabilities (longevity risk);

(c)   the risk of loss, or of adverse change in the value of insurance liabilities, resulting from changes in the level, trend or volatility of disability, sickness and morbidity rates (disability – morbidity risk);

(d)   the risk of loss, or of adverse change in the value of insurance liabilities, resulting from changes in the level, trend, or volatility of the expenses incurred in servicing insurance or reinsurance contracts (life expense risk);

(e)   the risk of loss, or of adverse change in the value of insurance liabilities resulting from fluctuations in the level, trend, or volatility of the revision rates applied to annuities, due to changes in the legal environment or in the state of health of the person insured (revision risk);

(f)   the risk of loss, or of adverse change in the value of insurance liabilities, resulting from changes in the level or volatility of the rates of policy lapses, terminations, renewals and surrenders (lapse risk);

(g)   the risk of loss, or of adverse change in the value of insurance liabilities, resulting from the significant uncertainty of pricing and provisioning assumptions related to extreme or irregular events (life catastrophe risk).

Article 109 - Simplifications in the standard formula

Insurance and reinsurance undertakings may use a simplified calculation for a specific sub-module or risk module where the nature, scale and complexity of the risks they face justifies it and where it would be disproportionate to require all insurance and reinsurance undertakings to apply the standardised calculation.

Simplified calculations shall be calibrated in accordance with Article 101(3).

3. Advice

3.1 General considerations

3.1.1. Explanatory text

Design and structure

3.1.   A number of the life underwriting risk stresses are based on a delta-NAV (change in value of assets minus liabilities) approach. The change in net asset value should be based on a balance sheet that does not include the risk margin of the technical provisions. This approach is based on the assumption that the risk margin does not change materially under the scenario stress. This simplification is made to avoid a circular definition of the SCR since the size of the risk margin depends on the SCR.

3.2.   Furthermore, where a delta-NAV approach is used, the revaluation of technical provisions should allow for any relevant adverse changes in option take-up behaviour of policyholders in this scenario.

3.3.   Underwriting risks can affect an undertaking's liabilities as well as its assets. The scope of the life underwriting module is not confined to the liabilities.

Calibration

3.4.   The calibration of the life underwriting parameters should capture changes in the level, trend and volatility of the parameter. However, for QIS3, it was decided to reduce the complexity of the design of the underwriting risk module by maintaining the level and trend risk components only. It is assumed that the volatility risk component is implicitly covered by the level, trend and catastrophe risk components. This is considered to be acceptable since, for QIS2, the volatility risk proved to be considerably lower than the trend risk. CEIOPS therefore proposes to retain this approach.

3.5.   CEIOPS points out that the calibration in this advice is being considered to be in line with 99.5% VaR and a one year time horizon, incorporating the experience from the current crisis. QIS5 will give an indication of the overall impact of the proposed calibrations, not limited to the SCR but including technical provisions and own funds.

3.1.2. CEIOPS' advice

> **General considerations**
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> 3.4. The change in net asset value shall be based on a balance sheet that does not include the risk margin of the technical provisions.
>
> 3.5. The revaluation should allow for any relevant adverse changes in option take-up behaviour of policyholders in this scenario.
>
> 3.6. Where risk mitigation techniques meet the requirements set out in CEIOPS Advice on reinsurance and financial risk mitigation, the scenarios required for the calculation of the life underwriting risk module will incorporate their effect.
>
> 3.7. The calibration of the life underwriting parameters shall capture changes in the level and trend of the parameters only. It is assumed that the volatility risk component is implicitly covered by the level, trend and catastrophe risk components.

3.2 Mortality risk

3.2.1. Explanatory text

Introduction

3.8. Mortality risk is associated with (re)insurance obligations (such as term assurance or endowment policies) where a (re)insurance undertaking guarantees to make a single or recurring series of payments in the event of the death of the policyholder during the policy term.

3.9. It is applicable for (re)insurance obligations contingent on mortality risk i.e. where the amount currently payable on death exceeds the technical provisions held and, as a result, an increase in mortality rates is likely to lead to an increase in the technical provisions.

3.10. The capital charge for mortality risk is intended to reflect the uncertainty in mortality parameters as a result of changes in the level, trend and volatility of mortality rates and capture the risk that more policyholders than anticipated die during the policy term.

3.11. This risk is normally captured by increasing the mortality rates either by a fixed amount or by a proportion of the base mortality rates. The calibration (of the increase) should capture the impact of each of the above factors (level, trend and volatility).

Mortality risk in QIS4

3.12. The QIS4 approach to the SCR standard formula included a mortality risk sub-module in the life underwriting risk module (section TS.XI.B of the QIS4 Technical Specifications (MARKT/2505/08)). The calculation of the capital requirement for mortality risk was a scenario based stress. The scenario tested was a permanent 10% increase in mortality rates.

3.13. QIS4 feedback from several Member States suggested that a gradual change to inception rates and trends would be more appropriate than a one-off shock for biometric risks.

3.14. QIS4 feedback on the calibration of the mortality stress was varied. Some undertaking felt that the calibration was too strong and without sufficient granularity whereas other undertakings thought that the calibration was below the 99.5th percentile.

3.15. QIS4 also tested alternative approaches for dealing with (re)insurance obligations which provide benefits on both death and survival. The first option proposed that where the death and survival benefits are contingent on the life of the same insured person(s), the obligation should not be unbundled. Under the second option, all contracts were unbundled into two separate components: one contingent on the death and other contingent on the survival of the insured person(s). Only the former component was taken into account for the application of the mortality scenario.

3.16. Feedback from QIS4 indicated that the vast majority of (re)insurance undertakings chose not to unbundle the obligations (option one). The practical difficulty in unbundling obligations was cited as the main reason for choosing this option. Undertakings in one Member State also noted that this (option one) was consistent with IFRS classifications. Where supervisors offered views, they generally agreed with undertakings. However one Member State argued that more analysis would be necessary before deciding on the most appropriate option.

Calculation of the capital requirement

3.17. QIS4 participants suggested that a gradual change to inception rates and trends would be more appropriate than a one-off shock for biometric risks. However CEIOPS has considered this proposal (see in particular discussion under longevity risk below) and has concluded that a one-off shock is more appropriate in the context of the standard formula.

3.18. The capital requirement should therefore be calculated as the change in net asset value (assets minus liabilities) following a permanent increase in mortality rates of x%.

Calibration of mortality stress

3.19. The basis for the QIS4 calibration of the mortality risk stress is described in the CEIOPS paper "QIS3 Calibration of underwriting risk, market risk and MCR". This paper is available from the CEIOPS website[3].

3.20. As mentioned above, QIS4 feedback on the calibration of the mortality stress was varied. However an analysis of the mortality stress parameters provided by firms using internal models indicated that the standard formula parameter was relatively low. Based on a sample size of 21 internal model, the median stress was 22%, with an inter quartile range of 13% to 29%. This is significantly higher than the standard formula calibration of 10%.

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[3] http://www.ceiops.eu/media/files/consultations/QIS/QIS3/QIS3CalibrationPapers.pdf

3.21. CEIOPS therefore proposes to amend the calibration of the mortality stress to a permanent increase in mortality rates of 15%.

Unbundling of (re)insurance obligations

3.22. Where (re)insurance obligations provide benefits both in case of death and survival and the death and survival benefits are contingent on the life of the same insured person(s), these obligations should not be unbundled. For these contracts the mortality scenario should be applied fully allowing for the netting effect provided by the 'natural' hedge between the death benefits component and the survival benefits component (note that a floor of zero applies at the level of contract if the net result of the scenario is favourable to the (re)insurer).

3.23. Where obligations can be unbundled but are not material, then unbundling should not be required, in line with CEIOPS advice on segmentation (see CEIOPS-DOC-22/09)[4].

3.24. Where model points are used for the purposes of calculating the technical provisions and the grouping of the data captures appropriately the mortality risk of the portfolio, each model points can be considered to represent a single insured person for the purposes of applying the above advice.

3.2.2. CEIOPS' advice

Mortality risk

3.23. Based on the assumptions contained in the explanatory text, CEIOPS has calibrated the sub-module according to 99.5% VaR and a one year time horizon.

3.24. The mortality risk sub-module is applicable for (re)insurance obligations contingent on mortality risk i.e. where the amount currently payable on death exceeds the technical provisions held and, as a result, an increase in mortality rates leads to an increase in the technical provisions.

3.25. The calculation of the capital requirement for mortality risk shall be a scenario based stress.

3.26. The capital requirement shall be calculated as the change in net asset value (assets minus liabilities) following a permanent increase in mortality rates of 15%.

3.27. Where (re)insurance obligations provide benefits both in case of death and survival and the death and survival benefits are contingent on the life of the same insured person(s), these obligations should not be unbundled. For these contracts the mortality scenario should be applied fully allowing for the netting effect provided by the 'natural' hedge between the death benefits component and the survival benefits component (note that a floor of zero applies at the level of contract if the net result of the scenario is favourable to the (re)insurer).

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[4] Former CP 27. See http://www.ceiops.eu/index.php?option=content&task=view&id=575.

3.28. Where model points are used for the purposes of calculating the technical provisions and the grouping of the data captures appropriately the mortality risk of the portfolio, each model points can be considered to represent a single insured person for the purposes of applying the above advice.

3.3. Longevity risk

3.3.1. Explanatory text

Introduction

3.29. Longevity risk is associated with (re)insurance obligations (such as annuities) where a (re)insurance undertaking guarantees to make recurring series of payments until the death of the policyholder and where a decrease in mortality rates leads to an increase in the technical provisions, or with (re)insurance obligations (such as pure endowments) where a (re)insurance undertaking guarantees to make a single payment in the event of the survival of the policyholder for the duration of the policy term.

3.30. It is applicable for (re)insurance obligations contingent on longevity risk i.e. where there is no death benefit or the amount currently payable on death is less than the technical provisions held and, as a result, a decrease in mortality rates is likely to lead to an increase in the technical provisions.

3.31. The risk that a policyholder lives longer than anticipated is longevity risk. Longevity risk is particularly significant as a result of an increasing life expectancy among policyholders in most developed countries.

3.32. The capital charge for longevity risk is intended to reflect the uncertainty in mortality parameters as a result of changes in the level, trend and volatility of mortality rates and capture the risk of policyholders living longer than anticipated.

3.33. This risk may be captured in a number of different ways: a simple approach of a reduction in base mortality rates, a more realistic approach of using improvement factors which leads to a two dimensional mortality table, or a combination of these two approaches. In any event, the calibration (of the increase) should capture the impact of each of the above factors (level, trend and volatility).

Longevity risk in QIS4

3.34. The QIS4 approach to the SCR standard formula included a longevity risk sub-module in the life underwriting risk module (section TS.XI.C of the QIS4 Technical Specifications (MARKT/2505/08)). The calculation of the capital requirement for longevity risk was a scenario based stress. The scenario tested was a permanent 25% decrease in mortality rates.

3.35. QIS4 feedback from several Member States suggested that a gradual change to inception rates and trends would be more appropriate than a one-off shock for biometric risks.

3.36. With regard to the calibration of the longevity stress, several undertakings argued for an age and duration dependent treatment of longevity,

reinforcing more general comments that a one-off shock is not the most appropriate form of stress for biometric risks. An improvement of x% per annum (over base mortality) was suggested as an alternative by one respondent.

3.37. Some undertakings felt the longevity shock was too conservative.

Calculation of the capital requirement

3.38. QIS4 participants suggested that a gradual change to inception rates and trends would be more appropriate than a one-off shock for biometric risks. For example, one respondent suggested that an improvement of x% per annum (over base mortality) could be used as an alternative.

3.39. Subsequent to QIS4, an analysis by UNESPA proposed an alternative structure to the longevity shock which depended on age and duration.

3.40. CEIOPS has considered the above mentioned proposals but has concluded that a one-off shock to longevity is more appropriate for the purposes of the standard formula for the following reasons:

- It is more straightforward to apply

- With respect to differentiating by duration, CEIOPS' investigations (see Appendix B to this paper) indicate that shocks for different durations are small and are not monotone.

- With respect to differentiating by age, portfolios of (re)insurance obligations for which longevity risk is applicable are generally heavily weighted in favour of older age groups.

- We do not believe that there is sufficient reliable data to calibrate at a more granular level

3.41. The capital requirement should therefore be calculated as the change in net asset value (assets minus liabilities) following a permanent decrease in mortality rates of x%.

Calibration of longevity stress

3.42. The basis for the QIS4 calibration of the longevity risk stress is described in the CEIOPS paper "QIS3 Calibration of underwriting risk, market risk and MCR".[5]

3.43. Subsequent to QIS4, an investigation has been carried out by the Polish FSA which analysed the mortality data for nine countries indicated based both on historic improvements and a stochastic model of future mortality improvements.

3.44. The results of this analysis indicated that, on average (across the nine countries for which data was analysed), historic improvements in mortality rates over 15 years from 1992 to 2006 were higher than 25%. Although the results of the stochastic model of future mortality improvements may imply a lower stress, CEIOPS has attached more weight to the analysis of historic improvements because of the significant uncertainty inherent in modelling mortality.

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[5] http://www.ceiops.eu/media/files/consultations/QIS/QIS3/QIS3CalibrationPapers.pdf.

3.45. Furthermore feedback from internal model firms as part of QIS4 indicates that the median stress was 25%.

3.46. CEIOPS therefore proposes to maintain the QIS4 calibration of the longevity risk stress i.e. the stress shall be based on a permanent 25% decrease in the mortality rates assumed in the calculation of best estimate.

Unbundling of (re)insurance obligations

3.47. Where (re)insurance obligations provide benefits both in case of death and survival and the death and survival benefits are contingent on the life of the same insured person(s), these obligations should not be unbundled. For these contracts the longevity scenario should be applied fully allowing for the netting effect provided by the 'natural' hedge between the death benefits component and the survival benefits component (note that a floor of zero applies at the level of contract if the net result of the scenario is favourable to the (re)insurer).

3.48. Where model points are used for the purposes of calculating the technical provisions and the grouping of the data captures appropriately the longevity risk of the portfolio, each model points can be considered to represent a single insured person for the purposes of applying the above advice.

3.3.2. CEIOPS' advice

Longevity risk

3.49. Based on the assumptions contained in the explanatory text, CEIOPS has calibrated the sub-module according to 99.5% VaR and a one year time horizon.

3.50. The longevity risk sub-module is applicable for (re)insurance obligations contingent on longevity risk i.e. i.e. where there is no death benefit or the amount currently payable on death is less than the technical provisions held and, as a result, a decrease in mortality rates is likely to lead to an increase in the technical provisions.

3.51. The calculation of the capital requirement for longevity risk shall be a scenario based stress.

3.52. The capital requirement shall be calculated as the change in net asset value (assets minus liabilities) following a permanent decrease in mortality rates of 25%.

3.53. Where (re)insurance obligations provide benefits both in case of death and survival and the death and survival benefits are contingent on the life of the same insured person(s), these obligations should not be unbundled. For these contracts the longevity scenario should be applied fully allowing for the netting effect provided by the 'natural' hedge between the death benefits component and the survival benefits component (note that a floor of zero applies at the level of contract if the net result of the scenario is favourable to the (re)insurer).

3.54. Where model points are used for the purposes of calculating the technical provisions and the grouping of the data captures appropriately the longevity risk of the portfolio, each model points can be considered to represent a single insured person for the purposes of applying the above advice.

3.4. Disability-morbidity risk

3.4.1. Explanatory text

Introduction

3.55. Morbidity or disability risk is associated with all types of insurance compensating or reimbursing losses (e.g. loss of income) caused by illness, accident or disability (income insurance), or medical expenses due to illness, accident or disability (medical insurance), or where morbidity acts as an acceleration of payments or obligations which fall due on death.

3.56. It is applicable for (re)insurance obligations contingent on a definition of disability. However CEIOPS expects that the majority of (re)insurance obligations for which disability-morbidity risk is applicable will be covered by the health module rather than by the life underwriting module. This sub-module of the life underwriting risk module is therefore likely to be applicable only in cases where it is not appropriate to unbundle contracts.

3.57. Where obligations can be unbundled but are not material, then unbundling should not be required, in line with the principle of materiality developed in the CEIOPS advice on segmentation (see CEIOPS-DOC-22/09 mentioned previously.

3.58. The capital charge for morbidity or disability risk is intended to reflect the uncertainty in morbidity and disability parameters as a result of changes in the level, trend and volatility of disability, sickness and morbidity rates and capture the risk that more policyholders than anticipated are diagnosed with the diseases covered or are or unable to work as a result of sickness or disability during the policy term.

3.59. The (re)insurance obligations may be structured such that, upon the diagnosis of a disease or the policyholder being unable to work as a result of sickness or disability, recurring payments are triggered. These payments may continue until the expiry of some defined period of time or until either the recovery or death of the policyholder. In the latter case, the (re)insurance undertaking is also exposed to the risk that the policyholders receives the payments for longer than anticipated i.e. that claim termination rates are lower than anticipated (recovery risk).

3.60. Morbidity and disability risk is normally captured by increasing the claim inception rate either by a fixed amount or by a proportion of the base inception rates and, where applicable, reducing the claim termination rates. The calibration (of the increase) should capture the impact of each of the above factors (level, trend and volatility).

3.61. The QIS4 approach to the SCR standard formula included a morbidity and disability risk sub-module in the life underwriting risk module (section TS.XI.B of the QIS4 Technical Specifications (MARKT/2505/08)). The calculation of the capital requirement for morbidity and disability risk was a scenario based stress. The scenario tested was an increase of 35% to "disability rates" for the first year followed by a 25% increase in "disability rates" for all subsequent years.

3.62. An alternative scenario was also proposed by the UK under which the capital charges for critical illness, income protection and long term care obligations were calculated separately and there was an additional capital charge in respect of recovery risk.

3.63. There were a number of comments from QIS4 participants on the general methodology of the morbidity and disability stress:

- One respondent argued that recovery rates should be taken into account.

- There was some confusion over the treatment of disability in terms of catastrophe risk.

- Support for the UK alternative approach was noted by one Member State.

3.64. With respect to the calibration of the morbidity and disability stress, some (re)insurance undertakings commented that the calibration was too strong.

Calculation of the capital requirement

3.65. As described above, there are two aspects to morbidity/disability risk:

- The risk that the number of claims are greater than anticipated

- The risk that the duration of the claim is higher than anticipated

The second risk is only applicable for (re)insurance obligations where benefits consist of recurring payments which continue until either the recovery or death of the policyholder.

3.66. Therefore the capital requirement should be calculated as:

- The change in net asset value (assets minus liabilities) following an increase of x_1% in morbidity/disability inception rates for the first year followed by an increase of x_2% in morbidity/disability inception rates for all subsequent years.

- Plus, where applicable, the change in net asset value (assets minus liabilities) following a permanent decrease of y% in morbidity/disability recovery rates

Calibration of morbidity and disability stress

3.67. The basis for the QIS4 calibration of the morbidity-disability risk stress is described in the CEIOPS paper "QIS3 Calibration of underwriting risk, market risk and MCR". This paper is available from the CEIOPS website.

3.68. Subsequent to QIS4, an investigation by the Swedish FSA indicated that an increase of 50% in morbidity/disability inception rates for the first year would be more appropriate.

3.69. This investigation also suggested that the appropriate calibration of the decrease in morbidity/disability recovery rates was 20%.

3.70. The results of the investigation by the Swedish FSA are explained further in Appendix A.

3.71. In addition, the UK Actuarial Profession Healthcare Reserving Working Party has undertaken a survey which investigated the levels of 1 in 200 year morbidity stresses used by the major UK life insurance firms.[6]

3.72. The range of stress used by the major UK life insurers for income protection business averaged 27% for inception rates and 15% for termination rates. For critical illness, morbidity margins, intended to represent a 99.5% confidence over 1 year, averaged around 40%.

3.73. Furthermore, on average, the average morbidity margins for statutory reserving for critical illness and income protection (both inceptions and terminations) were about 20%. The margins in a statutory reserving basis are partly to allow for adverse deviations of the inception and termination rates used in the pricing. As such, a 1 in 200 stress should be at least greater than these margins as these margins are not normally set at the same level as a 1 in 200 year scenario.

3.74. Looking at the results of this survey in conjunction with the results of the investigation by the Swedish FSA, we would propose the following calibration of the disability-morbidity stress:

- The change in net asset value (assets minus liabilities) following an increase of 50% in morbidity/disability inception rates for the first year followed by an increase of 25% in morbidity/disability inception rates for all subsequent years.

- Plus, where applicable, the change in net asset value (assets minus liabilities) following a permanent decrease of 20% in morbidity/disability recovery rates. This should be applied together with the above increase in inception rates i.e. it is a combined stress.

3.4.2. CEIOPS' advice

Morbidity-disability risk

3.75. Based on the assumptions contained in the explanatory text, CEIOPS has calibrated the sub-module according to 99.5% VaR and a one year time horizon.

3.76. The morbidity-disability risk sub-module is applicable for (re)insurance obligations contingent on a definition of disability.

3.77. The calculation of the capital requirement for disability risk shall be a scenario based stress.

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[6] http://www.actuaries.org.uk/__data/assets/pdf_file/0006/136707/reserving_survey.pdf.

3.78. The capital requirement shall be calculated as the change in net asset value (assets minus liabilities) following:

- An increase of 50% in morbidity/disability inception rates for the first year followed by an increase of 25% in morbidity/disability inception rates for all subsequent years.

- Plus, where applicable, a permanent decrease of 20% in morbidity/disability recovery rates.

3.5 Life expense risk

3.5.1. Explanatory text

Introduction

3.79. Expense risk arises from the variation in the expenses incurred in servicing insurance or reinsurance contracts.

3.80. It is likely to be applicable for all (re)insurance obligations.

3.81. The capital charge for expense risk is intended to reflect the uncertainty in expense parameters as a result of changes in the level, trend or volatility the expenses incurred.

3.82. This risk is normally captured by increasing expected future expenses by a fixed proportion, increasing expected future expense inflation or a combination of both.

Expense risk in QIS4

3.83. The QIS4 approach to the SCR standard formula included an expense risk sub-module in the life underwriting risk module (section TS.XI.F of the QIS4 Technical Specifications (MARKT/2505/08)). The calculation of the capital requirement for expense risk was a scenario based stress. The scenario tested was:

- An increase of 10% in future expenses compared to best estimate anticipations,

- An increase of 1% per annum of the expense inflation rate compared to anticipations

For policies with adjustable loadings[7], 75% of these additional expenses can be recovered from year 2 onwards by increasing the charges payable by policyholders.

3.84. There was a range of opinions with regard to the calibration of the expense risk as a result of which no useful conclusion could be drawn.

Calculation of the capital requirement

3.85. QIS4 participants did not raise any significant issues with the design and structure of this module and CEIOPS has therefore concluded that the approach adopted in QIS4 is appropriate.

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[7]   Policies with adjustable loadings are those for which expense loadings or charges may be adjusted within the next 12 months.

3.86. The capital requirement should therefore be calculated as the change in net asset value (assets minus liabilities) following:

- An increase of x% in future expenses compared to best estimate anticipations,
- An increase of y% per annum of the expense inflation rate compared to anticipations

3.87. However CEIOPS does not intend to retain the specific reference to policies with adjustable loadings. This is because any future change to charges payable by policyholders is, in essence, a management action and should thus be considered in light of CEIOPS' advice on management actions rather than specified by CEIOPS.

3.88. CEIOPS notes that some firms have outsourced their expense activities (for example IT systems, policyholder complaints handling etc.), this can produce a different set of risks which, if significant, may mean the capital charge in respect of expense risk outside of the standard formula calibration.

Calibration of expense stress

3.89. The basis for the QIS4 calibration of the expense risk stress is described in the CEIOPS paper "QIS3 Calibration of underwriting risk, market risk and MCR". This paper is available from the CEIOPS website.

3.90. As mentioned above, QIS4 feedback on the calibration of the expense stress was varied. However the expense risk capital charge from the internal model tended to be, for many undertakings, in line with the standard formula. The median ratio was equal to 100% and the inter quartile range was 85% to 166%.

3.91. CEIOPS therefore proposes to maintain the QIS4 calibration of the expense risk stress i.e. the stress shall be based on:

- An increase of 10% in future expenses compared to best estimate anticipations,
- An increase of 1% per annum of the expense inflation rate compared to anticipations

3.5.2. CEIOPS' advice

Expense risk

3.92. Based on the assumptions contained in the explanatory text, CEIOPS has calibrated the sub-module according to 99.5% VaR and a one year time horizon.

3.93. The calculation of the capital requirement for expense risk shall be a scenario based stress.

3.94. The capital requirement shall be calculated as the change in net asset value (assets minus liabilities) following:

- An increase of 10% in future expenses compared to best estimate anticipations,

- An increase of 1% per annum of the expense inflation rate compared to anticipations

3.6 Revision risk

3.6.1. Explanatory text

Introduction

3.95. In the context of the life underwriting risk module, revision risk is intended to capture the risk of adverse variation of an annuity's amount, as a result of an unanticipated revision of the claims process.

3.96. This risk should be applied only to:

- Annuities arising from non-life claims (including accident insurance, but excluding workers compensation) where the amount of the annuity may be revised during the next year.

- Benefits that can be approximated by a life annuity arising from non-life claims (including accident insurance, but excluding workers compensation) where the amount of the annuity may be revised during the next year.

Revision risk in QIS4

3.97. The QIS4 approach to the SCR standard formula included a revision risk sub-module in the life underwriting risk module (section TS.XI.G of the QIS4 Technical Specifications (MARKT/2505/08)). The calculation of the capital requirement for revision risk was a scenario based stress. The scenario tested was an increase of 3% in the annual amount payable for annuities exposed to revision risk.

3.98. QIS4 feedback indicated that the application of the revision risk module was not universally clear in some member states. This has been addressed by expanding on the application of this sub-module in the introduction above.

3.99. With regard to the calibration of the revision risk stress, one undertaking stated that the shock for revision risk is too low.

Calculation of the capital requirement

3.100. QIS4 participants did not raise any issues with the design and structure of this module and CEIOPS has therefore concluded that the approach adopted in QIS4 is appropriate.

3.101. The capital requirement should therefore be calculated as the change in net asset value (assets minus liabilities) following an increase of x% in the annual amount payable for annuities exposed to revision risk.

Calibration of revision risk stress

3.102. The basis for the QIS4 calibration of the revision risk stress is described in the CEIOPS paper "QIS3 Calibration of underwriting risk, market risk and MCR". This paper is available on the CEIOPS website.

3.103. Only one participant in QIS4 commented on the calibration of this module. CEIOPS has therefore concluded that the calibration adopted in QIS4 is appropriate for the majority of (re)insurance undertakings.

3.104. CEIOPS therefore proposes that the revision risk is calculated assuming an increase of **3%** in the annual amount payable for annuities exposed to revision risk.

3.6.2. CEIOPS' advice

Revision risk

3.105. Based on the assumptions contained in the explanatory text, CEIOPS has calibrated the sub-module according to 99.5% VaR and a one year time horizon.

3.106. The calculation of the capital requirement for revision risk shall be a scenario based stress.

3.107. The capital requirement shall be calculated as the change in net asset value (assets minus liabilities) following an increase of 3% in the annual amount payable for annuities exposed to revision risk.

3.7 Lapse risk

3.7.1 Explanatory text

Previous advice

3.108. In its "Further advice to the European Commission on Pillar 1 issues" of March 2007, CEIOPS recommended the inclusion of an explicit requirement for lapse risk under the SCR standard formula. Lapse risk was understood to arise from unanticipated (higher or lower) rate of policy lapses, terminations, changes to paid-up status (cessation of premium payment) and surrenders. [8]

3.109. In the advice document it was noted that the complex dependence structure of lapse risk is difficult to model in a modular approach to the standard formula. [9]

Lapse risk in QIS4

3.110. The QIS4 approach to the SCR standard formula included a lapse risk sub-module in the life underwriting risk module. [10] The calculation of the capital requirement for lapse risk was based on three scenarios:

- a permanent increase of lapse rates by 50%;
- a permanent decrease of lapse rates by 50%; and
- a mass lapse event where 30% of the policies are surrendered.

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[8] See http://www.ceiops.eu/media/files/publications/submissionstotheec/CEIOPS-DOC-08-07AdviceonPillarI-Issues-FurtherAdvice.pdf, CEIOPS-DOC-08/07, March 2007 (hereafter "Advice of March 2007").
[9] Advice of March 2007, paragraph 5.24.
[10] QIS4 technical specifications, see
http://www.ceiops.eu/media/docman/Technical%20Specifications%20QIS4.doc, 31 March 2008, Section TS.XI.E.

Treatment of lapse risk in the scenario calculations

3.111.For life insurance, the calculation of the SCR is essentially scenario-based: all life insurance underwriting risks and all market risks except spread risk and concentration risk are quantified by means of scenario analysis. Moreover, the loss-absorbing capacity of technical provisions is determined by means of a scenario.

3.112.The definition of these scenarios is usually understood as follows: assume that a specific change relating to a certain risk (e.g. change of interest rates or a change of equity prices or a change of mortality rates) takes place while all parameters relating to other risks remain unchanged. This is the approach that was applied in QIS4. Discussions during the exercise in some markets have shown that this simple and straightforward scenario definition may lead to unrealistic results which do not fully reflect the risk that the insurers are exposed to. The following examples should illustrate the issue.

Three examples for lapse risk triggered by other risks

Example 1: Lapse triggered by the reduction of bonus rates

3.113.In life with-profit business, many risks can be mitigated by cutting future bonuses. The QIS4 report shows that the adjustment for the risk mitigating effect has a significant influence on the SCR in many countries. In the market with the highest impact, about 75% of the BSCR is reduced by the adjustment for the loss-absorbing capacity of technical provisions on average. Under the scenario definition outlined above, this may be a fair reflection of the undertaking's profit sharing systems.

3.114.Nevertheless, for certain kinds of business the outcome appears to be unrealistic because a significant cut of future bonuses may change the lapse behaviour of policyholders. For example, consider a term insurance where the extra benefit of the policies is used to reduce the premiums. A significant cut of extra benefits as a reaction to (for instance) an equity shock would increase the number of lapses because many policyholders would rather terminate the contract than pay a significantly higher premium. The increase of lapses would consequently increase the technical provisions because the business is usually profitable and the future profit of the terminated treaties cannot be taken into account anymore in the provision. Hence, the cut of extra benefits would trigger lapses which would at least partly thwart the mitigating effect of profit sharing.

3.115.This effect was not taken into account under the QIS4 scenario approach because it was assumed that lapse rates are fixed in the equity scenario. Moreover, this effect is also not fully covered by the lapse risk module because firstly, the lapse effect of the reduction in extra benefits can be higher than the shocks considered in the lapse sub-module and secondly, there is a high diversification effect between lapse risk and equity risk in the standard formula. According to Annex IV of the Level 1 text, the correlation factor for market risk and life underwriting risk is 25%. However, in the example there is a causal connection between equity risk and lapse risk.

Example 2: Lump-sum option triggered by the increase of interest rates

3.116. In deferred annuity insurance, the policyholder can often choose between a lump sum and a previously fixed annuity at expiration of the mortality cover. The take-up rate for this option is very likely to be interest rate sensitive.

3.117. If the market interest rates are significantly lower than the technical rate that was used to determine the annuity, it is rational for all policyholders to choose the annuity. Therefore, in the interest rate decrease, scenario the number of policyholders which choose the annuity would go up, thereby increasing the loss of the insurer.

3.118. On the other hand, if the market interest rates are significantly higher than the technical rate more policyholders are likely to choose the lump sum. Therefore, in the scenario of an interest rate increase the reduction of technical provisions due to discounting with higher rates may be partly countered by the loss of future profit. Neither of both effects is currently allowed for in the SCR.

Example 3: Reduction of insurance cover triggered by the decrease of interest rates in health insurance

3.119. In health insurance as described in Article 204 of the Level 1 text (technical basis similar to that of life insurance), the insurer can adjust the premiums according to a specific mechanism in order to take into account a change in risk factors like health expenses, longevity or interest rates. For example, under the interest rate decrease scenario, this mechanism is usually applied to mitigate the stress. In line with the scenario definition outlined above, all other risk factors remain unchanged.

3.120. However, in reality it is very likely that the increase in premium levels would cause a part of the policyholders to reduce its insurance cover to compensate for the financial strain. This would reduce the future profits and therefore reduce the mitigating effect of the premium increase.

3.121. Similar effects may exist in relation to other kinds of insurance with adjustable premiums.

3.122. Summarising, the three examples differ in both the triggering event as well as the option that they affect:

Example	Triggering event	Option affected
3.113	bonus rate reduction	lapse
3.116	change in interest rate	lump sum option
3.119	premium adjustment	reduction of insurance cover

3.123. An insufficient allowance for lapse risk in the SCR standard formula has also been noted by stakeholders. It was criticised that "the main risk in life insurance is not taken into account in the standard formula", namely "a policyholder run touched-off by market, credit, or operational risk".

Lapse triggered by deterioration of financial position

3.124. Another important external trigger of policyholder action is the deterioration of the undertaking's financial position. Such an event, if it becomes apparent, may cause a mass lapse incident, thereby reinforcing the decline of the financial position.

Proposal to allow for lapse risk in the SCR scenarios

3.125. The examples demonstrate that the QIS4 approach to lapse risk (and other option take-up risks) does not take into account that the take-up of the option by the policyholder may be triggered by other risks or the reaction of the insurer to other risks. On the contrary, the QIS4 standard formula makes the assumption that lapse risk is approximately independent from other risks.[11] Disregarding the dependence of option take-ups and other risks may lead to a significant underestimation of the 99.5% confidence level of the SCR.

3.126. It seems that this deficiency cannot be eliminated by an increase of the correlation factors that are used to aggregate lapse risk and the other risks. In order to model a high dependence between lapse risk and, for example, interest rate risk in the current modular structure of the SCR, the correlation factor for market and life underwriting risk must be increased. But this would also increase the modelled dependence between market risk and mortality risk, longevity risk and CAT risk although these risks are likely to be less dependent. Hence, an increase of the correlation factors may partly remedy the deficiency in relation to lapse risk, but would lead to an unjustified increase of the dependence between other risks.

3.127. Another way to tackle the problem would be to relax the scenario definition applied in the SCR calculations. Instead of changing one parameter (e.g. interest rates) in the scenario and keeping all other parameters fixed, the scenario could also allow for adverse changes in option take-up rates. For instance, the interest rate decrease scenario (net of profit sharing) could be defined as follows:

$$nMkt_{int}^{Down} = \Delta NAV|downwardshock,$$

where $\Delta NAV|downwardshock$ is the change in the net value of asset and liabilities due to revaluing all interest rate sensitive instruments using altered term structures. The revaluation is done under the condition that the participant is able to vary its assumptions on future bonus rates in response to the shock. Moreover, the revaluation should allow for any relevant adverse changes in option take-up behaviour of policyholders in this scenario.

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[11] In the QIS4 life underwriting risk module, there is a correlation factor of 0.25 in relation to longevity and 0.5 in relation to expenses. In relation to mortality, disability and CAT risk a factor of 0 was chosen. According to Annex IV of the Level 1 text, the correlation factor for life underwriting risk and market risk is 0.25.

3.128.The proposal should not to cause practical problems. In principle, the undertaking already needs to make assumptions about the behaviour of its policyholders in extreme scenarios in order to calculate the value of options and guarantees for the best estimate provisions according to Article 78 of the Level 1 text. Consistent assumptions can be used in the SCR scenarios to allow for changed policyholder behaviour. In case an approximation is used to value the options and guarantees, it should be possible to derive assumptions about the stressed option-take up rates which are consistent with the approximations. Nevertheless, in some cases it may be helpful to give market-specific actuarial guidance about the policyholder behaviour in relation to certain products in order to ensure the practicability and comparability of the SCR calculations.

3.129.In line with the proportionality principle, the proposal includes only the relevant changes in option take-up rates.

Relation to the lapse risk sub-module

3.130.According to the proposal, lapse risk is allowed for twice in the SCR standard formula: in the lapse risk sub-module and in each scenario which has a relevant adverse effect on the lapse rates. However this does not give rise to a double counting of lapse risks.

3.131.Conceptually, two elements of lapse risk can be distinguished:

    A. Misestimate of current lapse rates

       A misestimate of the lapse rates which are appropriate (this year and in future years) according to the current situation (i.e. the current interest rates, bonus rates etc.).

    B. Change of lapse rates

       The change of lapse rates owing to a change of the current situation (i.e. a change in interest rates, bonus rates etc.). The examples given in paragraphs 3.113 to 3.123 illustrate this risk.

3.132.An allowance for lapse risk in the SCR scenarios as proposed above would only cover lapse risk of type B. Besides, it would not fully cover this kind of lapse risk because not all possible changes of the current situation which affect the lapse rates are reflected in SCR. For instance, the effect described in the example of paragraph 3.123 is not covered by the SCR scenarios.

3.133.Complementary to this approach, the lapse sub-module of the life underwriting risk module allows for the residual lapse risk of type B as well as the complete lapse risk of type A. Therefore, the proposal does not lead to double counting of lapse risk. However, the calibration of the lapse scenarios in the lapse sub-module, in particular of the mass lapse event, should take into account the distinction made paragraph 3.131.

Scope of the lapse risk sub-module

3.134. According to Article 105(3f) of the Level 1 text, the lapse risk sub-module covers the risk of

"loss, or of adverse change in the value of insurance liabilities, resulting from changes in the level or volatility of the rates of policy lapses, terminations, renewals and surrenders (lapse risk)"

3.135. This description does not fully clarify which policyholder options are included in the sub-module. In particular, the scope of the terms "lapse", "termination" and "surrender" is not clear. For example, in QIS4 the risk relating to changes to paid-up status were included in the sub-module because it was interpreted as a partial termination. The scope of the module should be clarified at Level 2 in order to remove potential ambiguity in the calculation of the lapse risk capital requirement.

3.136. There are two possible antipodal approaches to the scope of the lapse risk module:

- A narrow definition of the scope: only those options are included which either fully renew the insurance cover or which fully terminate the policy and which are defined as surrender or lapse options in the terms and conditions of the policy.

- A wide definition of the scope: all options are included where a take-up or non take-up reduces the insurance cover.

3.137. There is a range of possible definitions between these antipodal approaches.

3.138. The narrow definition would not include, for example, changes to paid-up status. If the narrow definition is applied it may be advisable to add further sub-modules to the life underwriting risk module in order to cover the risk of other options. Moreover, with the narrow definition arbitrage opportunities appear to be unavoidable. Policyholder options which slightly differ in their effect or description may be treated differently in the SCR calculation. For example, a partial termination option which reduces the insurance cover by 99% is not included in the narrow definition although the economic effect is comparable to a full termination which is included.

3.139. On the other hand, a wide definition could be a clear and simple way to cover all material option risks consistently within the structure of the standard formula. It would not be necessary to add further sub-modules to the life underwriting modules which cover other option risks. Therefore, the wide definition is preferable.

3.140. Under the wide definition of scope, the scenarios which define a permanent decrease and increase of option take-up rates could be defined as follows:

$lapseshock_{down}$ = Reduction of x% in the assumed option take-up rates in all future years for all policies without a positive surrender strain or otherwise adversely affected by such risk. Affected by the reduction are options to fully or partly terminate, decrease, restrict or suspend the insurance cover. Where an option allows the full or partial establishment, renewal, increase,

extension or resumption of insurance cover, the x% reduction should be applied to the rate that the option is not taken up.

$lapseshock_{up}$ = Increase of y% in the assumed option take-up rates in all future years for all policies with a positive surrender strain or otherwise adversely affected by such risk. Affected by the increase are options to fully or partly terminate, decrease, restrict or suspend the insurance cover. Where an option allows the full or partial establishment, renewal, increase, extension or resumption of insurance cover, the y% increase should be applied to the rate that the option is not taken up.

3.141. The surrender strain of a policy is defined as the difference between the amount currently payable on surrender and the best estimate provision held. The amount payable on surrender should be calculated net of any amounts recoverable from policyholders or agents e.g. net of any surrender charge that may be applied under the terms of the contract. Capital requirements for the three sub-risks (see paragraph 3.142) should be calculated based on a policy-by-policy comparison of surrender value and best estimate provision. In this context, the term "surrender" should refer to all kind of policy terminations irrespective of their name in the terms and conditions of the policy. In particular, the surrender value may be zero if no compensation is paid on termination.

Calculation of the capital requirement

3.142. The calculation of the capital requirement for lapse risk in QIS4 was based on three scenarios:

- a permanent increase of lapse rates;
- a permanent decrease of lapse rates; and
- a mass lapse event.

3.143. The capital requirement was obtained as the loss of net asset value under the most adverse of the three scenarios. This simple approach has some shortcomings. For example, an insurer may be exposed to the risk of an increase in lapse rates on one part of its portfolio and a decrease of lapse rates in another part of the portfolio. Such situations are not covered by the approach. However, within the natural limitations of the standard formula the QIS4 approach appears to be an acceptable solution. The feedback from the QIS4 participants gives no other indication.

Calibration

Calibration of $lapseshock_{up}$ and $lapseshock_{down}$

3.144. As lapse rates are not frequently used for reserving under Solvency I, the empirical basis for a calibration of the permanent shocks $lapseshock_{up}$ and $lapseshock_{down}$ is poor for most markets.

3.145. The QIS4 calibration of the shocks was based on a study of the UK with-profit life insurance market in 2003 performed by order of the British FSA.[12] The analysis resulted in estimates for quantiles of permanent lapse rate decreases as follows:

Quantile	Relative change of lapse rate
90%	-28.5%
91%	-29.3%
92%	-30.3%
93%	-31.7%
94%	-33.0%
95%	-34.5%
97.5%	-39.0%

3.146. The quantile produced in the study are lower than the Solvency II confidence level of 99.5%. Nevertheless, by extrapolation of the above values, the QIS4 calibration of -50% can be justified. The study does not cover the risk of a permanent increase of lapse rates, however, in absence of better evidence it is appropriate to assume a symmetrical stresses for both scenarios and choose +50% for the increase scenario.

3.147. CEIOPS has looked for further evidence from other markets. An analysis of the Polish supervisor on the national life insurance market supports the above calibration assumptions (see Annex C). The study shows that the 99.5% quantile of annual lapse rate deviations from a long-term mean is between 60% and 100% for increases and between -60% and -90% for decreases. As these values are based on an annual deviation they overestimate the shock of a permanent change. However, the results indicate that the range of the proposed calibration is appropriate.

3.148. The lapse shocks were calibrated on small rates. If the rates are much larger, the calibration may produce excessive results. Moreover, it needs to be avoided that the shocked rates exceed 100%.

3.149. Therefore, the shocked take-up rate should be restricted as follows:

$$R_{up}(R) = \min(150\% \cdot R; 100\%) \quad \text{and}$$

$$R_{down}(R) = \min(\max(50\% \cdot R; R - 20\%), 0),$$

where

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[12] Financial Services Authority »Calibration of the Enhanced Capital Requirement for with-profits life insurers«, 2004 (http://www.fsa.gov.uk/pubs/policy/04_16/ww_report.pdf).

R_{up} =   shocked take-up rate in *lapseshock_{up}*

R_{down} =   shocked take-up rate in *lapseshock_{down}*

R =   take-up rate before shock

Calibration of the mass lapse event

3.150. The scenario shocks *lapseshock_{up}* and *lapseshock_{down}* cover the risk of a misestimation or of a permanent change of lapse rates. By contrast, the mass lapse event covers the risk of a temporary and drastic rise of lapse rates. The likeliness that policyholders terminate their policies is increased for a limited span of time. The cause for this change in policyholder behaviour can be of an internal or external nature. An internal cause could, for example, be the deterioration of the financial position of the undertaking or any other event that significantly affects the reputation of the undertaking or the group it belongs to. Examples of external events would be changes in the economic situation or changes in the tax regulations that directly or indirectly affect the policies of the undertaking. An event in the banking sector comparable to the mass lapse event would be a "bank run".

3.151. The calibration of the mass lapse event should account for the scenario definition as defined above (paragraph 3.111 ff.). Where the change in lapse behaviour is triggered by a change in scenario-based risk like interest rate risk or equity risk, an allowance in the mass lapse event is not necessary. The calibration of the mass lapse event should only cover those changes in behaviour which are not triggered by these risks.

3.152. On the other hand, the calibration of the mass lapse event has to reflect the fact that mass lapse is a "catastrophe" type event.[13] Policyholder behaviour under extreme conditions is difficult to assess as it can be determined by complex phenomena like herd behaviour and self-reinforcing mechanisms. Experience from the banking sector during the current financial crises shows (for example Northern Rock bank run in 2007) that policyholder behaviour can pose a significant risk to financial institutions.

3.153. Under Solvency I insurance and reinsurance undertakings are less affected by lapse risk as the technical provisions for a policy must not be lower than its surrender value. But under Solvency II it may happen that the assets of an undertaking do not cover the surrender values. Such insurers are highly vulnerable to mass lapse events, in particular when their situation becomes public.

3.154. The empirical basis to calibrate the mass lapse event is poor. In the absence of better evidence, CEIOPS proposes to maintain the QIS4 calibration of 30% of the sum of positive surrender strains.

3.155. It has been discussed whether different types of life insurance policies are affected differently by mass lapse events: products with significant

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[13] The nature of the „catastrophe" event in the lapse risk sub-module is clearly distinct from the nature of the "catastrophe" events in the life CAT risk sub-module.

guarantees like with-profit products may show a higher persistency than products with low guarantees like many unit-linked policies.

3.156. On the other hand, for non- retail business[14], the risk of a mass lapse is substantially greater for the following reasons:

- Institutional investors tend to be better informed and would be quick to withdraw funds if there was any question over the solvency of a firm, particularly if they were aware that the firm did not have sufficient funds to meet all claims;

- There are generally no surrender penalties.

3.157. CEIOPS therefore believes that a higher calibration of the mass lapse stress is appropriate for this business. In the absence of other information, CEIOPS proposes to use the QIS3 calibration of 70% of the sum of positive surrender strains.

3.158. At this stage, taking into account a simple valuation of the mass lapse event, CEIOPS is considering whether to differentiate further between different insurance products for the purposes of the mass lapse stress.

Simplifications

Calculation on policy-by-policy basis

3.159. In case the best estimate is calculated on the basis of homogeneous risk groups instead of on a policy-by-policy basis, the determination of the surrender strain as defined in paragraph 3.141 may be burdensome and not necessary to arrive at a sufficiently accurate capital requirement. Therefore, if it is proportionate to the nature, scale and complexity of the risk, the comparison of surrender value and best estimate provision might be made on the level of homogeneous risk groups instead of a policy-by-policy basis.

3.160. As the calculation on a homogeneous risk group level is likely to result in the same or a lower capital requirement than the policy-by-policy calculation, it seems necessary to set up criteria for its application. A calculation on the level of homogeneous risk groups should be considered to be proportionate if:

(a) the homogeneous risk groups appropriately distinguish between policies of different lapse risk;

(b) the result of a policy-by-policy calculation would not differ materially from a calculation on homogeneous risk groups; and

(c) a policy-by-policy calculation would be an undue burden compared to a calculation on homogeneous risk groups which meet criteria (a) and (b).

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[14] Non-retail business covers pension fund management as described in Article 2(3) and is a specified class of long term insurance business. It falls within Article 2(3)(b)(iii) where it simply involves the management of investments and assets representing the reserves of bodies that effect payments on death or survival or in the event of discontinuance or curtailment of activity. It falls within Article 2(3)(b)(iv) where it is also combined with insurance covering conservation of capital. The insurance covering conservation of capital could be linked business. In that case, the undertaking would be carrying on both Class VII (pension fund management) and Class III (linked long term). In addition, non retail business covers business falling within Class III of Annex II, where the policyholder is a person other than a natural person.

Factor-based formula for scenario effect

3.161. For the two scenario calculations *lapseshock$_{down}$* and *lapseshock$_{up}$*, factor-based simplifications were provided in QIS4. These simplifications attempt to approximate the effect of the permanent change of lapse rates by projection of the effect of a temporary shock into the future. The effect of a temporary change in lapse rates can easily be measured by means of the surrender strain: for example, the loss incurred in a portfolio with positive surrender strain due to temporary change of lapse rates by 5 percentage points is approximately 5% of the surrender strain. In order to for the permanence of the change in the scenarios *lapseshock$_{down}$* and *lapseshock$_{up}$*, this loss can be multiplied with the duration of the portfolio in question.

3.162. This approach results in formulas as follows:

$$Lapse_{down} = 50\% \cdot l_{down} \cdot n_{down} \cdot S_{down}$$

and

$$Lapse_{up} = 50\% \cdot l_{up} \cdot n_{up} \cdot S_{up} \ ,$$

where

$l_{down}; l_{up}$ = 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

3.163. The simplified calculation should be done at an appropriate granularity.

3.164. The factor-based approximations should only be used if they are proportionate to the nature, scale and complexity of the risk. In particular, as an application of the scale criterion of the proportionality principle, the simplification should only be used if the capital requirement for lapse risk (determined with the simplification) is small compared to the overall capital requirement. A threshold of 5% of the overall SCR (before adjustment for the loss-absorbing capacity of technical provisions and deferred taxes) was tested in QIS4 and appears to be appropriate. Moreover, the simplification should only be used, if the more sophisticated result of the scenario analysis is not easily obtainable.

3.7.2 CEIOPS' advice

Treatment of lapse risk in the scenario calculations

3.165. In the scenario calculations of the SCR standard formula, the revaluation of technical provisions should allow for relevant adverse changes in option take-up behaviour of policyholders under the specified scenario.

Scope of the lapse risk sub-module

3.166. In relation to the policyholder options that the lapse sub-module covers, a

account of all legal or contractual policyholder options which can significantly change the value of the future cash-flows. This includes options to fully or partly terminate, decrease, restrict or suspend the insurance cover as well as options which allow the full or partial establishment, renewal, increase, extension or resumption of insurance cover.

3.167. In the following, the term "lapse" is used to denote all these policyholder options.

Calculation of the capital requirement in the lapse risk sub-module

3.168. Based on the assumptions contained in the explanatory text, CEIOPS has calibrated the sub-module according to 99.5% VaR and a one year time horizon.

3.169. The capital requirement for lapse risk should be calculated as follows:

$$Life_{lapse} = \max(Lapse_{down}; Lapse_{up}; Lapse_{mass}),$$

where

$Life_{lapse}$ = Capital requirement for lapse risk

$Lapse_{down}$ = Capital requirement for the risk of a permanent decrease of the rates of lapsation

$Lapse_{up}$ = Capital requirement for the risk of a permanent increase of the rates of lapsation

$Lapse_{mass}$ = Capital requirement for the risk of a mass lapse event

3.170. Capital requirements for the three sub-risks should be calculated based on a policy-by-policy comparison of surrender value and best estimate provision. The surrender strain of a policy is defined as the difference between the amount currently payable on surrender and the best estimate provision held. The amount payable on surrender should be calculated net of any amounts recoverable from policyholders or agents e.g. net of any surrender charge that may be applied under the terms of the contract. In this context, the term "surrender" should refer to all kind of policy terminations irrespective of their name in the terms and conditions of the policy. In particular, the surrender value may be zero if no compensation is paid on termination.

3.171. The capital requirement for the risk of a permanent decrease of the rates of lapsation should be calculated as follows:

$$Lapse_{down} = \Delta NAV \mid lapseshock_{down},$$

where

ΔNAV = Change in the net value of assets minus liabilities (not including changes in the risk margin of technical provisions where it needs to be calculated separately)

$lapseshock_{down}$ = Reduction of 50% in the assumed option take-up rates in all future years for all policies without a positive surrender strain or otherwise adversely

affected by such risk. Affected by the reduction are options to fully or partly terminate, decrease, restrict or suspend the insurance cover. Where an option allows the full or partial establishment, renewal, increase, extension or resumption of insurance cover, the 50% reduction should be applied to the rate that the option is not taken up.

The shock should not change the rate to which the reduction is applied to by more than 20% in absolute terms.

3.172. The capital requirement for the risk of a permanent increase of the rates of lapsation should be calculated as follows:

$$Lapse_{up} = \Delta NAV \mid lapseshock_{up},$$

where

ΔNAV = Change in the net value of assets minus liabilities (not including changes in the risk margin of technical provisions where it needs to be calculated separately)

$lapseshock_{up}$ = Increase of 50% in the assumed option take-up rates in all future years for all policies with a positive surrender strain or otherwise adversely affected by such risk. Affected by the increase are options to fully or partly terminate, decrease, restrict or suspend the insurance cover. Where an option allows the full or partial establishment, renewal, increase, extension or resumption of insurance cover, the 50% increase should be applied to the rate that the option is not taken up.

The shocked rate should not exceed 100%.

3.173. Therefore, the shocked take-up rate should be restricted as follows:

$$R_{up}(R) = \min(150\% \cdot R; 100\%) \quad \text{and}$$

$$R_{down}(R) = \min(\max(50\% \cdot R; R - 20\%), 0),$$

where

R_{up} = shocked take-up rate in $lapseshock_{up}$

R_{down} = shocked take-up rate in $lapseshock_{down}$

R = take-up rate before shock

3.174. The capital requirement for the risk of a mass lapse event $Lapse_{mass}$ should be defined as 30% of the sum of surrender strains over the policies where

the surrender strain is positive.

3.175. For non-retail business (see paragraph 3.156), the capital requirement for the risk of a mass lapse event $Lapse_{mass}$ should be defined as 70% of the sum of surrender strains over the policies where the surrender strain is positive.

Simplifications

Calculation on policy-by-policy basis

3.176. If it is proportionate to the nature, scale and complexity of the risk, the comparison of surrender value and best estimate provision referred to in paragraph 3.170 might be made on the level of homogeneous risk groups instead of a policy-by-policy basis. A calculation on the level of homogeneous risk groups should be considered to be proportionate if

(a) the homogeneous risk groups appropriately distinguish between policies of different lapse risk;

(b) the result of a policy-by-policy calculation would not differ materially from a calculation on homogeneous risk groups; and

(c) a policy-by-policy calculation would be an undue burden compared to a calculation on homogeneous risk groups which meet criteria (a) and (b).

Factor-based formula for scenario effect

3.177. A simplified calculation of $Lapse_{down}$ and $Lapse_{up}$ as defined in paragraph 3.178 may be made if the following conditions are met:

(d) The simplified calculation is proportionate to nature, scale and complexity of the risk.

(e) The capital requirement for lapse risk under the simplified calculation is less than 5% of the overall SCR before adjustment for the loss-absorbing capacity of technical provisions and deferred taxes. For this comparison the overall SCR can be calculated by means of the simplified calculation for the lapse risk capital requirement.

(f) The quantification of the scenario effect defined in paragraphs 3.171 and 3.172 would be an undue burden.

3.178. The simplified calculations are defined as follows:

$$Lapse_{down} = 50\% \cdot l_{down} \cdot n_{down} \cdot S_{down}$$

and

$$Lapse_{up} = 50\% \cdot l_{up} \cdot n_{up} \cdot S_{up} \; ,$$

where

$l_{down}; l_{up}$ = 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
>
> 3.179. The simplified calculation should be done at an appropriate granularity.
>
> 3.180. Note that under the simplification, the constraint to look at $Lapse_{down}$, $Lapse_{up}$, and mass Lapse still applies.

3.8 Life catastrophe risk

3.8.1. Explanatory text

Introduction

3.181. Catastrophe risk stems from extreme or irregular events whose effects are not sufficiently captured in the other life underwriting risk sub-modules. Examples could be a pandemic event or a nuclear explosion.

3.182. This risk is normally treated by using a one-off extreme mortality and/or morbidity rate.

3.183. Catastrophe risk is mainly associated with products (such as term assurance, critical illness or endowment policies) in which a company guarantees to make a single or recurring & periodic series of payments when a policyholder dies or is diagnosed with a specified disease within a pre-agreed period.

Life catastrophe risk in QIS4

3.184. The QIS4 approach to the SCR standard formula included a catastrophe risk sub-module in the life underwriting risk module (section TS.XI.H of the QIS4 Technical Specifications (MARKT/2505/08)). The calculation of the capital requirement for catastrophe risk was a scenario based stress. The scenario tested was a combination of the following events:

- an absolute 1.5 per mille increase in the rate of policyholders dying over the following year (e.g. from 1.0 per mille to 2.5 per mille)

- an absolute 1.5 per mille 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 becomes sick.

3.185. The following comments were made by QIS4 participants with regard to the catastrophe risk stress:

- An inconsistency was noted between the full and simplified standard SCR approaches for Cat risk: whereas the full approach allows a negative contribution from annuity business, this is not possible under the simplified methodology.

- The "policy by policy" calculation for the assessment of the Life Lapse and Life Cat risk is considered too burdensome for many undertakings.

Calculation of the capital requirement

3.186. QIS4 participants did not comment on the general methodology of the mortality catastrophe stress and CEIOPS has therefore concluded that the approach adopted in QIS4 was suitable.

3.187. Therefore the capital requirement should be calculated as the change in net asset value (assets minus liabilities) following an absolute increase in the rate of policyholders dying over the following year of x per mille.

3.188. With regard to the morbidity catastrophe stress, CEIOPS has considered further the modelling of health catastrophe risk as part of the development of the health underwriting module. There is a wide variety of health products written across Member States and CEIOPS believes that it is not possible to define a single stress which captures the catastrophe risk associated with different products. Therefore a number of pan European catastrophe scenarios will be developed for health business. For further information on this process, please refer to CEIOPS' advice on non life catastrophe risk.

3.189. In light of the above, CEIOPS proposes to remove the morbidity catastrophe stress from the life underwriting module. However firms will be expected to consider the extent to which any of the health catastrophe stresses are applicable for their business firm and, if so, apply these stresses in addition to the mortality catastrophe stresses defined above. Correlations between life and health catastrophe risk will be considered in a later paper.

Calibration of the life catastrophe stress

3.190. The QIS4 calibration of the mortality catastrophe stress was supported by a study carried out by Swiss Re[15] in 2007 which estimated that the 1 in 200 year pandemic stress for most developed countries is between 1.0 and 1.5 per mille within insured lives. This study was based on a sophisticated epidemiological model.

3.191. However, there are a number of potential weaknesses in this model such as not adequately allowing for the probability of flu jumping across species such as from birds to humans, not allowing for non-influenza pandemics (e.g. AIDS, drug resistant TB, Ebola virus / MRSA / SARS) or other causes of mortality catastrophe such as terrorism or physical catastrophes such as earthquakes. If these weaknesses were addressed, it is likely that the estimated stress would increase.

3.192. Furthermore, due to sparse historical data on pandemics, there is a significant degree of uncertainty around the calibration of any pandemic model.

3.193. We also note that the 1918 flu pandemic, which is the most significant mortality catastrophe for which data is available, gave rise to death levels of above 5 per mille.

3.194. The above proposal does not restrict the application of the catastrophe module to (re)insurance obligations which are contingent in mortality i.e. the module may also be applied to (re)insurance obligations, such as

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[15] http://www.swissre.com/resources/bbab850046606bf6b89cfd276a9800c6-SHAN-753GRL_Pandemic%20influenza.pdf

annuities, where the increase in mortality leads to a reduction in technical provisions.

3.195. Although this may seem to reflect the economic substance of (re)insurance undertakings' portfolios by allowing for the diversification between different lines of business, there is evidence to suggest that this diversification benefit may not exist in reality. In particular, historic data indicates that primarily young and healthy people died as a result of influenza pandemics.

3.196. CEIOPS is therefore proposing the restriction of the mortality catastrophe module to (re)insurance obligations which are contingent on mortality i.e. where an increase in mortality leads to an increase in techncial provisions.

3.197. CEIOPS believes that this restriction would mean that is is reasonable to consider a lower calibration of the mortality catastrophe stress.

3.198. For joint life policies, the mortality catastrophe loading should be applied separately for each insured person, rather than on a 'per policy' basis.

3.199. Therefore a mortality catastrophe stress constituting an absolute increase of 1.5 per mille is proposed.

3.8.2. CEIOPS' advice

Catastrophe risk

3.200. Based on the assumptions contained in the explanatory text, CEIOPS has calibrated the sub-module according to 99.5% VaR and a one year time horizon.

3.201. The calculation of the capital requirement for catastrophe risk shall be a scenario based stress.

3.202. The mortality catastrophe module is restricted to (re)insurance obligations which are contingent on mortality, i.e. where an increase in mortality leads to an increase in technical provisions.

3.203. The capital requirement shall be calculated as the change in net asset value (assets minus liabilities) following an absolute increase in the rate of policyholders dying over the following year of 1.5 per mille.

3.204. (Re)insurance undertakings shall also be required to consider whether any of the catastrophe scenarios defined as part of the health catastrophe module are applicable for the business covered by the life underwriting module. Where this is the case, (re)insurance undertakings shall be required to apply these stresses in addition to the mortality catastrophe stress.

Annex A Estimate of the volatility in disability incidence and recovery (Swedish FSA)

<u>Incidence</u>

A.1. The total incidence rate in terms of incurred and IBNR provisions for new claims has been recorded as a proportion of total volume of active (non-incurred) insurance business, for a number of companies and for up to 6 years (2002-2007).

A.2. The figures also include waiver-of premium insurance. The coefficient of variation (standard deviation divided by average) has been calculated for each company. The results are given in the following table.

Incidence	Var-coeff
Company 1	46%
Company 2	26%
Company 3	127%
Company 4	16%
Company 5	55%
Company 6	69%
Company 7	36%
Company 8	2%
Company 9	31%
Company 10	65%
Company 11	160%
Company 12	89%
Company 13	193%
Company 14	59%
Company 15	36%
Company 16	102%
Company 17	82%
Company 18	27%
Company 19	23%
Company 20	51%
Company 21	76%
Company 22	56%

<u>Reservation</u>

A.3.   The figures are based upon annual reports from the companies. The quality of data in some cases may be low. The conclusions must therefore be taken with some consideration.

<u>Conclusions</u>

A.4.   The data shows that the annual variation in incident rates ranges from 23% to 127% (discarding outliers) for different companies.

A.5.   It is important to note that disability insurance in Sweden is supplementary to social security insurance and there is little room for undertakings to apply their own judgement in respect of claims. During the period of the study, there was a significant trend moving from strong negative outcomes towards strong positive outcomes because of different management actions. This has been caused by limitations to policy conditions combined with external political decisions, for example the definition of accepted disability reasons and claims periods has been changed. Other external circumstances, for instance unemployment, could also have a significant impact on incidence rates.

A.6.   Since such circumstances may also occur in future, we believe that the inception rate for the first year may reasonably be stressed by as much as + 50 %.

<u>Recovery</u>

A.7.   The total recovery rate (including mortality) has been recorded in terms of provisions released as a result of recovery as a proportion of total provisions for in respect of disability for a number of companies and for up to 6 years (2002-2007). We have calculated the coefficient of variation (standard deviation divided by average) for every company. The results are given in the following table.

Recovery	Var-coeff
Company 1	126%
Company 2	146%
Company 3	69%
Company 4	35%
Company 5	36%
Company 6	4%
Company 7	95%
Company 8	31%
Company 9	51%

A.8.   Due to the uncertainty in the data quality, data from only 9 companies has been used in the investigation.

<u>Conclusions</u>

A.9.   The reservations described above also apply in respect of the analysis of recovery rates.

A.10.   The data shows that the annual variation in recovery rates ranges from 31% to 126% (discarding outliers) for different companies.

A.11.   It is clear that there is significant uncertainty in the estimate of the termination rates. Although the relationship is not straightforward, we believe there is sufficient reason to stress this probability by as much as 20%.

Annex B Longevity risk calibration analysis

B.1. For the purpose of the longevity risk calibration, CEIOPS has conducted two analyses:

- historic improvements in mortality rates,
- shocks of future improvements in mortality rates.

B.2. The analyses are based on the unisex mortality tables for 9 countries (DE, FR, England & Wales, ES, IT, SE, PL, HU, CZ) from 1992 till 2006 (15 years) from data available at www.mortality.org.

<u>Historic improvements in mortality rates</u>

B.3. CEIOPS has analysed historic improvements in mortality rates from 1992 to 2006 as well as for shorter intervals (from 1992 to 1999 and from 1999 to 2006). The results of this analysis are presented below:

Table 1. Improvements in mortality rates from 1992 to 2006

Age band	Average	DE	FR	UK[16]	ES	IT	SE	PL	HU	CZ
30-39	-39%	-46%	-40%	-9%	-46%	-45%	-34%	-34%	-55%	-38%
40-49	-25%	-28%	-19%	-12%	-19%	-29%	-31%	-26%	-28%	-35%
50-59	-22%	-22%	-13%	-23%	-19%	-30%	-23%	-19%	-17%	-29%
60-69	-29%	-32%	-25%	-34%	-26%	-35%	-27%	-26%	-22%	-32%
70-79	-27%	-30%	-25%	-29%	-26%	-31%	-25%	-28%	-22%	-30%
80-89	-20%	-22%	-24%	-19%	-18%	-23%	-16%	-22%	-20%	-20%
90-99	-11%	-7%	-15%	-6%	-9%	-14%	-6%	-15%	-21%	-10%

Table 2. Improvements in mortality rates from 1992 to 1999

Age band	Average	DE	FR	UK[17]	ES	IT	SE	PL	HU	CZ
30-39	-22%	-28%	-26%	-4%	-21%	-23%	-21%	-20%	-30%	-25%
40-49	-11%	-13%	-6%	-4%	-6%	-15%	-13%	-15%	-7%	-22%
50-59	-13%	-16%	-9%	-12%	-9%	-14%	-15%	-13%	-11%	-17%
60-69	-14%	-16%	-11%	-17%	-9%	-17%	-15%	-12%	-10%	-20%
70-79	-10%	-14%	-8%	-8%	-7%	-12%	-12%	-10%	-5%	-13%
80-89	-8%	-11%	-8%	-4%	-3%	-11%	-5%	-8%	-8%	-10%
90-99	-2%	-3%	-1%	-6%	2%	-4%	-1%	-3%	0%	0%

Table 3. Improvements in mortality rates from 1999 to 2006

Age band	Average	DE	FR	UK[18]	ES	IT	SE	PL	HU	CZ
30-39	-22%	-24%	-19%	-5%	-32%	-28%	-16%	-18%	-36%	-18%

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[16] England&Wales
[17] England&Wales
[18] England&Wales

Age band										
40-49	-16%	-17%	-15%	-8%	-14%	-17%	-21%	-14%	-23%	-17%
50-59	-10%	-7%	-4%	-13%	-11%	-18%	-10%	-8%	-7%	-15%
60-69	-17%	-19%	-16%	-21%	-18%	-22%	-13%	-16%	-13%	-15%
70-79	-20%	-19%	-19%	-23%	-20%	-22%	-15%	-20%	-18%	-20%
80-89	-14%	-12%	-18%	-15%	-16%	-14%	-11%	-15%	-14%	-11%
90-99	-6%	-4%	-14%	-11%	-11%	-10%	-4%	-12%	21%	-10%

Shocks of future improvements in mortality rates

B.4.   CEIOPS has also built a stochastic model to carry out prediction of future improvements in mortality rates. The model is similar to the stochastic model presented by Towers Perrin to the UNESPA[19].

B.5.   CEIOPS has calculated the mean and standard deviation of annual unisex mortality improvements in years 1992-2006 for each age for 9 countries. Assuming annual mortality improvements follow a Normal distribution[20], CEIOPS has simulated future mortality rates (1 000 simulations for each country). For each simulation CEIOPS build prospective mortality tables. Once these simulations have been carried out for different durations, CEIOPS compared the mean and the 99.5% percentile of the probability that someone aged x (x from given age band) will survive for t more years (t from coverage duration) - projected mortality improvement shock. Then CEIOPS transformed this shock to an equivalent one-off shock (a permanent change in mortality rates for each age) that probabilities that someone aged x will survive for t more years in one-off shock and in projected mortality improvement shock are the same.

Table 4. Average one-off shocks for future improvements in mortality rates according to age of insured person and outstanding duration of the contract.

Age band	Coverage duration						
	5	10	15	20	25	30	WL[21]
20-24	-18.2%	-17.0%	-17.1%	-15.7%	-15.6%	-15.5%	-21.8%
25-29	-17.6%	-17.0%	-15.0%	-14.1%	-14.6%	-14.6%	-20.9%
30-34	-16.6%	-14.2%	-13.2%	-13.4%	-13.5%	-13.0%	-20.1%
35-39	-13.3%	-11.9%	-12.0%	-12.5%	-11.9%	-10.8%	-19.1%
40-44	-11.0%	-11.1%	-11.7%	-11.1%	-10.1%	-9.1%	-18.3%
45-49	-10.7%	-11.0%	-10.1%	-9.3%	-8.2%	-11.8%	-16.9%
50-54	-11.2%	-9.7%	-8.4%	-7.5%	-11.2%	-15.1%	-15.4%
55-59	-9.3%	-7.9%	-7.2%	-11.1%	-14.5%	-18.1%	-15.1%
60-64	-7.3%	-6.4%	-10.8%	-14.0%	-16.9%	-15.4%	-14.7%
65-69	-6.3%	-10.7%	-13.3%	-15.7%	-13.9%		-12.8%
70-74	-11.3%	-13.2%	-14.2%	-12.2%			-11.8%

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[19] UNESPA Longevity Risk Investigation, Towers Perrin, 21 January 2009.
[20] This assumption was verified in the Towers Perrin paper.
[21] Whole life

Age band	Coverage duration						
	5	10	15	20	25	30	WL[21]
75-79	-13.2%	-13.7%	-11.3%				-10.7%
80-84	-13.0%	-9.8%					-9.5%
85-89	-8.8%						-8.7%
90-94							-8.8%

Conclusions

B.6.   The differences between shocks for different durations are small and are not monotone so CEIOPS rejected the proposal to differentiate shock for duration of the contract.

B.7.   The differences between shocks for different ages of insured person are higher than for durations. However they are not monotone for short term contracts. CEIOPS rejected the proposal to differentiate shock for age at the inception mainly due to the simplicity of calculations. The longevity risk concerns mainly pensioners who receive annuities. Differentiating shock would increase the complexity of calculations while the accuracy of results increases slightly because the number of insured person for pure endowment is relatively small compared to number of pensioners.

B.8.   CEIOPS leaves the longevity stress unchanged because historic improvements in mortality rates observed in many countries are sometimes higher than 25% and, according to QIS4 report, the median stress in internal models equals 25%, with an interquartile range of 19% to 25%.

Annex C Analysis of annual lapse rates in the Polish life insurance market

Risk description

C.1. According to the Article 105 (3) (f) of the Level 1 text, the lapse risk is defined as the risk of loss, or of adverse change in the value of insurance liabilities, resulting from changes in the level or volatility of the rates of policy lapses, terminations, renewals and surrenders.

C.2. According to the QIS4 Technical Specifications (par. TS.XI.E.1), lapse risk relates to the loss, or adverse change in the value of insurance liabilities, resulting from changes in the level or volatility of the rates of policy lapses, terminations, changes to paid-up status (cessation of premium payment) and surrenders.

C.3. In the Draft CEIOPS' Advice for Level 2 Implementing Measures on Solvency II: Treatment of lapse risk in the SCR standard formula, CEIOPS advices to take comprehensive approach in relation to the policyholder options that the lapse sub-module covers. Ideally, the module should take account of all legal or contractual policyholder options which can significantly change the value of the future cash-flows. This includes options to fully or partly terminate, decrease, restrict or suspend the insurance cover as well as options which allow the full or partial establishment, renewal, increase, extension or resumption of insurance cover.

C.4. However due to the lack of historic data on the use of each policyholder option, the following calibration covers only the pure policy lapses for which data are available.

Data used in the analysis

C.5. The analysis is based on the rates of policy lapses in Polish life insurance undertakings from 2004 to 2007. The number and rates of policy lapses for each product of life insurance undertakings are included in the statement of the state of insurance portfolio, which the actuary has to draw up annually and submit it to the supervisory authority according to the Act on insurance activity.

C.6. The statement of the state of insurance portfolio in life insurance undertakings for the particular reporting year contains separately for each product the following information:

- product characteristics:
  - type of policy: main, supplementary;
  - participation clauses: with profit, without profit, unit-linked;
  - type of policy: individual, group;
  - duration of policy: whole life, term;
  - classes of insurance: 1, 2, 3, 4, 5 (according to Polish law);
- number of policies in force;
- number of insured people;

- number and rates of policy lapses in reporting year *R* from policies written (signed):
  - in reporting year *R-i+1* (to be called further as "lapse rate *i*"), *i*= 1, 2, 3, 4, 5 (five rates);
  - at least 5 years before reporting year *R* (lapse rate 5+), *i>5*.

C.7. The above-mentioned information was sometimes not complete because of lack of electronic version of statements for some reporting years, withdrawal of some products or introduction of new products in recent years. The lapse rates were sometimes not reported, the value equaled to "0" or was higher than "1". Therefore only data meeting all the following conditions were chosen for further analysis:

- data on each product were reported in statements for three consecutive years,
- for each reporting year, for at least one *i*, lapse rate *i* was reported and was positive,
- all lapse rates were not higher than „1",
- number of insured people in last reporting year equaled at least 100.

C.8. Let $x_{i,n-r}{}^p$ denote lapse rate *i*, *i*=1,2,3,4,5,5+, for product *p* in reporting year *n-r*, where *n* is the last reporting year and *r*=0,1,2,3.

C.9. For each *i*∈{1, 2, 3, 4, 5, 5+} Let P_i denote the set of those products, for which at least three of the following lapse rate values $x_{i,n}{}^p$, $x_{i,n-1}{}^p$, $x_{i,n-2}{}^p$, $x_{i,n-3}{}^p \in (0;1>$.

C.10. For each lapse rate *i* (where *i*∈{1, 2, 3, 4, 5, 5+}) and each product *p*∈ P_i let:

$$k_i^p = \frac{n_i^p}{\displaystyle\sum_{r=0}^{3} x_{i,n-r}^p},$$

where n_i^p is the number of lapse rates $x_{i,n-r}{}^p \in (0;1>$.

C.11. For each *i*∈{1, 2, 3, 4, 5, 5+} the standardized lapse rate *i* equal

$$y_{i,n-r}^p = x_{i,n-r}^p \cdot k_i^p,, \quad r = 0,1,2,3, \quad p \in P_i$$

C.12. The purpose of calibration is to analyze the volatility of lapse rates. The time series are too short to analyze the volatility for each product. Therefore the calibration is carried out on panel data. Since for given *i* the sample mean of rates $x_{i,n}{}^p$, $x_{i,n-1}{}^p$, $x_{i,n-2}{}^p$, $x_{i,n-3}{}^p$ differs among products, the standardization was necessary to remove "between-samples" variability (i.e. variability resulting from the differences among products) from total variability. The standardization provides the same mean of rates $y_{i,n}{}^p$, $y_{i,n-1}{}^p$, $y_{i,n-2}{}^p$, $y_{i,n-3}{}^p$ for lapse rates *i* within product *p*.

C.13. The total variability of lapse rates *i*, *i*=1,2,3,4,5,5+ is composed of two variabilities:

$$\forall_{i\in\{1,2,3,4,5,5+\}} \quad \sum_{p\in P_i}\sum_{r=0}^{3}(x_{i,n-r}^{p} - \overline{\overline{x}}_i)^2 = \sum_{p\in P_i}(\overline{x_i^p} - \overline{\overline{x}}_i)^2 + \sum_{p\in P_i}\sum_{r=0}^{3}(x_{i,n-r}^{p} - \overline{x_i^p})^2$$

where

$$\overline{x_i^p} = \frac{1}{n_i^p}\sum_{r=0}^{3}x_{i,n-r}^{p}, \quad \overline{\overline{x}}_i = \frac{1}{n_i}\sum_{p\in P_i}\sum_{r=0}^{3}x_{i,n-r}^{p}, \quad n_i = \sum_{p\in P_i}n_i^p.$$

The part of the total variability which equal $\sum_{p\in P_i}(\overline{x_i^p} - \overline{\overline{x}}_i)^2$ results from the different sample means of lapse rates among products. After standardization, for each i the mean from the whole sample $\overline{\overline{y}}_i = \frac{1}{n_i}\sum_{p\in P_i}\sum_{r=0}^{3}y_{i,n-r}^{p}$, and the sample means for each product $\overline{y_i^p} = \frac{1}{n_i^p}\sum_{r=0}^{3}y_{i,n-r}^{p}$ equal "1". Hence the total variability of lapse rate i equals

$$\forall_{i\in\{1,2,3,4,5,5+\}} \quad \sum_{p\in P_i}\sum_{r=0}^{3}(y_{i,n-r}^{p} - \overline{\overline{y}}_i)^2 = \sum_{p\in P_i}\sum_{r=0}^{3}(y_{i,n-r}^{p} - \overline{y_i^p})^2.$$

Moreover the standardization does not change the value of variation coefficient for given products

$$\forall_{i\in\{1,2,3,4,5,5+\}} \quad \forall_{p\in P_i} \quad \frac{Sd(x_i^p)}{\overline{x_i^p}} = \frac{Sd(k_i^p \cdot x_i^p)}{k_i^p \cdot \overline{x_i^p}} = \frac{Sd(y_i^p)}{\overline{y_i^p}}.$$

C.14. To sum up, the shocks for lapse rate i, $i=1,2,3,4,5,5+$ are calibrated on standardized lapse rates and the results of calibration are the relative changes of lapse rates compared to average level of lapse rate from last r years (in QIS4 the shocks refer to assumed future rates of lapsation).

C.15. For each $i\in\{1, 2, 3, 4, 5, 5+\}$, standardized values of lapse rate i made the data sample to determine shocks. Moreover, for each $i\in\{1, 2, 3, 4, 5, 5+\}$ subsamples containing lapse rates i for products with particular product characteristics were formed.

C.16. The extreme values and outliers for all standardized lapse rates i within sample (individually for the whole sample and individually for each subsample) were identified by the programme *Statistica* and were removed from further analyzes.

Methodology assumptions

C.17. On the basis of standardized lapse rates i, $i=1,2,3,4,5,5+$, the empirical distribution functions were derived, for the whole sample and for each subsample.

C.18. The downward and upward shocks have been determined as $\dfrac{VaR_{0.005} - \overline{y_i}}{\overline{y_i}}$

and $\dfrac{VaR_{0.995} - \overline{y_i}}{\overline{y_i}}$ respectively of the empirical distribution function for lapse rate i, where $\overline{y_i} = 1$.

Table 1: The values of downward and upward lapse shocks.

	Sample	—	Type of policy		Participation clauses			Duration		Type of policy	
	Lapse rate	All	Main	Supp	UL	With	Without	Term	Whole	Individ	Group
Downward shock	1	-87.3%	-97.1%	-95.0%	-81.4%	-76.1%	-98.0%	-97.8%	-77.0%	-94.6%	-96.4%
	2	-86.2%	-75.8%	-89.8%	-87.9%	-73.2%	-88.9%	-75.6%	-59.1%	-74.3%	-95.1%
	3	-79.2%	-83.9%	-75.7%	-83.7%	-62.3%	-84.2%	-72.7%	-91.8%	-71.9%	-94.8%
	4	-69.1%	-80.4%	-56.0%	-80.2%	-66.5%	-63.8%	-82.2%	-77.7%	-61.1%	-94.3%
	5	-81.9%	-82.6%	-77.1%	-89.6%	-51.0%	-82.1%	-82.8%	-83.2%	-70.3%	-84.1%
	5+	-68.5%	-66.0%	-67.1%	-58.0%	-65.8%	-68.3%	-65.6%	-55.9%	-51.0%	-96.2%
Upward shock	1	103.6%	108.2%	97.2%	118.6%	75.0%	103.8%	106.0%	117.2%	99.9%	106.2%
	2	83.8%	74.6%	90.7%	81.6%	73.4%	90.3%	76.2%	65.2%	75.5%	98.9%
	3	74.4%	76.1%	68.2%	81.8%	39.1%	74.4%	60.7%	81.7%	66.7%	84.9%
	4	64.9%	63.0%	64.7%	64.7%	41.5%	65.1%	57.0%	62.8%	56.2%	84.2%
	5	74.3%	75.2%	71.1%	75.9%	37.5%	74.3%	74.5%	78.9%	62.8%	104.8%
	5+	67.1%	69.9%	66.6%	45.4%	69.5%	63.0%	62.4%	57.3%	50.8%	113.7%

C.19. The above downward and upward shocks should be interpreted as relative changes of future lapse rates *i* for each product compared to average value of lapse rates or compared to the assumed rates of lapsation, in all future years for policies where the surrender strain is expected to be negative or positive respectively.

Annex D Impact assessment on life underwriting risk

In its Call for Advice of 1 April 2009, the Commission has asked CEIOPS to contribute to the Commission's impact assessment of the Level 2 implementing measures.[22] To this end, a list of issues has been set up by the Commission and CEIOPS, identifying the Level 2 implementing measures that should be accompanied by an impact assessment. The objectives of the issues have been selected among the list of objectives used by the Commission in its Level 1 impact assessment.[23] On 12 June 2009, the Commission has issued an updated list of policy issues and options, to which reference is being made.[24] This impact assessment covers issue 12 (sub-issue B) of the list of policy issues and options.

Two summary tables accompany the impact assessment, published in a separate excel document.

1. Description of the policy issue

D.1.   The life underwriting risk module reflects the risk arising from the underwriting of life insurance contracts, in relation to the perils covered and the processes used in the conduct of business. It is calculated as a combination of the capital requirements for (at least) the following sub-modules: mortality risk; longevity risk; disability – morbidity risk; life expense risk; revision risk; lapse risk; and life catastrophe risk.

D.2.   The issue concerns the calculation method to be adopted in Level 2 implementing measures for the life underwriting risk (other than catastrophe risk) in the SCR standard formula

D.3.   The design of the standard formula SCR shall aim to be as risk sensitive as possible without becoming overly complex, achieving harmonization across Member States and incentivizing improved risk management.

D.4.   The choice of methodologies available under the standard formula plays a fundamental role in achieving such objective.

D.5.   In the options below, when reference is made to "life insurance", health insurance conducted on a similar basis to life insurance is assumed to be also included; similarly, when reference is made to "non-life insurance", health insurance conducted on a similar basis to non-life insurance is assumed to be also included.

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[22] http://www.ceiops.eu/media/files/requestsforadvice/EC-april-09-CfA/EC-call-for-advice-Solvency-II-Level-2.pdf
[23] http://ec.europa.eu/internal_market/insurance/docs/solvency/impactassess/final-report_en.pdf
[24] http://www.ceiops.eu/media/files/requestsforadvice/EC-June-09-CfA/Updated-List-of-policy-issues-and-options-for-IA.pdf.

2. Detailed description of policy options and assessment of the relative impacts on the different affected parties

D.6.   Option 1: Simulation of the impact of a pre-defined shock on the financial position of the (re)insurance undertaking (i.e. Scenario based approach).

D.7.   A scenario-based modeling approach to life underwriting risk would require the definition of a set of scenarios that adequately describe any adverse development of the underwriting result of the insurers' portfolio. In general, capital requirements derived via a scenario based approach for life underwriting risk show a higher risk sensitivity and would allow for a better alignment with the calibration standards under Solvency II compared to factor-based calculations.

D.8.   Option 2: Definition of a closed formula calibrated to a VaR at the 99.5% confidence level over a one-year period (design and calibration of the closed formula to be determined) (i.e. Factor based approach).

D.9.   The conclusion of the QIS2 exercise was that the capital requirement derived through a factor-based approach was too low. QIS4 results also showed that this approach gives insufficient recognition to the risk characteristics of the undertakings portfolio.

D.10.   Given the reduced complexity of option 2 compared to option 1, a harmonized application of the method is more likely to occur.

Impact on industry, policyholders and beneficiaries and supervisory authorities

Costs and benefits

• Industry

D.11.   The scenario based calculations to be performed are relatively complex for a substantial number of undertakings (mostly for undertakings of a lesser scale and with activities of a lower complexity). This would however not be a significant drawback as the principle of proportionality included in the Level 1 text would allow inclusion of factor based simplifications for smaller undertakings where the nature of the risk is less complex.

D.12. Due to its limited risk sensitiveness, the factor-based method would probably result in a higher capital requirement which will push more sophisticated undertakings towards the development of internal models.

- Policyholders and beneficiaries

D.13. A more risk sensitive approach would be the preferred option, as this would aim to capture risks appropriately and would make sure firms are adequately capitalized, providing additional security to policyholders.

D.14. However for smaller - medium undertakings this method may be disproportionate compared to the nature, scale and complexity of their risks, resulting in increased costs and eventually leading to an increase in expenses that would ultimately be passed on to policyholders.

- Supervisory authorities

D.15. The scenario based approach will generate a substantial additional workload for some supervisory authorities (and may necessitate hiring specialized and thus expensive staff).

D.16. The complexity of the approach may have as an incidence that the limited understanding by undertakings leads to divergences in the application of the methodology, in turn leading to an unlevel playing field between undertakings in the initial phases of the application. This risk is material as the expertise of the supervisor also has to grow over time so that at that point in time there is little corrective action to be expected from the supervisor.

3. Relevant objectives

D.17. The determination of the method for the calculation of the life underwriting risk falls under the scope of the following operational objectives:

- Introduce risk sensitive harmonized solvency standards,

- Introduce proportionate requirements for small undertakings

- Harmonize supervisory powers, methods and tools.

4. Comparison between the different options based on the efficiency and effectiveness in reaching the relevant operational objectives

D.18. The comparison and ranking of the policy options is based on the effectiveness and efficiency of each option in reaching the relevant objectives. Effectiveness is defined as the extent to which options achieve the objectives of the proposal. Efficiency is defined as the extent to which the objectives can be achieved at the lowest cost (cost-effectiveness).

D.19. The QIS4 conclusions on the suitability of the methodology for the calculation of the life underwriting risk module confirms the very broad support for the approach under that exercise and reiterates earlier conclusions on the subject.

D.20. The factor-based approach does not meet the objective of risk sensitivity. It may however be the preferred methodology for less complex undertakings given the complexity of the scenario based approach.

D.21. The scenario-based approach would be the preferred approach because of its risk sensitivity. The refinement of the methodology in the Level 2 implementing measures should ensure efficiency of the approach and the necessary harmonization thus ensuring that all objectives are met with maximum efficiency.

D.22. The complexity of this method for a significant number of undertakings can be overcome through the possibility of using simplifications for some sub-modules.

D.23. As to the objective of harmonized supervisory methods and tools, all approaches identified aim at achieving harmonization and this goal could be reached in a nearly identical fashion under all options. However, under the scenario-based approach due consideration should be given to the complexity of the application based approach that may lead to a divergent application in the initial phases of the application leading to an unlevel playing field.

D.24. In conclusion, taking into account the potential cost and benefits for policyholders and beneficiaries, insurance and reinsurance undertakings and supervisory authorities, the effectiveness and efficiency level to meet the relevant objectives, and its sustainability and comparability levels, CEIOPS recommends Option 1 in its advice.