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

# Technical Provisions – Article 86 h

# Simplified methods and techniques to calculate technical provisions

**(former Consultation Paper 76)**

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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 simplified methods and techniques to calculate technical provisions in order to ensure that actuarial and statistical methodologies are proportionate to the nature, scale and complexity of the risks, as requested in Article 86(h) of the Level 1 text.[2]

1.3. This advice has some commonalities with certain features analyzed in CEIOPS-DOC-33-09 (former CP39) regarding actuarial and statistical methodologies to calculate the best estimate, and CEIOPS-DOC-37-09 (former CP 43_09) regarding data quality standards and approximations. Therefore CEIOPS recommends reading this advice having in mind the content of these two advices.

1.4. In view of the importance of the principle of proportionality with regard to the use of simplified methods, the paper first considers how an assessment of proportionality should be carried out in the context of a valuation of technical provisions.

1.5. In this respect, the paper builds on CEIOPS' advice on the principle of proportionality published in May 2008[3], expanding further on the process of a proportionality assessment in this context and on issues such as materiality and model error which are closely related to such an assessment.

1.6. It then elaborates on the role of simplified methods for the valuation of technical provisions under the Solvency II Framework, considering on whether a specification of such methods in Level 2 implementing measures would be desirable.

1.7. Finally, the Paper provides a sample of methods that may be used by undertakings for the estimation of the technical provisions, provided their appropriateness in the respective situations..

[1] See http://www.ceiops.eu/content/view/5/5/

[2] Directive 2009/138/EC of the European Parliament and of the Council of 25 November 2009 on the taking-up and pursuit of the business of Insurance and Reinsurance (Solvency II), Official Journal, L 335, 17 December 2009, http://eur-lex.europa.eu/JOHtml.do?uri=OJ%3AL%3A2009%3A335%3ASOM%3AEN%3AHTML

[3] Advice to the European Commission on the Principle of Proportionality in the Solvency II Framework Level 1 text Proposal (CEIOPS-DOC-24/08), http://www.ceiops.eu/media/docman/public_files/publications/submissionstotheec/AdviceProportionality.pdf

# 2. Extract from Level 1 Text

## 2.1. Legal basis for implementing measure

2.1.1. Reference for the advice presented in this paper is Article 86(h) of the Level 1 text:

*Article 86 - Implementing measures*

*The Commission shall adopt implementing measures laying down the following:*

*"(h) where necessary, simplified methods and techniques to calculate technical provisions, in order to ensure the actuarial and statistical methods referred to in point (a) and (d) are proportionate to the nature, scale and complexity of the risks supported by insurance and reinsurance undertakings including captive insurance and reinsurance undertakings.… "*

## 2.2. Other relevant Level 1 text

Recitals:

2.2.1. The following recitals explicitly refer to the principle of proportionality:

*(18) […] In order to ensure the effectiveness of the supervision all actions taken by the supervisory authorities should be proportionate to the nature and the complexity of the risks inherent in the business of an insurance or reinsurance undertaking, regardless of the importance of the undertaking concerned for the overall financial stability for the market.*

*(19) This Directive should not be too burdensome for small and medium-sized insurance undertakings. One of the tools by which to achieve that objective is the proper application of the proportionality principle. That principle should apply both to the requirements imposed on the insurance and reinsurance undertakings and on the exercise of supervisory powers.*

*(20) In particular, this Directive should not be too burdensome for insurance undertakings that specialise in providing specific types of insurance or services to specific customer segments, and it should recognise that specialising in this way can be a valuable tool for efficiently and effectively managing risk. […]*

*(21) This Directive should also take account of the specific nature of captive insurance and reinsurance undertakings. As those undertakings only cover risks associated with the industrial or commercial group to which they belong, appropriate approaches should thus be provided in line with the principle of proportionality to reflect the nature, scale and complexity of their business.*

*(133) […] In accordance with the principle of proportionality, as set out in that Article, this Directive does not go beyond what is necessary in order to achieve those objectives.*

2.2.2. The following recitals provide background to the general principles on the valuation of technical provisions:[4]

*(53) In order to allow insurance and reinsurance undertakings to meet their commitments towards policy holders and beneficiaries, Member States should require those undertakings to establish adequate technical provisions. The principles and actuarial and statistical methodologies underlying the calculation of those technical provisions should be harmonised throughout the Community in order to achieve better comparability and transparency.*

*(54) The calculation of technical provisions should be consistent with the valuation of assets and other liabilities, market consistent and in line with international developments in accounting and supervision.*

*(55) The value of technical provisions should therefore correspond to the amount an insurance or reinsurance undertaking would have to pay if it transferred its contractual rights and obligations immediately to another undertaking. Consequently, the value of technical provisions should correspond to the amount which anotherinsurance or reinsurance undertaking (the reference undertaking) would be expected to require to take over and fulfil the underlying insurance and reinsurance obligations. The amount of technical provisions should reflect the characteristics of the underlying insurance portfolio. Undertaking-specific information, such as that regarding claims management and expenses, should therefore be used in their calculation only insofar as that information enables insurance and reinsurance undertakings better to reflect the characteristics of the underlying insurance portfolio.*

*(58) It is necessary that the expected present value of insurance liabilities is calculated on the basis of current and credible information and realistic assumptions, taking account of financial guarantees and options in insurance or reinsurance contracts, to deliver an economic valuation of insurance or reinsurance obligations. The use of effective and harmonised actuarial methodologies should be required.*

2.2.3. The following recital explicitly refers to the valuation of technical provisions using simplified approaches:

(59*) In order to reflect the specific situation of small and medium-sized undertakings, simplified approaches to the calculation of technical provisions should be provided for.*

Articles

2.2.4. With regard to the principle of proportionality, Article 29 stipulates that this is fundamental to all requirements in the Level 1 text:

*Article 29 - General principles of supervision*

*"[…]*

[4] Recitals (56) and (57) have been omitted since they address more specific issues in the valuation of technical provisions which are not immediately relevant for the purposes of this paper.

*3. Member States shall ensure that the requirements laid down in this Directive are applied in a manner which is proportionate to the nature, complexity and scale of the risks inherent in the business of an insurance or reinsurance undertaking.*

*4. The Commission shall ensure that implementing measures take into account the principle of proportionality, thus ensuring the proportionate application of this Directive, in particular to small insurance undertakings."*

2.2.5. General requirements on the valuation of technical provisions – also applicable to the use of simplified approaches - are set out in Articles 76 to 82. For the purposes of this paper, background relevant to this paper is provided in particular by Articles 75, 76(2) and 81:

*Article 76 – General provisions*

*"[…]*

*2. The value of technical provisions shall correspond to the current amount insurance and reinsurance undertakings would have to pay if they were to transfer their insurance and reinsurance obligations immediately to another insurance or reinsurance undertaking.*

*3. The calculation of technical provisions shall make use of and be consistent with information provided by the financial markets and generally available data on underwriting risks (market consistency).*

*4. Technical provisions shall be calculated in a prudent, reliable and objective manner. […]"*

*Article 77(2) – Calculation of the technical provisions*

*"The best estimate shall correspond to the probability-weighted average of future cash-flows, taking account of the time value of money (expected present value of future cash-flows), using the relevant risk-free interest rate term structure.*

*The calculation of the best estimate shall be based upon up-to-date and credible information and realistic assumptions and be performed using adequate, applicable and relevant actuarial and statistical methods.*

*The cash-flow projection used in the calculation of the best estimate shall take account of all the cash in- and out-flows required to settle the insurance and reinsurance obligations over the lifetime thereof.*

*The best estimate shall be calculated gross, without deduction of the amounts recoverable from reinsurance contracts and special purpose vehicles. Those amounts shall be calculated separately, in accordance with Article 81."*

*Article 82 – Data quality and application of approximations, including case-by-case approaches, for technical provisions*

*"[…]Where, in specific circumstances, insurance and reinsurance undertakings have insufficient data of appropriate quality to apply a reliable actuarial method to a set or subset of their insurance and reinsurance obligations, or amounts recoverable from reinsurance contracts and special purpose vehicles, appropriate approximations, including case-by-case approaches, may be used in the calculation of the best estimate."*

*Article 86 - Implementing measures*

*The Commission shall adopt implementing measures laying down the following:*

*(f) the standards to be met with respect to ensuring the appropriateness, completeness and accuracy of the data used in the calculation of technical provisions, and the specific circumstances in which it would be appropriate to use approximations, including case-by-case approaches, to calculate the best estimate;"*

# 3. Advice. Explanatory text

## 3.1. Proportionality

### 3.1.1. Role of proportionality in the valuation of technical provisions

3.1 This sub-section considers the overall purpose and role of a proportionality assessment in the valuation of technical provisions. It first sets out how such an assessment is interlinked with the selection of an appropriate valuation methodology. It then considers the notion of estimation uncertainty (or model error) and sets out why this is central to a proportionality assessment. Finally, it introduces the notions of "simplified methods" and approximations and considers their role in the valuation process.[5]

*Selection of valuation methodology*

3.2 Solvency II envisages a principles-based approach to the valuation of technical provisions. This means that the regulatory requirements relating to the valuation process would generally not prescribe any specific approaches to carrying out the valuation. Instead, there will typically be a range of different approaches which are available to the (re)insurance undertaking, which then has to select a valuation methodology which is appropriate with regard to the valuation principles established under Solvency II.

3.3 Within this context, the principle of proportionality requires that the (re)insurance undertaking should be allowed to choose and apply a valuation method which is

- suitable to achieve the objective of deriving a market-consistent valuation according to the Solvency II principles; but
- not more sophisticated than is needed in order to reach this objective.[6]

3.4 Considering that the valuation of technical provisions under Solvency II aims at properly reflecting the risks underlying the obligations, this means that undertakings should be allowed to choose valuation methods which are

- Compatible with the Solvency II valuation principles; and
- Proportionate to the nature, scale and complexity of the risks.

3.5 In this way application of the principle of proportionality allows a reduction of the complexity of the valuation methodology where this is still proportionate to the underlying risk profile of the portfolio, enabling (re)insurance undertakings to minimise resources in form of e.g. actuarial expertise or IT implementation costs.

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[5] For an example illustrating the main issues concerning proportionality, we refer to annex A of this paper.

[6] Note this is implied by the general concept of proportionality as embedded in the *acquis communautaire* and expressed in recital 92 of the Level 1 text.

3.6 It is noted that in the recitals to the Level 1 text, the importance of the principle of proportionality is explicitly linked to the need to avoid excessive strain on small and medium-sized undertakings.[7] This does however not mean that an application of the principle of proportionality is restricted to small and medium-sized undertakings, nor does it mean that size is the only relevant factor when the principle is considered. Instead, the individual risk profile should be the primary guide in assessing the need to apply the proportionality principle.[8] Hence where a (simplified) valuation technique is proportionate to the underlying risks and compatible with the Solvency II valuation techniques, it would be appropriate for application by the (re)insurance undertaking irrespective of its size.

*Estimation uncertainty and its link to proportionality*

3.7 Due to the uncertainty of future events, any "modelling" of future cash flows (implicitly or explicitly contained in the valuation methodology) flows will necessarily be imperfect, leading to a certain degree of inaccuracy and imprecision in the measurement. Sources for this estimation uncertainty or "model error"[9] are for example the possibility that the assumptions and parameters used in the model are incorrect, or that the model itself is deficient. [10]

3.8 Where simplified approaches are used to value technical provisions, this could potentially introduce additional uncertainty (or model error). This is the case since:

- Often simplified method are used in situations where there is a lack of undertaking-specific claims data, in which case the setting of the parameters and assumptions used in the method will usually require a considerable amount of judgment; and
- due to its simplicity the method may not be able to fully capture the nature, scale and complexity of the risks arising from the contracts.

3.9 The degree of model error in the measurement of technical provisions is closely linked to the reliability and suitability of the valuation. Indeed, the higher the estimation uncertainty, the more difficult it will be for the (re)insurance undertaking to rely on the estimation and to verify that it is suitable to achieve the objective of deriving a market-consistent valuation according to the Solvency II principles.

3.10 With regard to the principle of proportionality, these considerations show that it is important to assess the model error that results from the use of a given valuation technique.

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[7] Cf. e.g. recital 14a of the Level 1 text.

[8] Compare paragraphs 11 and 15 in CEIOPS' Advice on Proportionality

[9] In the following, the terms "estimation uncertainty" and "model error" are used synonymously. Hence the term "model error" is used in a broad sense, comprising the possibility that the assumptions and parameters used in the model are incorrect (in other sources, this latter risk is sometimes denoted as "parameter risk" as distinguished from model risk).

[10] In this context, uncertainty does not refer to the randomness of future outcomes (sometimes referred to as *volatility risk* or *process risk*), but to the fact that the nature of this randomness is itself unknown. The uncertainty of the risk in terms of volatility risk or process risk is an inherent quality of the risk (independent of the valuation method applied) and is assessed as part of the nature of the risk (cf. para. 3.38).

*Simplified methods*

3.11 Typically, there will be a range of different valuation methods available to the (re)insurance undertaking, differing in their degree of complexity and sophistication. Following the proportionality principle as expressed in para. 3.4 will enable the undertaking to simplify a given valuation method in case where the simplified method is still proportionate to the underlying risks.

3.12 In this case, the term "simplified method" would refer to a situation where a specific valuation technique has been simplified in line with the proportionality principle. In a loose sense, the term "simplified method" (or "simplification") could also be used to refer to a valuation method which is considered to be simpler than a "commonly used" benchmark or reference method.[11]

3.13 However, any distinction between "simplified" and "non-simplified methods would necessarily need some assessment and, hence, it is necessary to explore how to achieve a categorisation, as clearer as possible, of the range of available methods:[12]

- a method which is appropriate for an (re)insurance undertaking's particular book of business[13] need not be appropriate for the book of business of another undertaking, even within the same line of business; hence it would be difficult to define any "default" methods which would be appropriate for all undertakings;
- within a line of business, it is common practice for different valuation methods to be applied, hence in general there is no single "best practice" method which could be used as a benchmark or reference;
- best practice evolves over time, and so likewise any notion of what is considered as "more simple" than best practice would not be static; and
- even where a benchmark method could be established, in practice it would be very difficult to decide whether a given valuation method is more simple than the benchmark method.

3.14 In light of these considerations, it would not seem appropriate to introduce in Level 2 (on basis of a "hard" definition of what can be considered to be a "simplified" method) a categorisation of the range of available methods for the valuation of technical provisions into "simplified" methods and "non-simplified" methods. Indeed, to some extent it could be argued that all methods are simplified and none are exact, since a valuation of future cash flows involves a modelling of real-world phenomena which requires the setting of simplifying assumptions.

*Approximations*

3.15 For the valuation of technical provisions, the amount and quality of the statistical data underlying the calculation is of central importance. The Level 1 text therefore stipulates that (re)insurance undertakings should

[11] It is considered that the term "simplified methods" is used in this sense in the wording of Article 85(h).

[12] Cf. the Groupe's interim report to CEIOPS on *Valuation of Best Estimate under Solvency II in Non-Life Insurance*, 11 November 2008, pp. 23-24

[13] with regards to the nature, scale and complexity of the underlying risks, cf. sub-section 3.1.2.1

have in place internal processes and procedures to ensure the appropriateness, completeness and accuracy of such data.[14]

3.16 Under certain circumstances, however, it will be unavoidable for the undertaking to have only insufficient company-specific data of appropriate quality to apply a reliable statistical actuarial method for the determination of technical provisions.[15] It is therefore important to develop valuation techniques which would substitute a lack of company-specific data by e.g. using external market information.

3.17 In the Solvency II debate, the term "proxy" was introduced to denote such valuation techniques. In view of their practical relevance, a number of proxy techniques have been included in the QIS4 exercise.[16] In the Level 1 text, such techniques are referred to as "approximations" (Article 87).

3.18 Where approximation techniques are applied these would typically be based on a fixed set of assumptions and would tend to be less complex than techniques which carry out explicit cash flow projections based on undertaking-specific data. Approximations may therefore often be regarded as a specific kind of simplified methods (where the simplification is due to a lack of data). The use of expert judgement plays a key role in this context.

*Role of simplified methods in the valuation framework*

3.19 We note that CEIOPS has laid out advice with regard to actuarial and statistical methodologies for the calculation of the best estimate (as requested in Article 85(a)). This has regard to:

- the quality and selection of valuation techniques;
- the elements that need to be taken into account when estimating the future cash-flows;
- the setting of assumptions underlying the valuation; and
- the validation methods for ensuring the quality of the valuation.

3.20 Where the (re)insurance undertaking selects a valuation methodology (irrespective of whether this is regarded as a simplified method or an approximation), it should be appropriate for the calculation of the technical provision. Hence, the principles-based expectations and requirements set out in CEIOPS' advice as referred to above are intended to apply generally, including the use of approximations and simplified methods and techniques.[17]

3.21 In this context, it is noted that Consultation Paper 26 introduces a distinction between simulation, analytic and deterministic techniques. A (stochastic) simulation technique would involve choosing a (suitably

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[14] Cf. Article 81 and the corresponding implementing measure in Article 85(f). CEIOPS has set out its advice relating to this Article in a separate consultation paper, cf. CEIOPS-CP43-09 http://www.ceiops.eu/content/view/14/18/

[15] For example, this may be the case where the insurer writes a new line of business, cf. CEIOPS-CP43-09 http://www.ceiops.eu/content/view/14/18/.

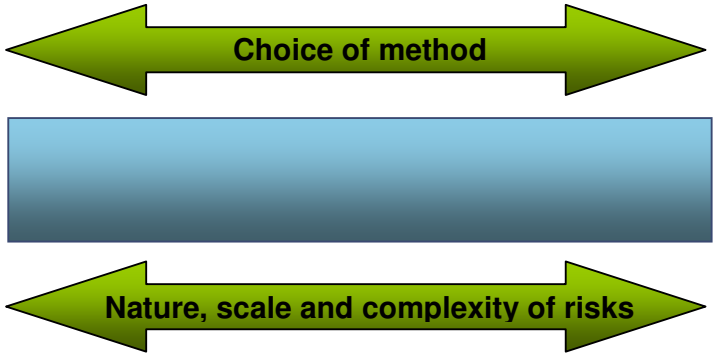
[16] Cf. to the Coordination Group's Report on Proxies and QIS4 technical specifications.

[17] Note that this is in line with the observation contained in para. 3.14 that a categorisation of the range of methods into "simplified" and "non-simplified" methods would not seem appropriate.

large) number of scenarios which are representative of all possible futures, as for example in a Monte Carlo simulation.[18] In contrast, analytical techniques (based on closed-form solutions) and deterministic techniques (based on a fixed set of assumptions) would generally be less complex and capture the uncertainty in the valuation in a more implicit way. Hence it can be expected that simplified methods or approximations would typically lead to an application of analytic or deterministic techniques.[19]

3.22 In the same way, the principle of proportionality applies generally when a valuation methodology is chosen, allowing (re)insurance undertakings the flexibility to select a technique which is proportionate to the nature, scale and complexity of the underlying risks:

*Figure 1: Assessment of proportionality in the valuation of technical provisions*




Hence where the following sub-sections elaborate further on how such a proportionality assessment could be carried out, these considerations and the related advice set out in this document is applicable to technical provision calculation in general rather than being specific to technical provisions calculation using "simplified methods"

3.23 Notwithstanding, following Article 85(h) it could be contemplated to specify individual simplified methods under Level 2 which (re)insurance undertakings may use under certain conditions, thus complementing the principles-based approach to the valuation of technical provisions. The feasibility of this option – with regard to individual components of the valuation such as best estimate, risk margin and reinsurance recoverables – is discussed in section 3.2 below.

### 3.1.2. Proportionality assessment – a three step process

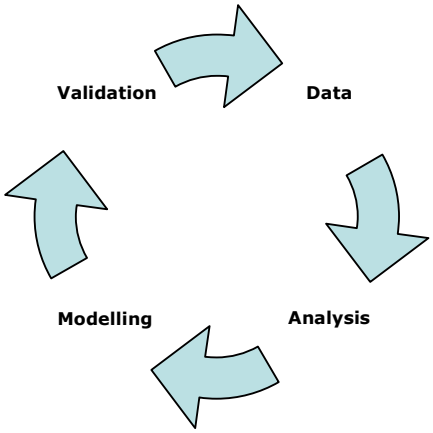
3.24 Whereas the ultimate aim of calculating technical provisions is to assign an appropriate valuation to the underlying insurance obligations, it would

[18] Cf. CEIOPS-DOC-21-09, former CP26.

[19] Note that this does not imply, conversely, that analytical and/or deterministic techniques should typically be considered as simplified methods or approximations, or that such techniques can only be applied where the risk profile of the portfolio is sufficiently simple. Indeed, it may be appropriate for the insurer to apply analytical and/or deterministic techniques even in case of more complex risks provided that the insurer can demonstrate that the valuation technique and the underlying assumptions are realistic and reflect the uncertain nature of the cash-flows, cf. CEIOPS Consultation Paper No. 26.

not be appropriate to reduce this valuation as only providing a single number. Instead, it is important that consideration is given to the different stages of the valuation process. These stages would generally include data, analysis, modelling an validation:[20]

*Figure 2: Stages of valuation process*




3.25 The assessment of proportionality of the selected valuation methodology to the nature, scale and complexity of the underlying risks is an integral part of this process.[21]

3.26 It would be appropriate for such an assessment to include the following three steps:

- **Step 1**: Assess nature, scale and complexity of underlying risks
- **Step 2**: Check whether valuation methodology is proportionate to risks as assessed in step 1, having regard to the degree of model error resulting from its application
- **Step 3**: Back test and validate the assessment carried out in steps 1 and 2

Below, these steps are discussed in more detail.

3.27 Rather than proposing a prescriptive rule, the outlined process is intended to set out general expectations on (re)insurance undertakings and supervisors as to how proportionality should be applied when selecting a valuation methodology. It is important that a flexible and principle-based framework is maintained to allow undertakings to follow an approach which is appropriate with regard to their specific circumstances and risk profile.

*Relation to undertaking's internal governance and to supervisory review*

3.28 We note that it is the responsibility of the (re)insurance undertaking to choose an adequate and reliable calculation of the technical provisions.[22] Whereas this responsibility ultimately lies with the administrative or

[20] Cf. CEIOPS-CP-39-09, http://www.ceiops.eu/content/view/14/18/

[21] We note that the valuation of technical provisions should be proportionate to the nature, scale and complexity of the portfolio throughout all stages of this process. This is also relevant with regard to the selection, use and review of data underlying the valuation analysis which is covered in a separate consultation paper.

[22] Cf. CEIOPS-DOC-21-09, former CP26.

management body of the undertaking, the actuarial function plays an important role in coordinating the valuation of technical provisions and in providing regular reports to the management body on its mandatory tasks performed.[23]

3.29 An assessment of the proportionality of the chosen valuation methodology vis-à-vis the nature, scale and complexity of the underlying risks (as described in this sub-section) should be seen as part of this process, which is part of the (re)insurance undertakings' internal system of governance.

3.30 Information on the methodology chosen by the undertaking (including an assessment of proportionality) would also be important for the supervisory review of the undertaking's compliance with the valuation requirements. In this context, there should be an open dialogue between the undertaking and the supervisor about the adequacy of the methods and their potential weaknesses.

3.31 For the discussion between undertaking and supervisor, objective quantitative figures or metrics might be helpful.[24] However, these figures should be a natural result of the usual actuarial work and should not be applied as rigid thresholds but be seen as a basis for discussion.

#### 3.1.2.1. Step 1: Assess nature, scale and complexity of risks

3.32 In this step, the (re)insurance undertaking should assess the nature, scale and complexity of the risks underlying the insurance obligations. This is intended to provide a basis for checking the appropriateness of specific valuation methods carried out in step two and shall serve as a guide to identify where simplified methods are likely to be appropriate.

3.33 In elaborating on this assessment, this sub-section analyses:

- the scope of risks to be considered;
- the interpretation of the three indicators "nature", "scale" and "complexity"; and
- the combination of the three indicators in an overall assessment.

*Which risks?*

3.34 For an assessment of nature, scale and complexity it is important to clarify the scope of risks which shall be included in the analysis. We note that this scope will depend on the purpose and context of the assessment.[25]

3.35 For the purpose of calculating technical provisions, the assessment should include all risks which materially affect (directly or indirectly) the amount or timing of cash flows required to settle the insurance and reinsurance obligations arising from the insurance contracts in the portfolio to be valued. Whereas this will generally include all insured risks, it may also include others such as inflation.

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[23] Cf. CEIOPS-DOC-29-09, Advice on the system of governance, section 3.6

[24] Cf. to the discussion on potential metrics to assess the „scale" criterion, below.

[25] For example, in the context of the calculation of the SCR, all risks impacting the level of own funds of the insurer would need to be considered.

3.36 Hence where an (re)insurance undertaking assess the nature, scale and complexity of the risks – and subsequently considers whether a specific valuation method is proportionate to these risks - it should only have regard to the risk characteristics of the cash-flows related to settling the insurance contracts but not to other risks to which the undertaking may be exposed. Following such an approach is expected to improve the comparability and consistency of such assessments across different undertakings.

*Nature and complexity*

3.37 Nature and complexity of risks are closely related, and for the purposes of an assessment of proportionality could best be characterised together. Indeed, complexity could be seen as an integral part of the nature of risks, which is a broader concept.[26]

3.38 In mathematical terms, the nature of the risks underlying the insurance contracts could be described by the probability distribution of the future cash flows arising from the contracts. This encompasses the following characteristics:

- the degree of homogeneity of the risks;
- the variety of different sub-risks or risk components of which the risk is comprised;
- the way in which these sub-risks are interrelated with one another;
- the level of certainty i.e. the extent to which future cash flows can be predicted;[27]
- the nature of the occurrence or crystallisation of the risk in terms of frequency and severity;
- the type of the development of claims payments over time;
- the extent of potential policyholder loss, especially in the tail of the claims distribution.

3.39 The first three bullet points in the previous paragraph are in particular related to the complexity of risks generated by the contracts, which in general terms can be described as the quality of being intricate (i.e. of being "entwined" in such a way that it is difficult to separate them) and compounded (i.e. comprising a number of different sub-risks or characteristics).

3.40 For example, in non-life insurance travel insurance business typically has relatively stable and narrow ranges for expected future claims, so would tend to be rather predictable. In contrast, credit insurance business would often be "fat tailed", i.e. there would be the risk of occasional large (outlier) losses occurring, leading to a higher degree of complexity and uncertainty of the risks. Another example in non-life insurance is catastrophe (re)insurance covering losses from hurricanes where there is

[26] I.e. whether or not a risk is complex can be seen as a property of the risk which is part of its nature.

[27] Note that this only refers to the randomness (volatility) of the future cash flows. Uncertainty which is related to the measurement of the risk (model error and parameter error) is not an intrinsic property of the risk, but dependent on the valuation methodology applied, and will be considered in step 2 of the proportionality assessment process.

very considerable uncertainty over expected losses, i.e. how many hurricanes occur, how severe they are and whether they hit heavily insured areas.

3.41 In life insurance, the nature and complexity of the risks would for example be impacted by the financial options and guarantees embedded into the contracts (such as surrender or other take-up options), particularly those with profit sharing features.

3.42 When assessing the nature and complexity of the insured risks, additional information in relation to the circumstances of the particular portfolio should be taken into account. This could include:

- the type of business from which the risks originate (e.g. direct business or reinsurance business);
- the degree of correlation between different risk types, especially in the tail of the risk distribution.

3.43 The undertaking should also seek to identify factors which would indicate the presence of more complex and/or less predictable risks. This would be the case, for example, where: [28]

- the cash-flows are highly path dependent; or
- there are significant non-linear inter-dependencies between several drivers of uncertainty; or
- the cash-flows are materially affected by the potential future management actions; or
- risks have a significant asymmetric impact on the value of the cash-flows, in particular if contracts include material embedded options and guarantees or if there are complex reinsurance contracts in place; or
- the value of options and guarantees is affected by the policyholder behaviour assumed in the model; or
- the undertaking uses a complex risk mitigation instrument, for example a complex non-proportional reinsurance structure; or
- a variety of covers of different nature is bundled in the contracts; or
- the terms of the contracts are complex (e.g. in terms of franchises, participations, or the in- and exclusion criteria of cover).

3.44 The degree of complexity and/or uncertainty of the risks are/is associated with the level of calculation sophistication and/or level of expertise needed to carry out the valuation. In general, the more complex the risk, the more difficult it will be to model and predict the future cash flows required to settle the obligations arising from the insured portfolio. For example, where losses are the result of interaction of a number of different factors, the degree of complexity of the modelling would be expected to also increase.

3.45 Therefore, to appropriately analyse and quantify more complex and/or less predictable risks, more sophisticated and elaborated tools will generally be required as well as sufficient actuarial expertise.[29]

[28] Cf. also para. 3.13 in CEIOPS-DOC-21-09, former CP26.

*Scale*

3.46 Assigning a scale introduces a distinction between "small" and "large" risks. The undertaking may use a measurement of scale to identify sub-risks where the use of simplified methods would likely to be appropriate, provided this is also commensurate with the nature and complexity of the risks.

3.47 For example, where the undertaking assesses that the impact of inflation risk on the overall risk profile of the portfolio is small, it may consider that an explicit recognition of inflation scenarios would not be necessary. A scale criterion may also be used, for example, where the portfolio to be measured is segmented into different sub-portfolios. In such a case, the relative scale of the individual sub-portfolios in relation to the overall portfolio could be considered.

3.48 Related to this, a measurement of scale may also be used to introduce a distinction between material and non-material risks. Introducing materiality in this context would provide a threshold or cut-off point below which it would be regarded as justifiable to omit (or not explicitly recognise) certain risks.[30]

3.49 Different interpretations of "scale" may be applied when considering risks, depending on the type of assessment to be made. For example, the undertaking may interpret the scale of a risk as the degree to which the undertaking is vulnerable to the risk. Following this option, in assessing the scale of a risk one should consider both the likelihood of the risk being realised and the impact of that risk when realised. The scale of the risk would increase as either the likelihood or the (potential) impact of the risk increases:

*Scale = vulnerability to risk = likelihood and impact*

3.50 Related to this, the scale of a risk may be defined in terms of the SCR, so that it would relate to the vulnerability of the undertaking under a "worst case" scenario:

*Scale = SCR = vulnerability to risk under "worst case" scenario*

3.51 Such interpretations of "scale" would seem adequate for the determination of regulatory capital requirements, which are intended to define the amount of capital resources which the undertaking needs to be protected against the realisation of the risk. However, in the context of this paper, valuation of technical provisions, a more natural approach might be to measure the scale of the risk in terms of the best estimate of the underlying obligations:

*Scale = size of best estimate*

A combination of both references may be even deliver a more sensible assessment.

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[29] However we note that in some cases there will not be enough data to support a very complex model. Consequently, a method would need to be chosen which maximises credibility within the bounds of available data.

[30] We note that materiality is also important where the uncertainty (or degree of model error) in the measurement is concerned. This will be considered in step 2 of the proportionality assessment process, cf. section 3.1.2.2.

3.52 To measure the scale of risks, further than introducing an absolute quantification of the risks the undertaking will also need to establish a benchmark or reference volume which leads to a relative rather than an absolute assessment. In this way, risks may be considered "small" or "large" relative to the established benchmark. Such a benchmark may be defined, for example, in terms of a volume measure such as premiums or technical provisions that serves as an approximation for the risk exposure.

3.53 For the examples described above, introducing a benchmark volume would lead to the following relative assessments of scale, where all pieces are assess at the same level, trying to capture cases where either best estmates or risks, or both of them, are significant:

*Scale = (relative) size of best estimate*

*Scale = likelihood and (relative) impact*

*Scale = SCR / volume measure*

3.54 To determine an appropriate benchmark for a relative measurement of scale, it is important to specify at which level the assessment is carried out: a risk which is small with regard to the business of the undertaking as a whole may still have a significant impact within a smaller segment, e.g. a certain line of business. For the calculation of technical provisions, Article 70 of the Level 1 text stipulates in this regard that the starting point for this valuation is defined by the level of homogeneous risk group (HRG). However, other levels are also relevant; for example, the calculation of the standard formula SCR necessitates a specification of the value of technical provisions per LOB.

3.55 All in all, the following four different levels may usefully be distinguished in the context of a calculation of technical provisions:

- the individual homogeneous risk group (HRG);
- the individual line of business (LOB);[31]
- the business of the undertaking as a whole and
- the group to which the undertaking belongs.[32]

3.56 Depending on the purpose and context of the valuation, the benchmark established to measure "scale" should relate to one of these four levels. For example, where it is the purpose to calculate the technical provision for a given LOB, the benchmark should relate to same level (e.g. in terms of the size of the overall best estimate in the LOB).

3.57 In particular, where the calculation of technical provisions is carried out in the context of a solo assessment, it would not be appropriate to consider a group-related benchmark.

3.58 Considering the various options to define "scale" as described above, we note that it would not seem feasible to define a universal metric for

[31] Potentially comprising several homogeneous risk groups.

[32] We note that such a level would only be relevant in the context of group solvency calculations carried out on the basis of the consolidated accounts. However, a group perspective would not be appropriate in the context of a solo assessment (cf. para. 3.56). As to the group specificities for the calculation of technical provisions, we refer to CEIOPS' advice on group solvency assessment.

"scale" that will apply in all cases. Considering this, specifying the content and structure of a "scale" criterion in Level 2 would be considered to be excessive. This does not preclude the possibility to set up additional criteria and/or guidance (on Level 2 or 3, respectively) concerning the definition and application of "scale" to support the principles-based proportionality assessment framework outlined in this sub-section.

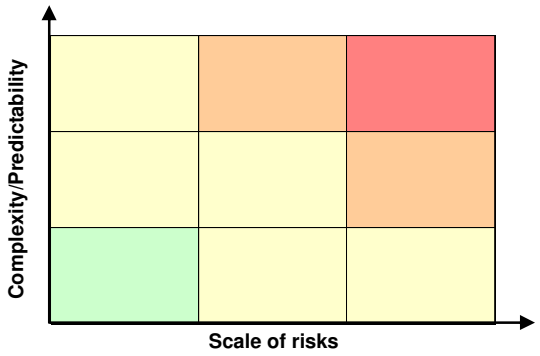
3.59 Following this principles-based framework, (re)insurance undertakings would be expected to use an interpretation of scale which is best suited to their specific circumstances and to the risk profile of their portfolio. Whatever interpretation of "scale" for risks or obligations is followed, this should lead to an objective and reliable assessment.

*Combination of the three indicators and overall assessment*

3.60 It can be concluded from the discussions above that the three indicators - nature, scale and complexity - are strongly interrelated, and in assessing the risks the focus should be on the combination of all three factors. This overall assessment of proportionality would ideally be more qualitative than quantitative, and cannot be reduced to a simple formulaic aggregation of isolated assessments of each of the indicators.

3.61 In terms of nature and complexity, the assessment should seek to identify the main qualities and characteristics of the risks[33], and should lead to an evaluation of the degree of their complexity and predictability.[34] In combination with the "scale" criterion, the undertaking may use such an assessment as a "filter" to decide whether the use of simplified methods would be likely to be appropriate. For this purpose, it may be helpful to broadly categorise the risks according to the two dimensions "scale" and "complexity/predictability":

*Figure 3: Risk matrix for proportionality assessment*




3.62 An assessment of nature, scale and complexity may thus provide a useful basis for the second step of the proportionality process where it is decided whether a specific valuation methodology would be proportionate to the underlying risks.

### 3.1.2.2. Step 2: Quantitative assessment of the model error

[33] Cf. para. 3.38.
[34] Cf. para. 3.43.

3.63 The second step of the proportionality assessment process concerns the assessment whether a specific valuation methodology can be regarded as proportionate to the nature, scale and complexity of the risks as analysed in the first step.

3.64 To carry out this assessment, the undertaking has to analyse whether the valuation methodology in question takes into account the properties and characteristics of risks identified in the first step in a proportionate way, and also has due regard to the scale of the risks.

3.65 Ultimately, when a decision needs to be taken whether a given valuation methodology can be regarded as proportionate, the supervisory objective underlying the valuation requirements would need to be considered.

3.66 For the best estimate, this means that a given valuation technique should be seen as proportionate if the resulting estimate is not expected to diverge materially from the "true" best estimate which is given by the mean of the underlying risk distribution, i.e. if the model error implied by the measurement is immaterial. More generally, a given valuation technique for the technical provision should be regarded as proportionate if the resulting estimate is not expected to diverge materially from the current transfer value specified in the Level 1 text.[35]

3.67 Where in the valuation process several valuation methods turn out to be proportionate, the undertaking would be expected to select and apply the method which is most appropriate in relation to the underlying risks.
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3.68 In the following, this second step of the proportionality assessment process is explored further, considering:

- How materiality should be interpreted in this context;
- How an assessment of the estimation uncertainty in the valuation may be carried out in practice; and
- which approach can be taken in cases where – e.g. due to a lack of data – it is unavoidable for the undertaking to apply a valuation method which leads to an increased level of estimation uncertainty in the valuation.

*Materiality in the context of a valuation of technical provisions*

3.69 In order to clarify the meaning of materiality for both undertakings and supervisors, CEIOPS proposes using as a reference the definition of materiality used in International Accounting Standards (IAS)[36] as CEIOPS considers that by using this definition undertakings should be familiar with this concept.[37] This definition states that:

*"Information is material if its omission or misstatement could influence the economic decisions of users taken on the basis of the financial statements. Materiality depends on the size of the item or error judged in the particular*

[35] Cf. Article 76(2) of the Framework Level 1 text.
[36] Materiality is defined in the glossary of the International Accounting Standards Board's "Framework for the Preparation and Presentation of Financial Statements"
[37] Cf. CEIOPS-DOC-50-09.

*circumstances of its omission or misstatement. Thus, materiality provides a threshold or cut-off point rather than being a primary qualitative characteristic which information must have if it is to be useful".*

3.70 In the context of a valuation of technical provisions, this means that a misstatement of the technical provision[38] is material if it could influence the decision-making or judgment of the intended user of the information contained in the valuation.

3.71 In its calculation of technical provisions, the (re)insurance undertaking should address materiality consistent with the principle set out in the above. For this purpose the undertaking should define a concept on materiality which should lay down the criteria on basis of which a decision on the materiality of a potential misstatement of technical provisions is made.

3.72 This materiality concept should be consistent with the undertaking's approach to materiality in other areas of solvency assessment (e.g. the determination of the SCR) and reporting, and should be reflected in the undertaking's own risk and solvency assessment (ORSA).

3.73 When determining how to address materiality, the undertaking should have regard to the purpose of the work and its intended users. For a valuation of technical provisions – and more generally for a qualitative or quantitative assessment of risk for solvency purposes – this should include the supervisory authority which uses the information when performing the SRP.

*Assessment of the estimation uncertainty in the valuation*

3.74 Regardless of what methods shall be applied for the valuation of technical provisions, it is important that an assessment of their appropriateness should in general include an assessment of the model error implicit to the calculations.

3.75 Such an assessment may be carried out, for example, by:

- Sensitivity analysis in the framework of the applied model: this means to vary the parameters and/or the data thereby observing the range where a best estimate might be located.
- Comparison with the results of other methods: applying different methods gives insight in potential model errors. These methods would not necessarily need to be more complex.
- Descriptive statistics: in some cases the applied model allows the derivation of descriptive statistics on the estimation error contained in the estimation.[39] Such information may assist in quantitatively describing the sources of uncertainty.
- Back-testing: comparing the results of the estimation against experience may help to identify systemic deviations which are due to deficiencies in the modelling.[40]

[38] I.e. the degree of model error inherent in the measurement.
[39] Of course, this would not include the uncertainty arising from a misspecification of the model itself.
[40] Cf. also the third step of the proportionality assessment process.

3.76 In conducting such an assessment, the undertaking should consider the level and the implications of the uncertainty related to the application of the valuation technique and be able to qualitatively describe the key risks and main sources of uncertainty in the valuation. Such consideration should be based on the assessment of the nature, scale and complexity of the risks carried out in Step 1 of the proportionality assessment process. In particular, where as a result of this first step of the proportionality assessment the undertaking has identified certain factors that indicate an increased level of complexity and/or unpredictability of the risks, the techniques described above should be used to assist the undertaking in quantitatively describing these sources of uncertainty and in deciding whether the valuation technique considered would be appropriate to address the underlying risks.

3.77 We note that in practice an assessment of the model error will not be easy. This is not only a problem for the simplified methods but for all methods. A precise determination of the model error will generally not be possible, neither for simplified methods nor for more complex so called best practice techniques.[41] Applying assessment techniques as described below may also lead to additional implementation costs for (re)insurance undertakings.

3.78 Therefore the undertaking should not be required to quantify the degree of model error in precise quantitative terms, or to re-calculate the value of its technical provisions using a more accurate method in order to demonstrate that the difference between the result of the chosen method and the result of a more accurate method is immaterial. Instead, it would be sufficient for the undertaking to demonstrate that there is reasonable assurance that the model error implied by the application of the chosen method (and hence the difference between those two amounts) is immaterial.[42]

*Approach in cases where model error is expected to be material*

3.79 Where the intended use of a valuation technique is expected to lead to a material degree of model error, the undertaking should consider which alternative techniques would be available to him. Where practicable, another more appropriate valuation method should be applied.

3.80 In some circumstances, however, it may be unavoidable for the undertaking to apply a valuation method which leads to an increased level of estimation uncertainty in the valuation. This would be the case where the undertaking, to carry out the valuation, would need to make assumptions which are uncertain or conjectural and which cannot be validated. For example, this could be the case where there are deficiencies in the data[43], so that there is only insufficient pertinent past experience data available to derive or validate assumptions.

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41 However, this is not necessarily the case for the part of the model error which is related to the uncertainty of the parameters and assumptions used in the model (sometimes referred to as "parameter error"), which generally can be more easily assessed than "pure" model error (i.e. the risk that the model itself is deficient).

42 Cf. CEIOPS' Advice on Proportionality (annex), para. TS.II.A.36.

43 Cf. CEIOPS-DOC-37-09

3.81 Under these circumstances, it would be acceptable for the undertaking to determine the best estimate of the technical provision applying a technique which carries an increased level of estimation uncertainty or model error. The undertaking should document that this is the case and consider the implications of the increased level of uncertainty with regard to the reliability of the valuation and its overall solvency position.

3.82 In particular the undertaking should assess whether the increased level of estimation uncertainty is adequately addressed in the determination of the SCR and the setting of the risk margin in the technical provision.

3.83 Where the use of a valuation technique results in a material increase in the level of uncertainty associated with the best estimate liability, the insurer should include a degree of caution in the exercise of the judgements needed in setting the assumptions and parameters underlying the best estimate valuation. However, this exercise of caution should not lead to a deliberate overstatement of the best estimate provision. To avoid a double-counting of risks, the valuation of the best estimate should be free of bias and should not contain any additional margin of prudence.

#### 3.1.2.3. Step 3: Back testing

3.84 As part of the actuarial control cycle, it should be checked whether the best estimates calculated in past years turn out to be appropriate in subsequent years. Such back testing is considered to be part of the validation process (re)insurance undertakings are expected to carry out when calculating technical provisions.[44]

3.85 Where the back testing identifies systematic deviation between experience and the best estimate calculations, the first two steps of the proportionality process described above should be re-performed to check whether in regard to nature, scale and complexity it would still seem appropriate to use the chosen valuation method.

3.86 Over time an (re)insurance undertaking's business may change considerably, as a result of internal factors or events (such as a change in undertaking strategy) or due to external factors or events (such as a change in market conditions), so that the previous assessment may no longer fully capture the nature, scale and complexity of the risks. Hence such a check should also be carried out in case where there is a significant change to the undertaking’s risk profile.

3.87 If it is found that the previously chosen method is no longer appropriate, the undertaking should switch towards a more appropriate method which captures the risk profile of the portfolio in a better way.

[44] Cf. CEIOPS-CP39-09, http://www.ceiops.eu/content/view/14/18/.

## CEIOPS' Advice

### A.- Role of proportionality in the valuation of technical provisions

3.88 The principle of proportionality is intended to support the consistent application of the principles-based solvency requirements to all (re)insurance undertakings.

3.89 The undertaking is responsible to determine the technical provisions by using an appropriate method selecting from the continuum of methods available, taking into account nature, scale and complexity of the risks.

3.90 In this context, "risks" should include all risks which materially affect (directly or indirectly) the amount or timing of cash flows required to settle the insurance and reinsurance obligations arising from the insurance contracts in the portfolio to be valued.

3.91 The undertaking should be able to explain what methods are used and why the specific methods are selected.

### A.1.- Process of assessment of proportionality

3.92 In assessing whether a valuation method could be considered proportionate to the underlying risks, the (re)insurance undertaking should have regard to the following steps:

*Step 1: Assessment of nature, scale and complexity*

3.93 The undertaking should assess the nature, scale and complexity of the risks underlying the insurance obligations. This is intended to provide a basis for checking the appropriateness of specific valuation methods carried out in the subsequent step and shall serve as a guide to identify where simplified methods are likely to be appropriate.

*Assessment of nature and complexity:*

3.94 Nature and complexity of risks are closely related, and for the purposes of an assessment of proportionality could best be characterised together. Indeed, complexity could be seen as an integral part of the nature of risks, which is a broader concept.[45]

3.95 In mathematical terms, the nature of the risks underlying the insurance contracts could be described by the probability distribution of the future cash flows arising from the contracts. This encompasses the following characteristics:

- the degree of homogeneity of the risks;
- the variety of different sub-risks or risk components of which the risk is comprised;
- the way in which these sub-risks are interrelated with one another;

[45] I.e. whether or not a risk is complex can be seen as a property of the risk which is part of its nature.

- the level of certainty i.e. the extent to which future cash flows can be predicted;[46]
- the nature of the occurrence or crystallisation of the risk in terms of frequency and severity;
- the type of the development of claims payments over time;
- the extent of potential policyholder loss, especially in the tail of the claims distribution.

3.96 The first three bullet points in the previous paragraph are in particular related to the complexity of risks generated by the contracts, which in general terms can be described as the quality of being intricate (i.e. of being "entwined" in such a way that it is difficult to separate them) and compounded (i.e. comprising a number of different sub-risks or characteristics).

3.97 When assessing the nature and complexity of the insured risks, additional information in relation to the circumstances of the particular portfolio should be taken into account. This could include:

- the type of business from which the risks originate (e.g. direct business or reinsurance business);
- the degree of correlation between different risk types, especially in the tail of the risk distribution; and
- any risk mitigation instruments (such as reinsurance or derivatives) applied, and their impact on the underlying risk profile.

3.98 The undertaking should also seek to identify factors which would indicate the presence of more complex and/or less predictable risks. This would be the case, for example, where: [47]

- the cash-flows are highly path dependent; or
- there are significant non-linear inter-dependencies between several drivers of uncertainty; or
- the cash-flows are materially affected by the potential future management actions; or
- risks have a significant asymmetric impact on the value of the cash-flows, in particular if contracts include material embedded options and guarantees or if there are complex reinsurance contracts in place; or

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46 Note that this only refers to the randomness (volatility) of the future cash flows. Uncertainty which is related to the measurement of the risk (model error and parameter error) is not an intrinsic property of the risk, but dependent on the valuation methodology applied, and will be considered in the back testing of the applied simplified methods.

47 Cf. also para. 3.13 in CEIOPS-DOC-33-09.

48 We note that materiality is also important where the uncertainty (or degree of model error) in the measurement is concerned. This will be considered in the back testing.

49 Potentially comprising several homogeneous risk groups.

50 We note that such a level would only be relevant in the context of group solvency calculations carried out on the basis of the consolidated accounts. However, a group perspective would not be appropriate in the context of a solo assessment (cf. para. 3.56). As to the group specificities for the calculation of technical provisions, we refer to CEIOPS' advice on group solvency assessment.

51 Of course, this would not include the uncertainty arising from a misspecification of the model itself.

- the value of options and guarantees is affected by the policyholder behaviour assumed in the model; or
- the undertaking uses a complex risk mitigation instrument, for example a complex non-proportional reinsurance structure; or
- a variety of covers of different nature is bundled in the contracts; or
- the terms of the contracts are complex (e.g. in terms of franchises, participations, or the in- and exclusion criteria of cover).

3.99 The degree of complexity and/or uncertainty of the risks is associated with the level of calculation sophistication and / or level of expertise needed to carry out the valuation. In general, the more complex the risk, the more difficult it will be to model and predict the future cash flows required to settle the obligations arising from the insured portfolio.

3.100 Therefore, to appropriately analyse and quantify more complex and/or less predictable risks, more sophisticated and elaborated tools will generally be required as well as sufficient actuarial expertise.

*Assessment of scale:*

3.101 Assigning a scale introduces a distinction between "small" and "large" risks. The undertaking may use a measurement of scale to identify (sub-) risks where the use of simplified valuation methods would likely to be considered proportionate to the underlying risks, provided this is also commensurate with the nature and complexity of the risks.

3.102 A measurement of scale may also be used to introduce a distinction between material and non-material risks. Introducing materiality in this context would provide a threshold or cut-off point below which it would be regarded as justifiable to use simplifications for certain risks.[48]

3.103 To measure the scale of risks, further than introducing an absolute quantification of the risks the undertaking will also need to establish a benchmark or reference volume which leads to a relative rather than an absolute assessment. In this way, risks may be considered "small" or "large" relative to the established benchmark. Such a benchmark may be defined, for example, in terms of a volume measure such as premiums or technical provisions that serves as an approximation for the risk exposure.

3.104 To determine an appropriate benchmark for a relative measurement of scale, it is important to specify at which level the assessment is carried out: a risk which is small with regard to the business of the undertaking as a whole may still have a significant impact within a smaller segment, e.g. a certain line of business. For the calculation of technical provisions, Article 80 of the Level 1 text stipulates in this regard that the starting point for this valuation is defined by the level of homogeneous risk group (HRG). However, other levels are also relevant.

3.105 All in all, at least the following four different levels may usefully be distinguished in the context of a calculation of technical provisions:

- the individual homogeneous risk group (HRG);
- the individual line of business (LOB);[49]
- the business of the undertaking as a whole and
- the group to which the undertaking belongs.[50]

3.106 Following this principles-based framework, (re)insurance undertakings would be expected to use an interpretation of scale which is best suited to their specific circumstances and to the risk profile of their portfolio. Whatever interpretation of "scale" for risks or obligations is followed, this should lead to an objective and reliable assessment.

*Step 2: Assessment of proportionality of valuation method*

3.107 In this step the undertaking shall assess whether a specific valuation method can be regarded as proportionate to the nature, scale and complexity of the risks analysed in the first step.

3.108 Where simplified approaches are used to value technical provisions, this could introduce additional estimation uncertainty (or model error). The higher the estimation uncertainty, the more difficult it will be for the undertaking to rely on the estimation and on its suitability to achieve the objective of deriving a market-consistent valuation.

3.109 Therefore the undertaking shall assess the model error that results from the use of a given valuation method, having regard to the nature, scale and complexity of the underlying risks The valuation method should be regarded as proportionate if the model error is expected to be non-material.

3.110 For this purpose the undertaking should define a concept on materiality which should lay down the criteria on basis of which a decision on the materiality of a potential misstatement of technical provisions is made. This materiality concept and should be reflected in the undertaking's own risk and solvency assessment (ORSA).

3.111 When determining how to address materiality, the undertaking should have regard to the purpose of the work and its intended users. For a valuation of technical provisions – and more generally for a qualitative or quantitative assessment of risk for solvency purposes – this should include the supervisory authority which uses the information when performing the SRP.

3.112 An assessment of the model error may be carried out, by:

- Sensitivity analysis in the framework of the applied model: this means to vary the parameters and/or the data thereby observing the range where a best estimate might be located.
- Comparison with the results of other methods: applying different methods gives insight in potential model errors. These methods

would not necessarily need to be more complex.

- Descriptive statistics: in some cases the applied model allows the derivation of descriptive statistics on the estimation error contained in the estimation.[51] Such information may assist in quantitatively describing the sources of uncertainty.
- Back-testing: comparing the results of the estimation against experience may help to identify systemic deviations which are due to deficiencies in the modelling.

3.113 The undertaking should not be required to quantify the degree of model error in precise quantitative terms, or to re-calculate the value of its technical provisions using a more accurate method in order to demonstrate that the difference between the result of the chosen method and the result of a more accurate method is immaterial. Instead, it would be sufficient for the undertaking to demonstrate that there is reasonable assurance that the model error implied by the application of the chosen method (and hence the difference between those two amounts) is immaterial.

3.114 Where in the valuation process several valuation methods turn out to be proportionate, the undertaking would be expected to select and apply the method which is most appropriate in relation to the underlying risks..

3.115 Where the intended use of a valuation technique is expected to lead to a material degree of model error, the undertaking should consider which alternative techniques would be available to him. Where practicable, another more appropriate valuation method should be applied.

3.116 In some circumstances, it may be unavoidable for the undertaking to apply a valuation method which leads to an increased level of estimation uncertainty in the valuation. This could e.g. be the case where there is only insufficient pertinent past experience data available to derive or validate assumptions or in case of portfolios with high-severity-low-frequency claims.

3.117 In such cases, the undertaking should document that this is the case and consider the implications with regard to the reliability of the valuation and its overall solvency position. In particular the undertaking should assess whether the increased level of estimation uncertainty is adequately addressed in the determination of the SCR and the setting of the risk margin in the technical provision..

*Step 3: Back testing*

3.118 As part of the actuarial function, it should be checked periodically whether the best estimates calculated in past years turn out to be appropriate in subsequent years. Where the back testing identifies systematic deviation between experience and the best estimate calculations, the first two steps of the proportionality process described above should be re-performed to check whether in regard to nature, scale and complexity it would still seem appropriate to use

the chosen valuation method. If it is found that the previously chosen method is no longer appropriate, the undertaking should switch towards a more appropriate method.

3.119 Such a check should also be performed where the undertaking's risk profile has significantly changed.

3.120 The scope and the frequency of back testing should be proportionate to the materiality of assumptions and the size of the deviation.

## 3.2. Best estimate

### 3.2.1. General issues

3.121 This sub-section considers the use of simplified methods for the valuation of the best estimate element of technical provisions, in the context of a proportionality assessment as described in section 3.1.

3.122 At first, it generally considers the role of simplified methods in the valuation framework, in particular with regard to whether it would be appropriate to include a specification of simplified methods on Level 2. It then analysis the availability and applicability of simplified methods for the two specific components of the technical provisions: best estimates (life and non-life) and risk margin.

3.123 The term "simplified method" may be used to refer to a situation where a specific valuation technique has been simplified in line with the proportionality principle, or where a valuation method is considered to be simpler than a certain reference or benchmark method.

3.124 However, any distinction between "simplified" and "non-simplified methods would necessarily need some assessment and, hence, it is necessary to explore how to achieve a categorisation, as clearer as possible, of the range of available methods.

#### 3.2.1.1. Specification of simplified methods on Level 2

3.125 Article 86(h) of the Level 1 text states that:

> "*The Commission shall adopt implementing measures laying down […] where necessary, simplified methods and techniques to calculate technical provisions, in order to ensure the actuarial and statistical methodologies referred to in point (a) and (d) are proportionate to the nature, scale and complexity of the risks supported by insurance and reinsurance undertakings including captive insurance and reinsurance undertakings.… "*

3.126 It is therefore necessary to consider:

- the circumstances under which simplified methods would need to be specified under Level 2; and
- for which specific cases these circumstances would apply.

*Circumstances which would necessitate specification of simplified methods*

3.127 In light of this, it may be argued that it would be not necessary to include any detail on specific simplified methodologies for the valuation of technical provisions on Level 2. There are a number of further aspects which would support this view:

- It would generally not be possible to define any "default" or reference method for the valuation of technical provisions; instead, a continuum of methods would typically be available to the undertaking, differing in their degree of complexity and sophistication.[52]
- Actuarial methodologies and techniques for the valuation of technical provisions are subject of continuous scientific research and

[52] Cf. para. 3.13

development, so that it is likely that a description of specific simplified techniques and their application criteria would need to be regularly reviewed and updated. The legal framework provided by Level 2 may not be sufficiently flexible to achieve this aim;

- The principle of proportionality provides an adequate framework to ensure that undertakings apply appropriate methodologies for the valuation of technical provisions, including the use of simplified techniques. The expectations and requirements on the undertaking's proportionality assessment[53] are principles-based rather than rules-based and would not need to be supplemented by providing simplified methods on Level 2.

3.128 On the other hand, not including to some extent a specification of simplified valuation techniques on Level 2 may erode the intention of the Level 1 text to achieve an increased harmonisation of quantitative and qualitative supervisory methods, including technical provisions.

3.129 In this regard, recital 53 of the Level 1 text states that

*(53) […] The principles and actuarial and statistical methodologies underlying the calculation of those technical provisions should be harmonised throughout the Community in order to achieve better comparability and transparency.*

3.130 In the same vein, recitals 15 and 58 stipulate that

*(15) […] Harmonisation should be increased by providing specific rules for the valuation of assets and liabilities, including technical provisions.*

*(58) […] The use of effective and harmonised actuarial methodologies should be required.*

3.131 A need to achieve harmonisation would be particularly relevant in areas where the use of simplified methods in the valuation is widespread, and where a common understanding of an actuarial "best practice" is still evolving.

3.132 Not including any detail on specific simplified valuation methods in Level 2 may also raise concerns with respect to the needs of small and medium-sized (re)insurance undertakings.[54] Whereas it could be argued that these needs are sufficiently addressed in a proper application of the principle of proportionality, an inclusion of specific simplified valuation methods in Level 2 may be helpful for small and medium-sized undertakings in

- making available valuation techniques which are tailored to the specificities of their business; and
- providing legal certainty on the appropriateness of such techniques under the Solvency II framework.

3.133 This consideration is also reflected in recital 59 of the Level 1 text which states that

[53] See section 3.1 for details

[54] Note that the Level 1 text emphasises that the new solvency regime should not be too burdensome for small and medium-sized insurance undertakings, cf. Recital 14b of the Level 1 text.

*"In order to reflect the specific situation of small and medium-sized undertakings, simplified approaches to the calculation of technical provisions should be provided for."*

3.134 In light of the considerations above, an inclusion of specific simplified valuation methodologies in Level 2 should only be foreseen for components of the valuation where:

- the use of simplified methods is expected to be widespread, and a common understanding of an actuarial "best practice" is still evolving; or
- there is a particular need for small and medium-sized undertakings for such an inclusion.

3.135 Where such simplified methods would be specified on Level 2, they should be available for all undertakings and be subject to appropriate application criteria. Such criteria should

- specify the circumstances and conditions under which they are intended to be used (in terms of the risk profile of the portfolio to be valued); and
- have due regard to the model error inherent in an application of the method.

#### 3.2.1.2. Components of the valuation where such circumstances would apply

3.136 Considering the conditions mentioned in para. 3.134, we note that in the QIS4 exercise a number of simplifications and proxies were included in the specifications, which covered the valuation of the best estimate technical provisions, including the valuation of reinsurance recoverables, and also the calculation of the risk margin.

3.137 In QIS4, a widespread use of simplified methods for the valuation of technical provisions was observed for the valuation of reinsurance recoverables and the risk margin.

3.138 It is expected that in these areas there is also a need for small and medium-sized undertakings to have simplified methods available. Hence these valuation components are analysed in more detail, below.

#### 3.2.1.3. Thresholds determining the allowance of simplified methods

3.139 This sub-section discusses the extent to which it would be appropriate to introduce external thresholds guiding the use of simplified methods for the valuation of technical provisions. The idea of such thresholds would be to provide a cut-off point below which it would be regarded as justifiable to use specific (simplified) valuation techniques (or a class of such techniques).

3.140 Such external thresholds may be specified:[55]

- In implementing measures on Level 2;

[55] Such external thresholds should be distinguished from internal thresholds or limits which the insurer may establish as part of its risk management system, consistent with its policy on capital and risk. For example, the insurer may internally introduce a threshold to assess whether certain sub-risks are considered material or not in order to decide whether the use of a simplified valuation technique would be appropriate.

- As part of supervisory guidance on Level 3; or
- As part of supplementary technical guidance or standards.

3.141 We note that where external thresholds are introduced in Level 2, these would be legally binding, which would not be the case for the other levels. This may lead to different conclusions on the feasibility and appropriateness of an introduction of thresholds on different levels. In the following, the analysis is focused on a potential inclusion of thresholds in Level 2 implementing measures.

#### 3.2.1.4. Types of thresholds to be considered

3.142 Where external thresholds are considered in the context of a valuation of technical provisions, these would typically apply to either

- the scale of the underlying risks;[56] or
- the degree of model error inherent in valuation methods.[57]

3.143 Usually, they would be defined as materiality thresholds, i.e. where they are not exceeded it would be considered that the scale of the risk (or, respectively, the degree of model error in the calculation) is immaterial, so that an application of certain simplified valuation techniques would seem appropriate.

3.144 It is also useful to distinguish between

- thresholds which are proposed to apply to individual valuation techniques; and
- thresholds which apply more broadly to all methods or to a specific class of methods.

3.145 The following figure illustrates these different types of thresholds:

*Table 1: Types of thresholds for the valuation of technical provisions*

| *Thresholds* | *Relating to scale of risk* | *Relating to model error* |
|---|---|---|
| *Applying broadly* | *Type 1* | *Type 2* |
| *Applying to individual methods* | *Type 3* | *Type 4* |

3.146 Most often a threshold would be expressed quantitatively, either in relative or in absolute terms. However, it would also be possible to specify a threshold in qualitative terms.

3.147 An example of a quantitative "Type 1" threshold (expressed in relative as well as absolute terms) is given by the (indicative) materiality threshold specified by CEIOPS for the use of simplified methods for the valuation of technical provisions in QIS4.[58] The intention of this threshold was to indicate when the liability that is valued would not be material in

[56] Cf. to the description of the scale of risks in sub-section 3.1.2.1.
[57] Cf. to the discussion of model risk contained in sub-section 3.1.2.2.
[58] Cf. QIS4 Technical Specifications http://www.ceiops.eu/media/docman/Technical%20Specifications%20QIS4.doc

absolute terms or relative to the overall size of the total best estimate. It was

- to be applied broadly to the set of all simplified methods; and
- based on simple volume measures (size of the best estimate of technical provisions) related to the scale of the underlying risks.

3.148 An example of a (qualitative) "Type 2" threshold is given by Step 2 of the proportionality assessment process outlined in section 3.1. Here, it was set out that a valuation technique (simplified or not) would be considered proportionate if it could be expected that the degree of model error inherent in an application of the method would not be material. In this context, "materiality" was expressed in qualitative terms, considering the degree to which the decision-making or judgment of the intended user of the information could be influenced.[59] This establishes a general materiality threshold which

- applies to all valuation methods which the (re)insurance undertaking may consider for calculating its technical provisions; and
- is directly related to the degree of model error inherent in the application of the method.

3.149 Whereas "Type 1" and "Type 2" thresholds would apply broadly to all methods or to a specific class of methods, "Type 3" and "Type 4" thresholds would be specific for individual simplified methods. This means that, where specific simplified methods would be introduced on Level 2, this could be supplemented by including specific "Type 3" or "Type 4" thresholds in their application criteria with the intention to limit or restrict the use of the method depending on the scale of the risk (in case of "Type 3" thresholds) or on the degree of model error expected from an application of the method (in case of "Type 4" methods).

3.150 To illustrate this by way of an example, consider the "Discounting Proxy" technique tested in QIS4, which provided a means to discount technical provisions by applying a pre-specified discounting factor.[60] Consider further that such a technique was specified on Level 2, with some general application criteria setting out certain minimum conditions on the risk profile of the portfolio to which the method could be applied. In this context, it may be decided to introduce a threshold specific to the "Discounting Proxy" technique which would e.g. specify that the technique may only be used to value up to 50% of the best estimate of the portfolio, where the percentage of "50%" would have been derived by assessing the degree of model error expected from an application of the techniques.

3.151 In the following, the appropriateness of introducing thresholds – in relation to the different types as described above – is considered further.

#### 3.2.1.5. Thresholds relating to the scale of the risks

3.152 As was mentioned above, it may be contemplated to implement external thresholds on basis of an assessment of the scale of risks, so that an (re)insurance undertaking would be allowed to use simplified methods in

[59] Cf. para. 3.70
[60] Cf. QIS4 Technical Specifications

case the threshold is not exceeded. However, such an approach could lead to a number of problems:

- relying on a threshold based on the scale of risks may not be sufficient. It is important to also consider the nature and complexity of the risks to which an undertaking is exposed;
- ultimately, it is not the scale of risk which is the deciding factor in a proportionality assessment, but whether the chosen method is proportionate to the risks and whether the degree of model error in the calculation is material. This aspect may not be sufficiently addressed in this type of threshold.

3.153 Moreover, where thresholds based on the scale of the risk are introduced, they would often rely on simple volume measures (such as the amount of premiums or technical provisions) related to the size of the undertaking. This may be problematic since:

- Size in itself may not be an adequate approximation to the risk to which an undertaking is exposed. In general, neither the premiums nor the technical provisions can be considered as a sufficient benchmark to specify a threshold below which the undertaking would no longer be vulnerable to the risk.
- undertakings within the scope of the Solvency II Level 1 text should not be classified differently on the basis of size. Indeed, policyholders should not expect a lower degree of protection simply because their cover is provided by a smaller undertaking.

3.154 Therefore, it would not seem appropriate to introduce thresholds based on the scale of the risks (e.g. with respect to the size of the undertaking or the size of the risks) to determine the allowance for a simplified approach for the calculation of technical provisions within implementing measures on Level 2.

#### 3.2.1.6. Thresholds relating to the degree of model error

3.155 When considering model error in context of Step 2 of the proportionality assessment process, it was observed that in practice an assessment of model error may be rather demanding on undertakings, leading to additional implementation costs.

3.156 In view of this, it could be contemplated to quantify the model error of simplified valuation methods centrally (by CEIOPS) before Solvency II is introduced. Following such an approach, specific thresholds (externally specified on Level 2 or 3) for the use of individual simplified valuation methods could be set which would reflect the assessed degree of model error.[61] As long as these thresholds would not be exceeded, it would be considered that the degree of model error resulting from an application of the method would not be material, and hence it would not be necessary for the undertaking to calculate or quantify model errors.

3.157 However, in view of the ultimate aim of Solvency II to improve risk assessment and risk management processes across (re)insurance undertakings, it is believed that a holistic approach – which integrates an assessment of model error into the valuation process as part of actuarial

[61] These would be Type 4 thresholds in the classification introduced above.

best practice - would be more suitable than an approach which stresses a need to avoid an assessment and potential quantification of model error.

3.158 Moreover, it seems likely that an approach to introduce thresholds as described would be difficult to implement in practice:

- The degree of model error incurred by an application of a method does not only depend on the method, but rather is determined by the degree to which the method is able to capture the undertaking's individual risk profile. However, since the same threshold would need to be specified for all undertakings, the assessment of the model error of the valuation method to which the threshold is attached would need to make some generalising assumptions on the characteristics of the risk profiles of the undertakings which would use the threshold. It seems likely that this would make the calibration of the calculation of such thresholds very demanding. It may also lead to a situation where for some undertakings the (central) assessment of the model error implicit in the determination of the threshold would not appropriately reflect the actual model risk which the undertaking incurs in applying the method.;
- it would seem difficult to integrate the calculation of such thresholds into the actuarial reserving process in a reasonable way; and
- under this approach, thresholds would be established for a selection of simplified methods which would be externally specified (on Level 2 or Level 3). However, these methods would only represent part of the spectrum of (simplified) methods which would be available for the undertaking. For these other (possibly similar) methods, the thresholds would not apply, and the undertaking would assess their appropriateness on basis of the proportionality assessment process outlined in section 3.1. This may create inconsistencies, where for similar methods this process would lead to a different assessment of the degree of the model error than is indicted by an application of the threshold.

3.159 Considering this, where external thresholds applicable to specific (simplified) valuation methods and relating to the degree of model error are introduced, care should be taken to ensure that:

- this is consistent with the principles-based proportionality assessment process outlined in section 3.1 of this paper;
- in implementing the threshold it can be ensured that the assessment of model error implicit in the calibration of the threshold adequately reflects the actual degree of model error incurred when the method is applied by individual undertakings;
- this should not lead to the impression that it would no longer be necessary for the undertaking to undertake an own assessment of the appropriateness of the method, including an assessment of the degree of model error.

3.160 Thresholds generally act as a boundary for both allowance and rejection of a simplified method. This means that, where the threshold is exceeded it is likely that the method would not be appropriate, whereas

if the threshold is not exceeded the method is likely to be acceptable. However, it is important to note that an application of a threshold cannot substitute an assessment of the individual risk profile of the portfolio to be valued, and an assessment of the appropriateness of the method against this risk profile. Hence where thresholds are applied there should be some allowance for the specificities of each insurer.

3.161 In line with Article 86 (h) CEIOPS is required to provide, where necessary, simplified methods and techniques to calculate technical provisions. CEIOPS provides in the following subsections a list of methods and techniques for the estimation of:

- Life, non life and health best estimates
- Risk margin
- Reinsurance recoverables and adjustments due to counterparty defaults
- Quarterly calculations

These methods and techniques should not be seen as a prescriptive list of methods, but as an open list.

3.162 Furthermore, CEIOPS advises not to introduce an exhaustive list of methods and techniques as level 2 implementing measures for the estimation of the best estimate, and would prefer to keep such methods and techniques as level 3 guidance. The rationale is that a principles based approach is more appropriate for level 2 advice, particularly since the methods illustrated may not be appropriate for all risk profiles. Furthermore, in line with stakeholder comments, methods continue to develop and prescription could hinder innovation in this area.

3.163 However, CEIOPS recognizes that the risk margin is a specific area where additional considerations should be included in the level 2 text, due to the complexity and uncertainty around the calculation methodology. Accordingly a hierarchy of simplifications is described in section 3.3 below – along with some illustrative examples. Moreover, CEIOPS would support flexibility for undertakings to use other simplified methods or techniques, provided they can demonstrate that these are appropriate.

3.164 The provisions of all the following subsections should be read in conjunction with the previous subsections of this advice, in particular 3.1.1 on the role of proportionality in the valuation of technical provisions.

## 3.2.2. Life insurance specific

3.165 This subsection discusses simplified methods and techniques that could be used in respect of the calculation of best estimates of life insurance business, and also sets out the circumstances in which use of such simplifications could be considered to be appropriate.

### 3.2.2.1. Biometric risk factors

3.166 Biometric risk factors are underwriting risks covering any of the risks related to human life conditions, e.g.:

- mortality/longevity rate,
- morbidity rate,
- disability rate.

3.167 When modelling biometric risk factors, undertakings should ensure that the best estimate assumptions for biometric risk factors which could be based on own or market experience in comparable situations or on combination of both take into account:

- the current observed experience which reflects the best estimate of experience on the valuation date; and
- the expected change in this experience in the future which reflects the best estimate of the future trend.

3.168 By modelling biometrical risk factors in stochastic manner the uncertainty related to the future development can be more appropriately captured and quantified given that appropriate market statistics on the biometric variable being projected is available, current and of good quality. For large portfolios it could be assumed that law of large numbers causes the variation to be rather narrowly spread around the mean, which could indicate that a deterministic approach would be acceptable, except possibly for the treand forecast for which the error is not diversifiable within a line of business. Stochastic models are typically based on statistical models such as time series and multivariate analysis and generalised linear models, or modelling frameworks.

3.169 The list of possible simplifications for obtaining biometric risk factors which does not include all simplifications allowed and which could be used in combination includes:

- neglect the expected future changes in biometrical risk factors[62];
- assume that biometric risk factors are independency from any other variable (i.e. mortality is independent of future changes of morbidity status of policyholder);
- use cohort or period data to analyze biometric risk factors;
- apply current tables in use adjusted by suitable multiplier function. The construction of reliable mortality, morbidity/ disability tables and the modelling of trends could be based on current (industry standard or other) tables in use adjusted by suitable multiplier function. Industry-wide and other public data and forecasts should provide useful benchmarks for suitable multiplier functions.

#### 3.2.2.2. Surrender option

3.170 The surrender option gives the policyholders the right to terminate the contracts before maturity and to receive the surrender value. The surrender value is commonly pre-determined according to some

[62] For example, this simplification could be applied to short term contracts.

principles. In following paragraphs only surrender option where the amount paid on surrender is guaranted is considered.

3.171 The surrender option is very important element for undertakings and should be taken into account when valuing the technical provisions. It could have significant financial effect for instance on uncharged expenses and uncharged costs for options and guarantees.

3.172 Literature usually distinguishes two broad approaches for modelling the surrender options that are usually assessed from an undertaking perspective on homogeneous groups rather than from a single policyholder's perspective. The first approach tries to encompass in the modelling rational behaviour of policyholders whereas the second one tries to encompass more irrational behaviour of the policyholders.

3.173 The problem of determining the price of the surrender option in the case of rational behaviour of policyholders could be described as an optimal stopping time with respect to the filtration generated by the prices of the financial assets. The price of surrender option is theoretically modelled using the theory of stochastic processes and their optimal stopping time. Thus it is optimal for the policyholder to surrender when realistic value of the contract is less than or equal to the amount received by immediately surrendering the contract. In practice the surrender option are commonly priced recursively using numerical methods such as binomial trees.

3.174 The argument in favour for irrational behaviour of policyholders is that approach based on rational behaviour of policyholders in most circumstances does not realistically model a policyholder's surrender behaviour and that the policyholder's information is asymmetric. It is rather common practice that the information about realistic value of insurance contract that needs to be compared with surrender value is not made in public and kept as internal information by the undertaking. The value of surrender option from the policyholder's perspective depends on own information and on own risk aversion and therefore is a subjective value different from policyholder to policyholder and is mostly unknown for the undertaking. The problem of determining the price of the surrender option is not defined as stopping time model and thus more suitable for modelling realistic surrender behaviour. Thus assumptions made on random time of surrender are rather general and allows many ways to construct it in practice. The approaches could consist of multifactor functions that vary with realistic value, surrender value, age, policy duration, time to maturity, interest rate, market volatilities, and other economic factors of importance. The dependence on the financial market would however result in rather comprehensive modelling more suitable for a stochastic simulation approach rather than a simple closed-form solution.

3.175 Besides the rational or irrational behaviour of policyholders discussed in previous paragraphs, the experience of surrenders tend to suggests that rational reasons for movements in surrender rates are:

- quality of sales advice and whether any misselling may occur leading to earlier surrenders in excess of later surrenders;

- the economic cycle affecting policyholders' ability to pay further premiums;
- the personal circumstances of policyholders and whether they can afford premiums

3.176 A non-exhaustive list of possible simplifications for modelling surrender rates, which could be used in combination includes:

- assume that surrenders occur independently of financial/ economic factors,
- assume that surrenders occur independently of biometric factors,
- assume independency in relation to management actions,
- assume that surrenders occur independently of the undertaking specific information,
- use a table of surrender rates that are differentiated by factors such as age, time since policy inception, product type,...,
- model the surrender as a harzard process either with a non-constant or constant intensity.

3.177 Some of these simplifications convert the hazard process in deterministic function which implies independency between the surrender time and the evaluation of economic factors, which are obvious not a realistic assumptions since policyholder behaviour is not static and is expected to vary as a result of changing economic environment.

3.178 Other possible surrender models[63] where the surrender rate $SR_t$ for a policy at time t also depend on economic variables include the following:

- Lemay's model $SR_t = a \cdot \alpha + b \cdot \frac{FV_t}{GV_t}$
- Arctangent model $SR_t = a + b \cdot \arctan(m\Delta_t - n)$
- Parabolic model $SR_t = a + b \cdot sign(\Delta_t) \cdot \Delta_t^2$
- Modified parabolic model $SR_t = a + b \cdot sign(\Delta_t) \cdot \Delta_t \cdot k + c^{(CR_{t-1} - CR_t)}$
- Exponential model $SR_t = a + b \cdot e^{m \cdot \frac{CR_t}{MR_t}}$
- New York State Law 126 $SR_t = a + b \cdot sign(\Delta_t) \cdot \Delta_t \cdot k - c \cdot (\frac{FV_t - CSV_t}{FV_t})$

where $a, b, c, m, n, j, k$ are coefficients, $\alpha$ denotes underlying (possible time dependent) base laps rate, $FV$ denotes the fund/account value of the policy, $GV$ denotes the guaranteed value of the policy, $\Delta$ equals reference market rate less crediting rate less surrender charge, $CR$ denotes the credit rate, $MR$ denotes the reference market rate, $CSV$ denotes the cash surrender value and

$sign(x) = 1$ if $x \geq 0$ and

[63] Models giving surrender rates above 100 % are not relevant.

$sign(x) = -1$ if $x < 0$.

3.179 Even after a model has been selected there is a great challenge to estimate the parameters. The policyholder behaviour may change over time and the current observed surrender pattern could be a poor prediction of future behaviour.

3.180 Undertakings could also assume that mortality is independent of the financial market. A questionable but practical simplification is to assume stochastic independency between surrender rate and financial markets and between surrender rate and mortality rate.

3.181 For with profit contracts the surrender option and the minimum guarantees are clearly dependent. Furthermore, management actions will also have a significant impact on the surrender options that might not easily be captured in a closed formula.

#### 3.2.2.3. Financial options and guarantees

3.182 Life insurance contracts usually have besides classical pure insurance elements also implicitly or explicitly built in different kinds of financial options and guarantees (see CEIOPS' advice DOC-21-09 and DOC-33-09 for a wider reference to these guarantees).

3.183 The benefits of with-profit contracts usually consist of a guaranteed benefit and of variable extra benefit that is based on the profits the undertaking has been able to generate and that is often added to the guaranteed benefits as reversionary extra benefit or a variable terminal extra benefit that is not guaranteed until maturity.

3.184 As discussed in CEIOPS-DOC-33-09, financial options and guarantees can generally be valued accordingly to two main techniques:

- use observed market price if the risk factor is hedgeable on deep, liquid and transparent market
- use mark-to-model if the risk factor is non-hedgeable i.e.:
- stochastic simulation technique,
- deterministic approach,
    - closed form estimate derived from an arbitrage-free model with parameters calibrated to market prices of similar options (e.g. Black-Scholes formula).

3.185 Valuing financial options and guarantees with stochastic simulation techniques (Monte Carlo or appropriate numerical partial differential equation approaches) considers a range of future stochastically varying economic conditions (e.g. interest rates) calibrated to a market consistent assets model. The connection to market consistent prices and arbitrage-free valuation is achieved by ensuring that the asset model reproduces observed market prices for some representative assets.

3.186 Deterministic approach made series of deterministic projections of the values of the underlying assets. Deterministic projection corresponds to a possible economic scenario together with the associated probability of occurrence. The cost of the financial options and guarantees equal to the

average costs generated with the probability weighted deterministic projection of the assets. The connection to market consistent prices and arbitrage-free valuation is achieved by ensuring that the probability weighted deterministic projections reproduce observed market prices for some representative assets.

3.187 In most of insurance contracts the complexity of insurance options and guarantees and other features such as management actions commonly creates interdependent risk factors. Modeling risk factors when independencies are observed and estimated leads to prefer appropriate methods based on stochastic simulations, as they can deal appropriately with very complicated liability structure such as for instance path-dependent behaviour.

3.188 Therefore for less advanced undertakings closed form approach are generally more practical. However, they are only suitable in special circumstances due to the various simplifying assumptions such as the existence of complete financial markets, the stochastic dynamics of the underlying assets follow a geometric Brownian motion, use of dynamic hedging, etc. which may distort the results.

3.189 The possible simplification for financial options and guarantees is to approximate them by assuming a Black-Scholes type of environment, although its scope should be carefully limited to those cases where the underlying assumptions of such model are tested. Additionally, even stochastic modelling may require some simplifications when facing extremely complex features. This latter may be developed as part of level 3 guidance.

#### 3.2.2.4. Investment guarantees

3.190 Some unit linked products guarantee a minimum benefit at maturity in absolute term or as an annual constant guaranteed rate of return at the issue of the contract. At maturity policyholder will receive an amount corresponding to the index but not less than the guaranteed amount.

3.191 The random payout at maturity $\tilde{V}(T)$ could be given by the formula

$$\tilde{V}(T) = \max\left\{\tilde{S}(T), \tilde{G}(T)\right\} = \begin{Bmatrix} G(T) + \max\left\{\tilde{S}(T) - G(T); 0\right\}; (Calloption) \\ \tilde{S}(T) + \max\left\{G(T) - \tilde{S}(T); 0\right\}; (Putoption) \end{Bmatrix}$$

where $\tilde{S}(T)$ is the random account value at time $T$ and $G(T)$ the guaranteed payment at maturity.

3.192 The time value of investment guarantees $IG$ assuming put-call parity for European options (assuming thus implicitly Black-Scholes framework), using risk free discount rate and taking the expectation of the random payout at maturity with respect to the risk-neutral measure can be written as:

$$IG = \begin{cases} Guarantee + IntrinsicValueOfExtraBenefits + OptionTimeValue \\ UnderlyingAsset + IntrinsicValueOfGuarantee + OptionTimeValue \end{cases} = \begin{cases} Call\_option \\ Put\_option \end{cases}$$

3.193 The time value of the investment guarantee shows the expected amount that should be held in addition to the underlying assets to be able to deliver the benefits due to the investment guarantee. In the call option approach the $IntrinsicValueOfExtraBenefits$ corresponds to the amount the call option is in-the-money if it would be exercised immediately and the $OptionTimeValue$ captures the potential to receive further extra benefits in the future due to the random fluctuations of the underlying assets. In the put option approach the $IntrinsicValueOfGuarantee$ corresponds to the amount the guarantee is in-the-money if it would be exercised immediately and the $OptionTimeValue$ captures the potential for the cost to change in value (guarantee to bite further) in the future, as the guarantee move (related to the variability of the underlying assets) into or out-of-the-money.

3.194 Introducing management actions and discretion into the valuation complicate valuation considerable. In practice past investment returns, decisions and especially the solvency position of the undertaking will usually have a significant impact on the management actions and decisions and create complex path-dependent processes not suitable for closed-form modelling.

3.195 The non-exhaustive list of possible simplifications for calculating the values of investment guarantees includes:

- assume non-path dependency in relation to management actions, regular premiums, cost deductions (e.g., management charges,...),
- use representative deterministic assumptions of the possible outcomes for determining the intrinsic values of extra benefits,
- assume deterministic scenarios for future premiums (when applicable), mortality rates, expenses, surrender rates, ...,
- apply formulaic simplified approach for the time values if they are not considered to be material.

#### 3.2.2.5. Other options and guarantees

3.196 Life insurance contracts may include different types of options and guarantees. Therefore it is rather impossible to give detailed valuation approaches that would be suitable for all possible options and guarantees.

3.197 With regard to principle of proportionality as an interim approach one could ignore those options and guarantees which are not material (e.g., it could be assumed that options with low probability of being exercise – heavily out of the money - and with low impact if exercised do not exist at all).

3.198 However some of them could be valued with similar techniques as those for the surrender option and some of them can be valued with similar techniques as those for the investment guarantee.

3.199 Where the surrender options valuation approach or similar techniques as those for the investment guarantee cannot be sensibly applied for the valuation of particular type of option or guarantee a last resort for those would be a subjective ad hoc valuation.

3.200 Ad hoc valuation should consist of following steps:

i. Analyse the characteristics of the option or the guarantee and how it would probable effect the cash-flows.

ii. Analyse the amount the option or guarantee is expected to be currently in-the-money.

iii. Determine how much the cost of the option or the guarantees is expected to vary as the time passes.

iv. Estimate the probability that the cost of the option or the guarantee would become more costly/less costly in the future.

3.201 Ad hoc valuation would then be crudely approximated the total cost of the option or guarantee as a subjective expected intrinsic value increased with a subjective expectation of future variation of cost, which could be estimated as the product of the probability for the option or guarantee to become more valuable in the future and the expected cost for that event.

3.202 The possible simplification for other options and guarantees are:

- ignore options and guarantees which are not material,
- group for instance guaranteed expense charge and/or guaranteed mortality charge with investment guarantee and approximate them as one single investment guarantee,
- use the process outlined in the previous paragraph in the absence of other valuation approaches if appropriate.

### 3.2.2.6. Distribution of future discretionary benefits

3.203 The management discretion and the wording of insurance contracts have a large influence in the valuation of technical provisions for with profit business. An accurate assessment and a detailed documentation of the mechanism for distribution of extra benefits form the cornerstones of the valuations of extra benefits. The mechanism for distribution of extra benefits is also strongly related to the financial position of the undertaking, which is often set as a primary restriction for distribution of extra benefits.

3.204 As for any other assumption a comprehensive analysis of past experience, practice and crediting mechanism is prerequisite for an appropriate valuation of technical provisions. However, the crediting mechanism is not expected to be static and even if it should be sufficiently stable over time it may be subject to changes.

3.205 Possible simplification for determining the future bonuses may include where appropriate:

- assume that economic conditions will follow a certain pattern, not necessarily stochastic, appropriately assessed
- assume that the business mix of undertaking's portfolio will follow a certain pattern, not necessarily stochastic, appropriately assessed

3.206 The undertakings could use all or some of the simplifications proposed in previous paragraph to determine amounts of future discretionary bonuses or approximate the amount of available extra benefits for

distribution to policyholders as the difference or appropriate percentage of the difference of the value of the assets currently held to back insurance liabilities of these contracts and the technical provisions for these contract without taking into account future discretionary bonuses.

3.207 The possible simplification for distribution of extra benefits to particular line of business (to each policy) is to assume a constant distribution rate of extra benefits.

#### 3.2.2.7. Expenses and other charges

#### A) Expenses

3.208 In accordance with Article 77 of Level 1 text insurance and reinsurance undertakings shall take into account among others all expenses that will be incurred in servicing insurance and reinsurance obligations when calculating technical provisions.

3.209 Under a stochastic simulation approach the expenses to be incurred should explicitly be included in the simulation and the future expenses inflation should be consistent with what is assumed in the interest rate assumptions and other relevant factors influencing the expenses. In many cases, both the future expenses and the expense loadings may be sensitive to changes in inflation. However, one should not assume them to be equal each other unless there is a proper evidence of such matching. The reference for expense inflation should be built up from the published prediction of an appropriate inflation-index.

3.210 The estimation of the best estimate assumptions for expenses should be based on the analysis of the undertaking's own experience. The aim of the analysis is to obtain an understanding of current and historical expenses that in addition to absolute amounts also includes an analysis of for instance where expenses occur, factors that influence the expenses and how the expenses are related to sizes and natures of portfolios.

3.211 Since not all of the expenses that are charged from the premiums or policyholder's fund are relevant for the valuation of the expense liability considerations has to be given to which expenses should be excluded. Typically excluded are marketing and acquisition expenses, product development expenses, parts of administration expenses, etc. It is also of special importance to identify the expenses that are sensitive to inflation (e.g. policy maintenance expenses).

3.212 An expense analysis is commonly based on a single financial year. In order to appropriate take into account trends and to be able to ensure the recent changes and trends in expense levels are reflected appropriately, several financial years should be included in the analysis.

3.213 The approach to value the expense liability relies on the existence of the model that projects the expenses into the future consistently with other cash-flows. This may require rather sophisticated modelling that might not be justified for all undertakings.

3.214 The possible simplification for expenses is to use an assumption built on simple models using information from current and past expense loadings to project future expense loadings, including inflation.

**B) Other charges**

3.215 For life insurance contracts with embedded options it is rather common that for the cost of the embedded option only a minor charge is made up front and that the remainder is due in an extended period of time. This does not necessarily have to be the total time until maturity and is in general not necessary fixed or known exactly in advance.

3.216 Charges from embedded options should be taken into account in the best estimate valuation of technical provisions and they should be kept separately from expense loadings. For example a surrender charge could possibly be seen as a charge to offset the uncollected charges in average, but could also be seen as a way to force the policyholder to continue the contract and hence it would not directly be related to the cost of embedded options.

3.217 Some charging structures for embedded options are disclosed in the valuation basis for a product, whereas some charging structures are disclosed in an undertaking's principles and practices to run the business.

3.218 If the charges can be explicitly valued and taken into account this should so be done in the valuation of the technical provisions.

3.219 The possible simplification for other charges is to assume that:

- other charges are a constant share of extra benefits or
- a constant charge (in relative terms) from the policy fund.

### 3.2.2.8. Other issues

3.220 Having in mind the wide range of assumptions and features taken into account to calculate life insurance best estimates, there are other areas not mentioned previously, where it might be possible to find methods meeting the requirements set out in this advice to apply simplifications.

3.221 As an example, other possible simplification is to assume that:

- the projection period is one year and that
- cash-flows to the policyholders occur either at the end of the year or in the middle of the year.

3.222 Another possible simplification for the payments of the premiums which also include lapses and premium waiver (e.g. premiums waiver in case of disability of the insured person) is to assume that future premiums are paid independently of the financial markets and undertakings specific information. If lapses and premium waiver could not be treated as independent of financial markets or independent of undertaking specific paramterers than lapses should be valued with similar technices as those for surrender option or investment guarantees.

3.223 As a further example, possible simplifications in relation to fund/account value projections (which is important for valuing financial options and guarantees) are to:

- group assets with similar features/use representative assets or indexes;

- assume independency between assets, for instance, between equity rate of return and interest rate.

## 3.2.3. Non-life insurance specific

### 3.2.3.1. Outstanding reported claim provision. First simplification

3.224 Description. This simplification applies to the calculation of the best estimate of reported claims by means of consider the number of claims reported and the average cost thereof. Therefore is a simplification applicable when it does not deliver material model error in the estimate of frequency, severity and its combination. This simplification can be used to calculate outstanding claims provision and provision for incurred but not reported claims as a whole, adding to Ni the IBNR claims calculated as Nt in 3.233.

3.225 Calculation. The calculation is rather straightforward:

$$\sum_{i}^{n} (Ni * Ai) - Pi$$

where:

Ni= number of claims reported, incurred in year i

Ai= average cost of claims closed in year i

Pi= payments for claims incurred in year i

Ni and Pi are known, while Ai is determined using the average cost of claims closed in the year i, independently of the accident year, multiplying that amount by a factor to take into account future inflation and discounting. See in annex A an explanatory example.

Undertakings should complete this reserve with an incurred but not reported provision (IBNR) and an ULAE provision.

3.226 Criteria for application. Additional to the general requirements set out in this advice, the above method is an allowable simplification when the size of claims incurred in a year has a little variance, or the number of claims incurred in a year is big enough to allow the average cost to be representative.

CEIOPS notes that these two conditions are unlikely to exist in case of claims that have a medium or long term of settlement since the claim is reported.

It should be noted that this method described does not seem appropriate in situations where only few development years or occurrence years respectively are available. In these cases it is likely that the claims which are still open are the more complex ones with higher average of expected ultimate loss. Especially for reinsurance business, this simplification is not applicable, as the necessary data are not available.

### 3.2.3.2. Outstanding reported claim provision. Second simplification

3.227 CEIOPS' advice on data quality standards and approximations points out that 'in circumstances where (e.g. due to the nature or size of the portfolio) a lack of data for the valuation of technical provisions is unavoidable for the undertaking, insurers may have to use "*appropriate approximations, including case by case approaches*" (Article 81). In such cases, further judgmental adjustments or assumptions to the data may often need to be applied in order to allow the valuation to be performed using such approximations in line with the principle of proportionality'.

3.228 Description. This method consists in the simple sum of estimates of each claim reported at the date of reference of the valuation. The allowance of a simplified method based on a *'case-by-case approach'* should be assessed carefully according the features of the claims portfolio and the undertaking internal structure and capabilities.

3.229 Scope. Further the general requirements set out in this advice, the undertaking should develop written documentation on:

- Procedures applicable to assess the initial valuation of a claim when hardly anything is known about its features. Valuation must be based on the experience on the average cost of claims with similar features
- The method to include inflation, discounting and direct expenses.
- The frequency of the valuations review which must be at least quarterly.
- The procedure to take into account the changes in both entity specific, legal, social, or economic environmental factors.
- The requirements in order to consider the claim to be closed.

3.230 Calculation. This method should start estimating each individual provision for a single claim upon up-to-date and credible information and realistic assumptions. Furthermore:

- This estimate should take account of future inflation according a reliable forecast of the time-pattern of the payments.
- The future inflation rates should be market consistent and suitable for each line of business and company.
- Individual valuations should be revised as information is improved.
- Furthermore, where back testing evidences a systematic bias in the valuation, this should be offset with an appropriate adjustment according the experience gained with claims settlement in previous years and the expected future deviations.
- Undertakings should complete the valuation resulting from this method with an incurred but not reported provision (IBNR) and an ULAE provision.

3.231 Criteria for application. Further the general requirements set out in this advice, this method is an allowable simplification in the case of small portfolios where the undertaking has sufficient information, but the number of claims is too small to test patterns of regularity.

3.232 This method is also allowable, although as an approximation, in case of (a) high-severity-low-frequency claims, and (b) new (re)insurance

company or new line of business, although only temporarily until achieving sufficient information to apply standard methods. However, where the lack of information is expected to be permanent (e.g. the case of 'tail' risks with a very slow process of collecting claims information), the undertaking would be required to complement the data available by making extra efforts to look for relevant external information to allow the understanding of the underlying risks and to use extensively adequate expert opinion and judgements. Documentation is also a key aspect in this subject.[64]

#### 3.2.3.3. Incurred but not reported claims provision. First simplification

3.233 Description. This simplification applies to the calculation of the best estimate of incurred but not reported claims (IBNR) by means an estimation of the number of claims that would expected to be declared in the followings years and the cost thereof.

3.234 Calculation. The final estimate of this technical provision is derived from the following expression, where just for illustrative purposes a three-year period of observation has been considered (the adaptation of the formula for longer series is immediate):

$$IBNR\ reserve\ year\ t = C_t \times N_t \quad ,$$

where

$C_t$ = average cost of IBNR claims, after taking into account inflation and discounting. This cost should be based on the historical average cost of claims reported in the after the relevant accident year. Since a part of the overall cost of claims comes from provisions, a correction for the possible bias should be applied.

and

$Nt = Rt * Av$, being

$$AV = [\ (N_{t-1} / p_1) + (N_{t-2} / p_2) + N_{t-3}\ ]\ /\ [\ R_{t-1}+R_{t-2}+R_{t-3}\ ]$$

Furthermore, in these expressions

$N_{t-i}$ = number of claims incurred but not reported at the end of the year t-i, independently of the accident year (to assess the number of IBNR claims all the information known by the undertaking till the end of the year t should be included).

$p_1$= percentage of IBNR claims at the end of year t-3 that have been reported during the year t-2

$p_2$= percentage of IBNR claims at the end of year t-3 that have been reported during the years t-2 and t-1

$R_{t-i}$= claims reported in year t, independently of accident year.

[64] See CEIOPS CP43 'Standards for data quality',

3.235 This method should be based on an appropriate number of years where reliable data are available so as to achieve a reliable and robust calculation. The more years of experience available the better quality of the mean obtained.

3.236 Obviously this method only applies where the incurred and reported claims provision has been valued without considering IBNR, for example it has been assessed using some of the aforementioned simplifications.

#### 3.2.3.4. Incurred but not reported claims provision. Second simplification

3.237 Description. This simplification should apply only when it is not possible to apply reliably the first simplification. In this simplification the best estimate of non reported claims (IBNR) is estimated as a percentage of the provision for reported outstanding claims.

3.238 Calculation. This simplification is based on the following formula:

$$Provision\ IBNR_{LOB} = factor_{LOB\_U} * PCO\_reported_{LOB},$$

where

$PCO\_reported_{LOB}$ = provision for reported claims outstanding

$factor_{LOB\_U}$ = factor specific for each LOB and undertaking.

3.239 Criteria for application. Further the general requirements set out to use simpifications, this method may apply only when it is not possible to apply reliably the first simplification due the number of years of experience is insufficient. Obviously this method only applies where the incurred and reported claims provision has been valued without considering IBNR, for example it has been assessed using some of the aforementioned simplifications.

#### 3.2.3.5. Simplification for claims settlement expenses

3.240 Description. This simplification estimates the provision for claims settlement expenses as a percentage of the claims provision.

3.241 Calculation. This simplification is based on the following formula, applied to each line of business:

$$Provision\ for\ ULAE = R * [\ IBNR\ +\ a * PCO\_reported\ ]$$

where:

$R$ = Simple average of $R_i$ (e.g. over the last two exercises) and

$R_i$ = Expenses / (gross claims + subrogations).

$IBNR$ = provision for IBNR

$PCO\_reported$ = provision for reported claims outstanding

$a$ = Percentage of claim provisions (i.e. set as 50 per cent[65])

3.242 Criteria for application. Further the general requirements set out in this advice, this method is an allowable simplification when expenses can

[65] See QIS4 Specifications, TS.IV.g.4

reasonable be supposed proportional to provisions as a whole, this proportion is stable in time and the expenses distribute uniformly over the lifetime of the claims portfolio as a whole.

### 3.2.3.6. Simplification for premium provision

3.243 Description. This simplification estimates the best estimate of the premium provision when the undertaking is not able to derive a reliable estimate of the expected future claims and expenses derived from the business in force.

3.244 Calculation. This simplification is based on the following formula, applied to each line of business:

Best estimate Premium provision =

*[ Pro-rate of unearned premium over the life of the premium + Adjustment for any expected insufficiency of the premium in respect future claims and expenses ] / ( 1 + rf_rate_1y / 3 )*
*time BE = (Present value of future premiums on existing contracts+Provision for unearned premiums + Provision for unexpired risks)/(1+i/3*[66])

where *rf_rate_1y* is the risk-free interest rate 1-year term

3.245 Criteria for application. Further the general requirements set out in this advice, this method is an allowable simplification when the premium provision is supposed to decrease at an even rate during the forthcoming year.

3.246 CEIOPS reminds that QIS4 specifications already contained a simplification regarding premium provisions, which remains as an additional possibility to be tested again in QIS5.

[66] See QIS4 Specifications, TS.IV.h.10

## CEIOPS' Advice: Simplifications regarding best estimate

General issues

3.247 The term "simplified method" may be used to refer to a situation where a specific valuation technique has been simplified in line with the proportionality principle, or where a valuation method is considered to be simpler than a certain reference or benchmark method.

3.248 However, any distinction between "simplified" and "non-simplified methods would necessarily need some assessment and, hence, it is necessary to explore how to achieve a categorisation, as clearer as possible, of the range of available methods.

Specification of simplified methods on Level 2

3.249 Considering the principles-based approach to the valuation of technical provisions envisaged by Solvency II, the inclusion of specific simplified methodologies for the valuation of technical provisions on Level 2 should be foreseen for components of the valuation where:

- the use of simplified methods is expected to be widespread, and a common understanding of an actuarial "best practice" is still evolving; or
- there is a particular need for small and medium-sized (re)insurance undertakings for such an inclusion.

3.250 Where simplified methods are specified on Level 2, they should be available for all (re)insurance undertakings, subject to application criteria which

- specify the circumstances and conditions under which they are intended to be used; and
- have due regard to the model error inherent in an application of the method.

Thresholds determining the allowance of simplified methods

3.251 Where external thresholds are established in Level 2 to determine the allowance of simplified approaches, these should be intended to capture the degree of model error in the calculation.

3.252 In implementing external thresholds , care should be taken to ensure that:

- this is consistent with the principles-based proportionality assessment process outlined in section 3.1 of this paper;
- the assessment of model error implicit in the calibration of the threshold adequately reflects the actual degree of model error

incurred when the method is applied by individual undertakings;

- this does not lead to the impression that it would no longer be necessary for the undertaking to undertake an own assessment of the appropriateness of the method, including an assessment of the degree of model error.

List of simplified methods

3.253 In line with Article 86 (h) CEIOPS is required to provide, where necessary, simplified methods and techniques to calculate technical provisions. CEIOPS provides in this document a list of methods and techniques for the estimation of:

- Life, non life and health best estimates
- Risk margin
- Reinsurance recoverables and adjustments due to counterparty defaults
- Quarterly calculations

These methods and techniques should not be seen as a prescriptive list of methods, but as an open list.

3.254 Furthermore, CEIOPS advises not to introduce an exhaustive list of methods and techniques as level 2 implementing measures for the estimation of the best estimate, and would prefer to keep such methods and techniques as level 3 guidance. The rationale is that a principles based approach is more appropriate for level 2 advice, particularly since the methods illustrated may not be appropriate for all risk profiles. Furthermore, in line with stakeholder comments, methods continue to develop and prescription could hinder innovation in this area.

3.255 However, as analyzed in the following subsection, CEIOPS recognizes that the risk margin is a specific area where additional considerations should be included in the Level 2 text, due to the complexity and uncertainty around the calculation methodology. Moreover, CEIOPS would support flexibility for undertakings to use other simplified methods or techniques, provided they can demonstrate that these are appropriate.

## 3.3. Risk margin

### 3.3.1. Calculation of the risk margin – the general approach

3.256 The general approach, as expressed in CEIOPS' consultation paper CP 42[67] on the calculation of the risk margin, states that the risk margin shall be calculated per line of business (LoB), and that no diversification effects shall be taken into account (see CEIOPS-DOC-36-09).

3.257 This means that[68]:

$$CoCM = \sum_{lob} CoCM_{lob},$$

where

$CoCM$ = the overall risk margin for the (re)insurer; and

$CoCM_{lob}$ = the risk margin for an individual line of business (*lob*).

3.258 For each line of business, the calculation of the risk margin $CoCM_{lob}$ as prescribed in CP 42, can in general terms be expressed in the following manner:

$$CoCM_{lob} = \sum_{t \geq 0} CoC \cdot SCR_{RU,lob}(t)/(1+r_{t+1})^{t+1},$$

where

$SCR_{RU,lob}(t)$ = the SCR for a given line of business (*lob*) for year $t$ as calculated for the reference undertaking,

$r_t$ = the risk-free rate for maturity $t$; and

$CoC$ = the Cost-of-Capital rate.

Some details regarding the discounting factors to be used in the risk margin calculations are explained in annex B.

3.259 The Cost-of-Capital rate "shall be the same for all insurance and reinsurance undertakings and shall be reviewed periodically" (Article 77(5) of the Level 1 text).

3.260 In summary, the calculation of the risk margin per line of business shall in general be carried out according to the following steps:

- project the SCRs throughout the lifetime of the (re)insurance obligations,
- apply the Cost-of-Capital rate to the projected yearly SCRs,
- discount with the risk-free interest rate curve, and
- sum the amounts over all future years.

[67] CEIOPS-DOC-36-09 on the calculation of the risk margin in technical provisions.
[68] For the purpose of the present subsection, 'a line of business' may refer to either a line of business or a homogenous risk group according to CEIOPS' advice on segmentation.

3.261 The general rule for calculating the risk margin (per line of business) as summarised in the previous paragraphs applies to all undertakings irrespective of whether the undertaking calculates its SCR using the standard formula or an internal model.

3.262 If the undertaking is using the standard formula for the calculation of its solvency capital requirement, all present and future SCRs for a given line of business (that is all $SCR_{RU,lob}(t)$ for $t \geq 0$) should in general be calculated as follows:

$$SCR_{RU,lob}(t) = BSCR_{RU,lob}(t) + SCR_{RU,lob,op}(t) - Adj_{RU,lob}(t),$$

where

$BSCR_{RU,lob}(t)$ = the Basic SCR for the given line of business (*lob*) and year *t* as calculated for the reference undertaking ,

$SCR_{RU,lob,op}(t)$ = the partial SCR regarding operational risk for the given line of business (*lob*) and year *t* as calculated for the reference undertaking; and

$Adj_{RU,lob}(t)$ = the adjustment for the loss absorbing capacity of technical provisions for the given line of business (*lob*) and year *t* as calculated for the reference undertaking.

Regarding the projections to be made for adjustments due to the loss absorbing capacity of technical provisions, see CEIOPS' advice DOC-46-09.

3.263 The present and future basic solvency capital requirements for a given line of business (i.e. $BSCR_{RU,lob}(t)$ for all $t \geq 0$) should be calculated by first using the relevant SCR-modules and sub-modules per line of business, and then aggregating the resulting SCRs (per line of business) based on the correlation assumptions given in Annex IV of the Level 1 text.

3.264 In the context of risk margin calculations, the relevant modules and sub-modules for calculating the basic solvency capital requirement per line of business cover the following risks:[69]

(a) underwriting risk with respect to the existing insurance and reinsurance obligations,

(b) counterparty default risk with respect to ceded reinsurance and SPVs, and

(c) unavoidable market risk.

3.265 If the undertaking uses an internal model, the assessed SCR has to cover at least the risks covered in the standard approach and referred to in CP 42.

3.266 Where the maturity of the obligations is more than one or two years, a full calculation of the risk margin according to the general approach sketched

[69] Cf. assumption 4 and 5 regarding the reference undertaking as laid down in CEIOPS-DOC-36-09.

above is likely to be both complex and time consuming. Especially the calculation of future SCRs, and then primarily the Basic SCRs and the adjustment for the loss absorbing capacity of the technical provisions, seems to be challenging, as these calculations would require input information that is not easily accessible at the point in time where the calculations are supposed to be carried out (i.e. at $t = 0$). Accordingly, there seems to be a considerable need for simplifying the risk margin calculations (while at the same time trying to keep as much as possible of the risk based approach).

3.267 In this context it may be referred to recital 59 of the Level 1 text which states as follows:

> *In order to reflect the specific situation of small and medium-sized undertakings, simplified approaches to the calculation of technical provisions should be provided for.*

3.268 However, it should also be noticed that the principle of proportionality applies to all undertakings – a fact that should be kept in mind in the context of all the simplifications discussed below.

3.269 Moreover, one of the lessons from the quantitative impact studies carried out so far (especially QIS3 and QIS4) has been that a majority of the insurance undertakings participating in these exercises has used the simplifications provided for the risk margin calculations. Only a few of the participating undertakings were able – or made the necessary effort – to carry out a full calculation of the risk margin according to the general approach sketched out in the paragraphs above.

3.270 Moreover, it may be noted that according to the QIS4 Report the ratio of the estimated risk margin to the best estimate was less than 5 per cent for more than 75 per cent of the participating life insurance undertakings. For the participating non-life insurance undertakings this ratio was less than 10 per cent for 75 per cent of the participants.[70]

### 3.3.2. Simplifications

#### Some general remarks

3.271 By definition the risk margin reflects the risks linked to the obligations. The size of the risk margin depends inter alia on

- the line of business and the relevant underwriting sub-risks
- the length of the contracts
- the maturity and run-off pattern of the obligations
- the exposure to catastrophes
- the unavoidable market risk linked to the obligations
- the reinsurers' and SPVs' share of the obligations
- the quality of the reinsurers and the SPVs (credit standing)

[70] On the other hand the stipulated risk margin may be relatively large compared to an undertaking's solvency capital requirement and/or available capital. This is especially the case for a number of life insurance undertakings.

- the loss absorbing capacity of the technical provisions
- etc.

3.272 As a general principle, where an (re)insurance undertaking applies a simplified valuation method, this should be proportionate to the underlying risks and compatible with the Solvency II valuation principles.[71] This would apply irrespectively of whether the method is specified under Level 2 implementing measures or not.

3.273 If a full projection of all future SCRs is necessary in order to capture the undertaking's risk profile – for all or some lines of business – the undertaking is expected to carry out these calculations.

3.274 When an undertaking considers whether or not it would be appropriate to apply a simplified valuation technique for the risk margin, it should carry out separate assessments at least for each line of business. This means that a decision to use simplifications in one line of business should have no definitive impact on the decisions made for other lines of business. As an integral part of this assessment, the undertaking should consider what kind of simplified methods would be most appropriate for the given line of business. The chosen method should be proportionate to the nature, scale and complexity of the risks in the line of business in question.

3.275 When the undertaking has decided to use a simplified method for a given line of business, it should consider whether the method could be used for the projections of the overall SCR (for the given line of business) or if the relevant (sub-)risks should be projected separately. In this context, the undertaking should also consider whether it should carry out the simplified projections of future SCRs individually for each future year or if it is possible to calculate all future SCRs in one step – but still for a given line of business.

**A hierarchy of simplifications**

3.276 Based on the general principles and criteria referred to above, the following hierarchy could be seen as a possible decision basis regarding the methods to be used for projecting future SCRs per line of business:

(1) make a full calculation of all future SCRs[72] without using simplifications;

(2) approximate the individual risks or sub-risks within some or all modules and sub-modules to be used for the calculation of future SCRs;

(3) approximate the whole SCR for each future year, e.g. by using a proportional approach; and

(4) estimate all future SCRs "at once", e.g. by using an approximation based on the duration approach.

[71] Cf. section 3.1.

[72] Note that, where all future SCRs have been projected, it should be straightforward to calculate the risk margin according to the general formula set out in CEIOPS-DOC-36-09 on the calculation of the risk margin in technical provisions.

Moreover a fifth level of this hierarchy could be added:

(5) approximate the risk margin by calculating it as a percentage of the best estimate.

3.277 In this hierarchy the simplifications are in general getting simpler step by step. In order to be able to use the simplifications given on each step appropriate eligibility criteria, based on quality and materiality considerations, have to be fulfilled.

3.278 It may also be argued that a simple and straightforward approach to be followed when deciding which level of the hierarchy is most appropriate could be structured along the following lines:

- Start from the bottom.
- If level no. n is appropriate, then use it.
- Otherwise, go upwards in the hierarchy to level no. n–1.

3.279 When using this approach, the aspired complexity on the calculations should not go beyond what is necessary in order to capture the undertaking's risk profile. In any case, this approach should be applied consistently with the framework set out when defining the proportionality principle and the necessity of assessing risks properly.

3.280 However, it should be stressed that based on the lessons learned from the QIS-exercises ("the state of the art" regarding risk margin calculations), it seems likely that the majority of (small and medium sized) undertakings will need more experience with the available methods for stipulating the risk margin before they can make a "final" decision with respect to the level of simplifications being most appropriate in their case.

3.281 It seems likely that the majority of undertakings will not be in a position to apply the most advanced methods for calculating the risk margin as indicated by level no. 1 of the hierarchy, cf. also the summary of QIS4 technical specifications and QIS4 results below.

3.282 A similar comment applies also to the simplifications on level no. 2, since this level still requires a very large number of calculations of future SCRs.

3.283 However, even if an undertaking is allowed to use a simplified method (an approximation) in its risk margin calculations under Solvency II, it should in general be encouraged to move to more sophisticated methods as it gathers more experience with respect to this kind of calculations.

3.284 It should also be noted that the distinction between the levels in the hierarchy sketched above is not always clear-cut. This is e.g. the case for the distinction between the simplifications on level no. 2 and level no. 3. An example may be a proportional method (based on the development of the best estimate technical provisions) applied for an individual module or sub-module relevant for the calculation of future SCRs for the reference undertaking. Such simplifications can be seen as belonging to either level no. 2 or level no. 3.

3.285 As a consequence of this, the simplifications briefly described from para 3.293 onwards should not be interpreted as an exhaustive list of simplifying approaches being available for the risk margin calculations. However, it would be reasonable to view these simplifications as representative examples of the simplifications that may be used on the various levels of the hierarchy of simplifications.

**The QIS4 technical specifications and the QIS4 report**

3.286 It was highlighted in the QIS4 Technical Specifications that in carrying out the risk margin calculations *"[t]he main practical difficulty […] is deriving the SCR for future years for each segment"*.[73] It should be stressed that this is the case even if on basis of the best estimate calculations reliable figures and parameters would be available as input to the calculation of future SCRs.

3.287 Acknowledging these practical difficulties, the QIS4 technical specifications proposed that "[t]he calculation of the different risk charges for the future SCRs can either be done by the direct application of the SCR formulae or through simplifications". In line with this statement and in order to reduce the burden of calculation the QIS4 Technical Specifications introduced several layers of simplifications and proxies which could be applied in the calculation of the risk margin.[74]

3.288 As a first layer the QIS4 technical specifications introduced several simplifications for calculating the partial SCR-charges for counterparty default risk for ceded reinsurance and the underwriting risk (for non-life, life and health insurance, respectively). On the other hand, simplifications were not introduced for the partial SCR-charge for operational risk, as the inputs needed for the calculation of this charge per line of business[75] are readily available from the calculation of the best estimate technical provisions.

3.289 With respect to the introduced simplifications for the risk margin, CEIOPS' QIS4 Report stated that:[76]

> *The majority, if not all, of undertakings (independently of their size) used simplifications to project the SCR for the purposes of calculating the risk margin. The risk margin proxy and helper tab for non-life were also extensively used by undertakings.*
>
> *The most common simplifications used were the duration simplification and the simplification based on best estimate ratios.*

3.290 Moreover, with respect to the practicability of the proposed methodologies, the QIS4 report referred e.g. to the following feedback from participating undertakings and supervisors:[77]

[73] Cf. QIS4 Technical Specifications, TS.II.C.16
[74] Cf. QIS4 Technical Specifications, sub-sections TS.II.C and TS.IV.N.
[75] Earned gross premiums and gross technical provisions and – for unit linked products – expenses (gross of reinsurance).
[76] Cf. QIS4 Report, sub-section 7.2.5, page 78
[77] Cf. QIS4 Report, sub-section 7.3.5, page 108–110.

*A number of undertakings commented on the fact that the risk margin depends to a large extent on the projected SCR so any limitations in the standard formula would also impact on the risk margin.*

*A number of participants criticised the technical difficulty of the risk margin calculation and the lack of more technical support.*

*Some undertakings stated that the calculation of the risk margin by LoBs needs a breakdown of underwriting, counterparty and operational risk SCR by LoBs that is difficult to apply.*

*[…]*

*Supervisors agree that more guidance is needed on the choice of the various proposed simplifications, which differ in their degree of complexity and risk-sensitivity.*

*[…]*

*Most undertakings used simplifications to project the SCR adopting either the duration approach or the ratio of SCR to best estimate approach. The simple risk margin proxy was also used by some non-life undertakings. Undertakings expressed concern at the variation of results depending on the chosen simplification. […] Undertakings felt that more guidance on the correct method was required.*

3.291 It may be argued that the QIS4 technical specifications as well as the QIS4 report confirm the presumption made above that in the initial phase of Solvency II a clear priority should be given to level no. 3 and 4 of the hierarchy sketched in para 3.276.

3.292 Moreover, the approaches indicated as level no. 3 and 4 of the hierarchy could be supplemented by even more simple approaches as e.g. the one indicated as level no. 5 – given that this can be justified according to the proportionality principle. Such further simplifications are relevant also for the quarterly calculations.

**Specific simplifications**

3.293 This section contains some proposals for simplified calculation methods that may be used at the various levels of the hierarchical structure referred to in para 3.276 above. As already explained the main focus should be on level no. 3 and 4 of this structure, i.e. on the so called proportional method and duration method, respectively. A discussion of simplifications to be used in calculations of the risk margin to be carried out during the year (the quarterly calculations) is given in section 3.5.

3.294 The simplifications proposed in this section are described in the context of the standard formula. CEIOPS considers that the application of simplifications for cases where the SCR is calculated with internal models should follow the general approach proposed in this paper with an appropriate case-by-case assessment.

3.295 With respect to the standard formula, it may be argued that the main focus should be on simplifications regarding the calculation of the Basic

SCR for the individual lines of business. A rationale for such an approach could be as follows:

- The SCR for operational risk depends mainly on earned premiums and technical provisions (best estimate) and information on these figures should in general be available per line of business.
- The adjustment for the loss absorbing capacity of technical provisions (which is first and foremost relevant for lines of business within life insurance) should be determined – at least in principle – by some scenario-based techniques.

3.296 However, while the scenario-based calculation of the loss absorbing capacity of technical provisions in general will be a standard approach with respect to the calculation of the present SCR, it is not obvious how to establish the scenarios to be used for the future years. This will have an impact on the applicability of an approach whereby the Basic SCR, the SCR for operational risk and the adjustment for loss absorbing capacity of technical provisions for future years are established separately, cf. e.g. level no. 2 of the hierarchy sketched in para 3.276.[78]

3.297 Moreover, with respect to the simplifications allowing for all future SCRs to be estimated "at once" (the duration approach), it will be natural to combine the calculations of the Basic SCR and the SCR related to operational risk for the lines of business within non-life insurance. For the lines of business within life insurance the comment made in the previous paragraphs regarding the adjustment for the loss absorbing capacity of technical provisions applies equally to simplifications based on the duration approach.

3.298 Accordingly, in order to simplify the projections to be made if level no. 3 of the hierarchy is applied, a practical solution could be to allow projections of the future SCRs (per line of business) in one step, instead of making separate projections for the basic SCR, the capital charge for operational risk and the loss absorbing capacity of technical provisions (per line of business), respectively.

3.299 It should also be stressed that in order to avoid circularity issues the best estimate technical provisions (and not the sum of the best estimate and the risk margin) should be applied when calculating the present and future SCRs for operational risk (per line of business). This should be in line with the advice given by CEIOPS in CP 53.[79]

3.300 Finally, it should be mentioned that the simplifications allowed for when calculating the SCR should in general carry over to the calculation of the risk margin. Some examples of simplifications that may be considered in this context are indicated in para 3.344-3.364 below, cf. also the CP on simplified calculations in the standard formula for SCR.

*Simplifications for the overall SCR for each future year*

[78] The problem of establishing reliable future scenarios for the loss absorbing capacity of technical provisions applies for level no. 1 of the hierarchy as well.
[79] Consultation Paper no. 53 on operational risk within the standard formula.

3.301 Simplifications classified as belonging to level no. 3 of the hierarchical structure sketched in para 3.276 are in general based on an assumption that the future SCRs for a given line of business are proportional to the best estimate technical provisions for this line of business and the relevant year – the proportionality factor being the ratio of the present SCR to the present best estimate technical provisions for the same line of business (as calculated by the reference undertaking).

3.302 These simplifications – also labelled the proportional method – were introduced already in connection with the second quantitative impact study (QIS2), where the risk margin according to the Cost-of-Capital method could be calculated on a voluntary basis. Moreover, this simplification was available in both QIS3 and QIS4 – in QIS4 also as a basis for the so called helper tabs.

3.303 By using a representative example of a proportional method the reference undertaking's SCR for a given line of business and year *t* could be fixed in the following manner:

$$SCR_{RU,lob}(t) = (SCR_{RU,lob}(0)/BE_{Net,lob}(0)) \cdot BE_{Net,lob}(t), \quad t = 1, 2, 3, \ldots ,$$

where

$SCR_{RU,lob}(0)$ = the SCR as calculated at time $t = 0$ for the reference undertaking's portfolio of (re)insurance obligations in an individual line of business;

$BE_{Net,lob}(0)$ = the best estimate technical provisions net of reinsurance as assessed at time $t = 0$ for the undertaking's portfolio of (re)insurance obligations in an individual line of business; and

$BE_{Net,lob}(t)$ = the best estimate technical provisions net of reinsurance as assessed at time *t* for the undertaking's portfolio of (re)insurance obligations in an individual line of business.

3.304 This simplification takes into account the maturity and the run-off pattern of the obligations net of reinsurance. However, the assumptions on which the risk profile linked to the obligations is considered unchanged over the years, are indicatively the following:

- the composition of the sub-risks in underwriting risk is the same (all underwriting risks),
- the average credit standing of reinsurers and SPVs is the same (counterparty default risk),
- the unavoidable market risk in relation to the net best estimate is the same (market risk),
- the proportion of reinsurers' and SPVs' share of the obligations is the same (operational risk),

- the loss absorbing capacity of the technical provisions in relation to the net best estimate is the same (adjustment).

3.305 An undertaking that intends to use this simplification for one or several lines of business (or homogenous risk groups), should consider to what extent the assumptions referred to in para 3.304 are fulfilled for the lines(s) of business in question. If some or all of these assumptions do not hold, the undertaking should carry out (at least) a qualitative assessment of how material the deviation from the assumptions is. If the impact of the deviation is not material compared to the risk margin as a whole, then the simplification can be used. Otherwise the undertaking should be encouraged to use a more sophisticated calculation or method.

3.306 The undertaking may also be able to apply the simplification in a piecewise manner across the years. For instance, if a line of business can be split into sub-lines having different maturities, then the whole run-off period of the obligations could be divided into periods of consecutive years where a proportional calculation method could be used.

3.307 When using the simplification sketched in para 3.301-3.304, some considerations should be given also regarding the manner in which the best estimate technical provisions net of reinsurance has been calculated. According to Article 77(2) of the Level 1 text the best estimate technical provisions shall at the outset be calculated gross of reinsurance, while Article 81 states that the calculation of reinsurance recoverables etc. should comply with Article 76 to 80.

3.308 However, section 3.1.6 discusses various simplifications that may be applied when calculating the best estimate technical provisions net of reinsurance. Accordingly, it should be assessed what impact the simplifications being applied when stipulating the best estimate net of reinsurance may have on the simplified methods for calculating the future SCRs.

3.309 In this context it should be noted that even if the applied gross-to-net techniques may lead to a reasonable figure for the best estimate net of reinsurance ($BE_{Net,lob}(t)$) as compared to the best estimate gross of re-insurance ($BE_{Gross,lob}(t)$) at time $t = 0$, this does not necessarily mean that all future estimates of the best estimate net of reinsurance will be equally reliable. And in such cases also the simplified method sketched above may be biased.

3.310 Moreover, with respect to operational risk it should be noticed that the capital charge for this risk at $t = 0$ is basically a function of the best estimate technical provisions gross of reinsurance and earned premiums gross of reinsurance, as well as annual expenses (for unit-linked business only). As a consequence it should be assessed to what extent the simplification based on the proportional method which assumes that the SCRs for the operational risk develop pari passu with the best estimate technical provisions net of reinsurance may introduce a bias in the risk margin calculations.

3.311 A similar comment concerns the scenario-based adjustments for the loss absorbing capacity of technical provisions to be taken into account when projecting the future SCRs, since it is likely to be (very) difficult to develop reliable scenarios to be applied to these projections. Accordingly, it may in practise be difficult to find other workable possibilities than allowing also this component to develop in line with the best estimate technical provisions net of reinsurance. It should, however, be required to make some assessments of the potential bias caused by this simplification.

3.312 As indicated above, a simplification as the one sketched in para 3.301-3.304 may be applied also at a more granular level, i.e. for individual modules and/or sub-modules. However, it should be noted that the number of calculations to be carried out will in general be proportional with the number of modules and/or sub-modules for which this simplification is applied (within a given line of business). Moreover, it should be considered whether a more granular calculation as indicated above will lead to a more accurate estimate of the future SCRs to be used in the calculation of the risk margin.

*Estimation of all future SCRs "at once"*

3.313 A representative example of a simplification belonging to level no. 4 of the hierarchical structure sketched in paragraph 3.276 is using information regarding the modified duration of the liabilities (for the individual lines of business) in order to calculate the present and all future SCRs in one single step.

3.314 These simplifications were introduced in QIS4 and different formulas were described for non-life insurance, life insurance and health insurance, respectively. The descriptions given in the following paragraphs are to a large extent based on the QIS4 Technical Specifications.

*Non-life insurance*

3.315 With respect to non-life insurance (excluding non-life annuities) the duration approach implies that the risk margin for an individual line of business ($CoCM_{lob}$) can be calculated in the following manner:

$$CoCM_{lob} = CoC \cdot \{SCR_{RU,lob}(0)/(1+r_1) + \sum_{t>0} SCR_{RU,lob}(t)/(1+r_{t+1})^{t+1}\},$$

$$\approx \{CoC/(1+r_1)\} \cdot \{SCR_{RU,lob}(0) + UW_{RU,lob,>0} + OP_{RU,lob,>0} + CD_{RU,lob,>0}\},$$

where the following variables and parameters all relate to the same line of business:

$SCR_{RU,lob}(0)$ = the SCR as calculated at time $t = 0$ for the reference undertaking's portfolio of (re)insurance obligations;

$UW_{RU,lob,>0}$ = an approximation of the sum of all future SCRs covering the underwriting risk related to the reference undertaking (as discounted to $t = 1$);

$OP_{RU,lob,>0}$ = an approximation of the sum of all future SCRs covering the operational risk related to the reference undertaking (as discounted to $t = 1$);

$CD_{RU,lob,>0}$ = an approximation of the sum of all future SCRs covering the counterparty default risk related to ceded reinsurance and SPVs related to the reference undertaking (as discounted to $t = 1$); and

$CoC$ = the Cost-of-Capital rate.

3.316 Within this set-up, the approximated sums of future SCRs related to each of the three main kinds of risks to be covered by the risk margin calculations are estimated as follows (for the given line of business)

$$UW_{RU,lob,>0} = Dur_{mod,lob}(1) \cdot 3 \cdot \sigma_{(res,lob)} \cdot PCO_{Net,lob}(1)$$

$$OP_{RU,lob,>0} = Dur_{mod,lob}(1) \cdot \lambda \cdot PCO_{Gross,lob}(1)$$

$$CD_{RU,lob,>0} = Dur_{mod,lob}(1) \cdot SCR_{RU,CD,lob}(0) \cdot PCO_{Re,lob}(1)/PCO_{Re,lob}(0)$$

where following variables and parameters all relate to the same line of business:

$PCO_{Net,lob}(1)$ = the best estimate provision for claims outstanding net of reinsurance as calculated at $t = 1$ ;

$PCO_{Gross,lob}(1)$ = the best estimate provision for claims outstanding gross of reinsurance as calculated at $t = 1$;

$PCO_{Re,lob}(1)$ = reinsurers' share of the best estimate provision for claims outstanding as calculated at $t = 1$;

$PCO_{Re,lob}(0)$ = reinsurers' share of the best estimate provision for claims outstanding as calculated at $t = 0$ ;

$SCR_{RU,CD,lob}(0)$ = the capital charge for the counterparty default risk related to ceded reinsurance and SPVs as allocated to the given line of business at $t = 0$;

$Dur_{mod,lob}(1)$ = the modified duration of reference undertaking's (re)insurance obligations net of reinsurance at $t = 1$;

$\sigma_{(res,lob)}$ = the standard deviation for reserve risk as defined in the premiums and reserve risk module of the SCR standard formula; and

$\lambda$ = the percentage to be applied on the best estimate technical provisions gross of reinsurance as defined in the operational risk module of the SCR standard formula.

With respect to the parameter λ it should be noted that according to the proposals put forward in CP 53 this should be set to 4.4 per cent.

3.317 This simplification takes into account the maturity and the run-off pattern of the obligations net of reinsurance. However, it is based on the following simplified assumptions:

- the length of the contracts is one year at the most, i.e. there is no premium and catastrophe risk after year 0 (non-life underwriting risks),
- the average credit standing of reinsurers and SPVs remains the same over the years (counterparty default risk),
- the modified duration is the same for obligations net and gross of reinsurance (operational risk, counterparty default risk).

3.318 An undertaking that intends to use this simplification for one or several lines of business (or homogenous risk groups), should consider to what extend the assumptions referred to in para 3.317 are fulfilled for the line(s) of business in question. If some or all of these assumptions do not hold, the undertaking should carry out (at least) a qualitative assessment of how material the deviation from the assumptions is. If the impact of the deviation is not material compared to the risk margin as a whole, then the simplification can be used. Otherwise the undertaking should either adjust the formula appropriately or be encouraged to use a more sophisticated calculation or method.

3.319 For example, if there is a notable difference in the modified durations of the obligations gross of reinsurance, net of reinsurance and reinsurers' share of the obligations, then the formula should be adjusted such that the modified duration used in $OP_{RU,lob,>0}$ is based on obligations gross of reinsurance and the modified duration used in $CD_{RU,lob,>0}$ is based on reinsurers' share of the obligations.

3.320 If there arises premium risk or catastrophe risk after the first year then an additional risk charge that represents this risk can be added to the formula.

3.321 In the calculations sketched in para 3.315 and 3.316 it has been tacitly assumed that with respect to the present (simplified) approach the unavoidable market risk can be disregarded for the lines of business within non-life insurance. If this assumption does not hold – and the unavoidable market risk is believed to have a substantial impact on the SCR-calculations – the method referred to should be adjusted by including an element covering this risk, e.g. by using the approximation described in para 3.360-3.364 below. As always the choice of simplified methods should be advocated by the undertaking.

3.322 It should also be mentioned that the calculations sketched above have disregarded the diversification effects between underwriting risk and counterparty default risk.[80] In the present context this should be viewed as a consequence of the trade-off between simplifications and accuracy that in general is present.

[80] In the Level 1 text the correlation coefficient between non-life underwriting risk and counterparty default risk has been set to 0.5 in the context of calculating the current SCR by the standard formula.

*Life insurance*

3.323 With respect to the lines of business within life insurance a somewhat simpler approach was described in connection with the QIS4-exercise. According to that approach the risk margin for a given line of business within life insurance ($CoCM_{lob}$) could be calculated according to the following formula:

$$CoCM_{lob} = (CoC/(1+r_1)) \cdot Dur_{mod,lob}(0) \cdot SCR_{RU,lob}(0),$$

where the following variables and parameters all relate to the same line of business:

$SCR_{RU,lob}(0)$ = the SCR as calculated at time $t = 0$ for the reference undertaking's portfolio of (re)insurance obligations;

$Dur_{mod,lob}(0)$ = the modified duration of reference undertaking's (re)-insurance obligations net of reinsurance at $t = 0$; and

$CoC$ = the Cost-of-Capital rate.

This approach applies also to life-like non-life obligations (e.g. non-life annuities).

3.324 This simplification takes into account the maturity and the run-off pattern of the obligations net of reinsurance. However, it is based on the following simplified assumptions:

- the composition and the proportions of the risks and sub-risks do not change over the years (basic SCR),
- the average credit standing of reinsurers and SPVs remains the same over the years (counterparty default risk),
- the modified duration is the same for obligations net and gross of reinsurance (operational risk, counterparty default risk),
- the unavoidable market risk in relation to the net best estimate remains the same over the years (market risk),
- the loss absorbing capacity of the technical provisions in relation to the net best estimate remains the same over the years (adjustment).

3.325 An undertaking that intends to use this simplification for one or several lines of business (or homogenous risk groups), should consider to what extend the assumptions referred to in para 3.324 are fulfilled for the line(s) of business in question. If some or all of these assumptions do not hold, the undertaking should carry out (at least) a qualitative assessment of how material the deviation from the assumptions is. If the impact of the deviation is not material compared to the risk margin as a whole, then the simplification can be used. Otherwise the undertaking should either adjust the formula appropriately or be encouraged to use a more sophisticated calculation or method.

3.326 For the lines of business within life insurance the current SCR as calculated for the reference undertaking covers the unavoidable market risk. However, according to the approach briefly described in para 3.360-3.364 the unavoidable market risk is restricted to the unavoidable mismatch between the cash-flows of the insurance liabilities and the financial instruments available to cover these liabilities. By taking this restriction into account, and especially the simplified method of calculation described in para 3.360-3.364, it may be the case that the formula referred to in para 3.323 exaggerates the impact of unavoidable market risk on the risk margin for these lines of business. In such cases it should be allowed to adjust the formula in para 3.323 in order to take into account the simplified calculation of unavoidable market risk in an adequate manner.

3.327 Moreover, in order to determine the present SCR for the reference undertaking, it is necessary to recalculate the SCR covering life underwriting risk for the individual lines of business. As in QIS4 this recalculation can be simplified by redistributing the sub-risk charges (mortality, longevity etc.) for the whole portfolio to the individual lines of business in proportion to appropriate risk measures. In this context the risk measures listed in table 3.1 may be used.[81]

*Table 3.1. Possible candidates for risk measures for the simplified risk margin calculations in life insurance.*

| Sub-risks | Expose measures |
|---|---|
| Mortality | Capital at risk × Duration of treaties under mortality risk |
| Longevity | Best estimate of treaties under longevity risk |
| Disability | Capital at risk × Duration of treaties under disability risk |
| Lapse | Best estimate of treaties under lapse risk<br>– Surrender values of treaties under lapse risk |
| Expenses | Renewal expenses × Duration |
| Revision | Best estimate of annuities exposed to revision risk |
| CAT | Capital at risk of treaties under mortality and disability risk |

3.328 The formula given above is based on the assumption that the relative loss-absorbing capacity is constant over the run-off of the portfolio and therefore amendments to the estimated risk margin should be made if this assumption does not hold.

*Combinations of non-life and life insurance*

3.329 If the line of business comprises both traditional non-life obligations and obligations in form of annuities, the risk margin is calculated by combining the results of a non-life calculation and a life calculation.

*Health insurance*

[81] Cf. the QIS4 Technical Specifications, TS.II.C.26, page 31.

3.330 With respect to health insurance it should be noted that the structure of the module and the approach of the risks has been changed considerably through the work with CP 50.[82] Accordingly, the simplifications described in the QIS4 Technical Specifications are no longer valid.[83]

3.331 However, a general guidance regarding simplifications to be used for health insurance may be to follow the approach described in CP 27[84] regarding the segmentation of health insurance obligations. According to this approach, the health insurance obligations shall be segmented into obligations pursued on a similar bases as life insurance (SLT Health) and non-life insurance (Non-SLT Health), respectively. Moreover, the SLT health obligations shall be segmented further according to the segmentation for life insurance obligations. In a similar manner the non-SLT health obligations shall be segmented further according to the segmentation for non-life insurance obligations.

3.332 A consequence of this approach will be that for a line of business within life insurance which comprises SLT health obligations, the calculation of the present SCR for the reference undertaking will have to take into account also the underwriting risks related to the health insurance obligations. A similar requirement applies to lines of business within non-life insurance comprising non-SLT health obligations.

3.333 The considerations summarised in the previous paragraphs above may apply also for the calculation of the present SCR of the reference undertaking under the proportional method as described in para 3.301-3.312 above. However, it seems to be necessary to develop these simplifications further in the supervisory guidance on Level 3.

*A simple method based on percentages of the best estimate*

3.334 The non-life insurance undertakings that participated in QIS4 were allowed to use a risk margin "proxy" if they were not able to use any of the other methods described in the technical specifications for the calculation of the risk margin. According to this "proxy" the risk margin for a given line of business ($CoCM_{lob}$) should be calculated as a percentage of the best estimate technical provisions net of reinsurance (at $t = 0$), that is

$$CoCM_{lob} = a_{lob} \cdot BE_{Net,lob}(0),$$

where

$BE_{Net,lob}(0)$ = the best estimate technical provisions net of reinsurance as assessed at time $t = 0$ for the undertaking's portfolio of (re)insurance obligations within the given line of business; and

$a_{lob}$ = a fixed percentage for the given line of business.

[82] Consultation Paper no. 50 on the health underwriting risk module under the SCR standard formula.
[83] Cf. Consultation paper on simplifications for the SCR standard formula.
[84] Consultation Paper no. 27 on lines of business on the basis of which (re)insurance obligations are to be segmented.

3.335 The percentages fixed for the QIS4-exercise varied from 4–6 per cent for (very) short-tailed lines of business to 17–21 per cent for (very) long-tailed lines of business. This approach was, however, criticised by some participants for leading to too high risk margins (at least for some lines of business).

3.336 It may be argued that this rather simple method for calculating the risk margin could have possible uses beyond being a "proxy"-method under QIS4. Some potential applications are briefly described below:

(A) Cases where an undertaking at given point in time and for a given line of business has calculated the risk margin according to a method belonging to one of the levels 1–4 as listed in para 3.276.

If the undertaking can justify that the characteristics and proportions of the risks in the line of business in question have not changed (after the more detailed calculations were carried out) or that the impact of changes in these characteristics and proportions are not material, then the ratio of the risk margin to the best estimate can be assumed to be the same as in the initial calculations.

(B) Cases where the impact of the risk margin calculated for a given line of business on the overall risk margin is not material.

(C) Cases of small undertakings for which the more advanced calculations of the risk margin may be very time-consuming compared to the undertakings available (human) resources.

In such cases the method based on a percentage of the best estimate may be deemed as sufficiently accurate.

3.337 It should be stressed that there is a considerable difference between alternative A and alternatives B and C as described in the previous paragraph. While in alternative A it is assumed that the undertaking has carried out a more detailed calculation of the risk margin at least once, alternatives B and C presuppose that some prescribed percentages (per line of business) are readily available for the undertaking. Accordingly, the use of alternative A may in practise be limited to cases where the time-consuming aspect of the risk margin calculations is the issue at stake. On the other hand, the use of alternative B and C may be justified also in other settings.

3.338 At the outset, the cases referred to in the previous paragraphs should in principle apply to lines of business within both life and non-life insurance – given that the indicated criteria for using the various simplifications are fulfilled.

3.339 However, it seems likely that only alternative A will be relevant for the lines of business within life insurance. For these lines of business it will in any case be necessary to carry out at least one calculation of the risk margin being more detailed than the one based on percentages of the best estimate, in order to have an idea regarding the level/size of the percentages (i.e. the $a_{lob}$s) to be used. In addition, it should be noted that in practise it will turn out to be very difficult to find a set of such percentages

being applicable for life insurance undertakings in all EU/EEA-states. Finally, it should be stressed that a life insurance undertaking should be expected to know the duration of its obligations and accordingly it should be able to apply at least the duration approach as described in para 3.323-3.328 above.

3.340 The statement in the previous paragraph regarding knowledge of the duration of obligations applies in general also for the lines of business within non-life insurance. However, it may be argued that it is premature to rule out from the very beginning that e.g. small and medium-sized non-life insurance undertakings – in a similar manner as in QIS4 – may need simplifications like the ones indicated by alternative B and C above.

3.341 In order for a non-life insurance undertaking to be able to use alternative B or C as sketched above a set of estimated percentages needs to be available and therefore procedures for fixing these parameters as well as updating them need to be elaborated.

3.342 A possible approach could be to update the percentages per lines of (non-life) business as used in the QIS4-exercise by taking into account the feedback received on these parameters.

3.343 However, even for the lines of business within non-life insurance it may turn out to be difficult to come up with percentages that can be considered as reasonable for undertakings (allowed to use this simplification) in all EU/EEA-states. An alternative approach that may be worthwhile to consider could be to estimate

(i) regional percentages for at least some lines of business (e.g. the most heterogeneous lines of business); or

(ii) different percentage for some homogenous risk groups (or sub-lines of business) within the most heterogeneous lines of business,

to the extent that such approaches can be considered to be in line with the Level 1 text. In any case the more detailed work on this issue would be a task for the Level 3 guidance.

*Simplifications for individual modules and sub-modules*

3.344 As already explained in the sub-section on the hierarchy of simplifications (para 3.276-3.285, level no. 3 and 4 of the hierarchy should be prioritised at the present stage of the work regarding simplifications. However, a more sophisticated approach to the simplifications would be to focus on the individual modules or sub-modules in order to approximate the individual risks and/or sub-risks covered by the relevant modules.

3.345 In practise, this would require that the undertakings look closer at the risks and sub-risks being relevant for the following modules:

- underwriting risk (life, health and non-life, respectively),
- counterparty default risk with respect to ceded reinsurance and SPVs, and

- unavoidable market risk,

in order to investigate to what extent the calculations could be simplified or approximated.

3.346 In the following paragraphs some proposals for such simplifications are put forward and the main aspects of the simplifications are briefly explained. These proposals are in to a large extent based on the proposals put forward in the QIS4 Technical Specifications or the CP on simplifications for the SCR calculations.

*Life Underwriting Risk*

3.347 In the QIS4 Technical Specifications simplifications were described for all sub-modules regarding life underwriting risk (life mortality risk, life longevity risk, life disability risk etc.).

3.348 With respect to the capital charges for mortality, longevity and disability risk the simplifications allowed for in QIS4 concerned the following aspects (of the assumptions for the calculations):

- the permanent increase/decrease ("the shock") of the "baseline" mortality and "baseline" disability, respectively,
- the expected average death rate / disability inception rate over the next year,
- the projected mortality/disability increase and
- the modified duration of the liability cash flows.

3.349 With respect to the other sub-modules the simplified calculations allowed for in QIS4 may be summarised as follows:

(a) Lapse risk: A simple factor-based (multiplicative) method taking into account an increase (decrease) in the assumed lapsation rates for policies with expected positive (negative) surrender strains.

(b) Expenses risk: A fixed (initial) shock of the renewal expenses combined with the impact of changes in the future expected expense inflation.

(c) Revision risk and life catastrophe risk: A fixed percentage applied to suitable bases of calculation (the net technical provisions for annuities (exposed to revision risk) and the capital at risk, respectively).

3.350 The simplifications given by the QIS4 Technical Specifications are assessed in CP on simplified calculations in the standard formula for SCR. With respect to mortality, longevity and disability risk the conclusion is that the main structure of the simplified calculation of capital charges for these risks should be kept. However, the shock applied to the "baseline" mortality is increased for mortality risk. Moreover, with respect to disability a distinction has been introduced between the first and the subsequent run-off years regarding the expected movement from healthy to sick. See the summary description in annex C.

*Health Underwriting Risk*

3.351 The structure of the health underwriting risk module has been substantially changed compared to the version described in the QIS4 Technical Specifications, cf. CP 50 (SCR standard formula – Health underwriting risk module). As a consequence the simplifications used in the context of health underwriting risk in the QIS4 exercise are no longer valid.

3.352 According to CP on simplified calculations in the SCR standard formula, the simplifications applied in the life underwriting module can in general be applied also in the sub-module for SLT health underwriting risk, i.e. for health insurance obligations pursued on a similar basis as life insurance. However, some adjustment should be made regarding revision risk (inflation risk should be included), while no simplifications are proposed for health catastrophe risk.

3.353 With respect to the sub-module for non-SLT health underwriting risk, the simplifications introduced for the non-life underwriting risk (if any) should be used.

*Non-life Underwriting Risk*

3.354 Within the context of simplifications for individual modules and sub-modules, there seems to be no obvious manner in which the formula (per se) applied for calculating the capital charges for premium and reserve risk can be simplified.

3.355 However, the calculation of the future SCRs related to premium and reserve risk will be somewhat simplified due to the fact that renewals and future business are not taken into account:

- If the premium volume in year $t$ is small compared to the reserve volume, then the premium volume (for the individual lines of business) for year $t$ can be set to 0. An example may be the lines of business comprising no multiple-year contracts, where the premium volume can be set to 0 for all future years $t$ where $t \geq 1$.
- If the premium volume is zero, then the capital charge for non-life underwriting can be approximated by the formula:

  $$3 \cdot \sigma_{(res,mod)} \cdot PCO_{Net,lob}(t)$$

  where $\sigma_{(res,mod)}$ represents the standard deviation for reserve risk and $PCO_{Net,lob}(t)$ the best estimate provision for claims outstanding net of reinsurance in year $t$.

3.356 As a further simplification it can be assumed that the undertaking-specific estimate of the standard deviation for premium risk and reserve risk (for the individual lines of business) remain unchanged throughout the years.

3.357 Also the underwriting risk charge for catastrophe risk should be taken into account only with respect to the insurance contracts that exist at $t = 0$. With respect to the present and future capital charge for this risk further simplifications may be applied for allocating this charge to the individual lines of business, e.g. by using the earned premiums net of reinsurance per line of business as weights.

*Counterparty Default Risk*

3.358 The counterparty default risk charge with respect to reinsurance ceded can be calculated directly from the definition for each segment and each year. If the exposure to the default of the reinsurers does not vary considerably throughout the development years, the risk charge can be approximated by applying reinsurers' share of best estimates to the level of risk charge that is observed in year 0.

3.359 According to the standard formula counterparty default risk for reinsurance ceded is assessed for the whole portfolio instead of separate segments. If the risk of default in a segment is deemed to be similar to the total default risk or if the default risk in a segment is of negligible importance then the risk charge can be arrived at by applying reinsurers' share of best estimates to the level of the total capital charge for reinsurers' default risk in year 0.

*Unavoidable Market Risk*

3.360 As explained in CP42 on the risk margin, the main case of unavoidable market risk is an unavoidable mismatch between the cash-flows of the insurance liabilities and the financial instruments available to cover the liabilities. In particular, such a mismatch is unavoidable if the maturity of the available financial instruments is lower than the maturity of the insurance liabilities. If such a mismatch exists it usually leads to a capital requirement for interest rate risk under the downward scenario. The focus of the simplification is on this particular kind of market risk.

3.361 The contribution of the unavoidable market risk to the risk margin may be approximated as follows for a given line of business:

$$CoCM_{lob,Mkt} \approx CoC \cdot UM_{RU,lob,\geq 0}$$

where *CoC* is the Cost-of-Capital rate, while the approximated sum of the present and future SCRs covering the unavoidable market risk ($UM_{RU,lob,\geq 0}$) is calculated as follows:

$$UM_{RU,lob,\geq 0} = max\{0.5 \cdot BE_{Net,lob}(0) \cdot (Dur_{mod,lob} - n)\ (Dur_{mod,lob} - n + 1) \cdot \Delta r_n;\ 0\}$$

where

$BE_{Net,lob}(0)$ = the best estimate net of reinsurance as assessed at time $t = 0$ for the undertaking's portfolio of (re)insurance liabilities in the given line of business;

$Dur_{mod,lob}$ = the modified duration of the undertaking's (re)insurance liabilities net of reinsurance in the given line of business at $t = 0$;

$n$ = the longest duration of available risk-free financial instruments (or composition of instruments) to cover the (re)insurance liabilities in the given line of business; and

$\Delta r_n$ = the absolute decrease of the risk-free interest rate for maturity $n$ under the downward stress scenario of the interest rate risk sub-module.

3.362 The calculations should be carried out per currency (for the individual lines of business where the unavoidable market risk is assumed to be material.

3.363 The calculation method sketched may also be applied in the context of a proportional method (cf. para 3.301-3.312) or a duration method (cf. para 3.313-3.333) – given that the necessary adjustments are made in the relevant formulas.

3.364 It should, however, be noted that in cases where the longest duration of the risk-free financial instruments is low compared to the modified duration of the insurance liabilities, the unavoidable market risk may have a huge impact on the overall risk margin. This is especially the case if the rather crude approximation sketched in para 3.361 is applied. In these cases the undertaking may find it worthwhile to use more accurate simplifications, e.g. by taking into account the fact that the best estimate (of technical provisions) to be applied in the calculation of unavoidable market risk in general will decrease over time. Moreover, the calculations may be carried out in a manner that reflects the risk-reducing effect of technical provisions (e.g. future bonuses), cf. the reference to this aspect in para 3.295 above.

3.365 A further explanation of the technical aspects of this simplification is given in annex D.

## CEIOPS' Advice

### Simplifications regarding risk margin

3.366 As a general principle, where an (re)insurance undertaking applies a simplified valuation method, this should be proportionate to the underlying risks and compatible with the Solvency II valuation principles.[85] This would apply irrespectively of whether the method is specified under Level 2 implementing measures or not.

3.367 As aforementioned, and as a general approach, especially in respect of best estimates simplifications, CEIOPS advises not to introduce an exhaustive list of methods and techniques as level 2 implementing measures for the estimation of the best estimate, and would prefer to keep such methods and techniques as level 3 guidance.

3.368 However, CEIOPS recognizes that the risk margin is a specific area where additional considerations should be included in the level 2 text, due to the complexity and uncertainty around the calculation methodology, see para 3.369-3.372 below. Moreover, CEIOPS would support flexibility for undertakings to use other simplified methods or techniques, provided they can demonstrate that these are appropriate.

3.369 If a full projection of all future SCRs is necessary in order to capture the undertaking's risk profile – for all or some lines of business – the undertaking is expected to carry out these calculations.

3.370 When an undertaking considers whether or not it would be appropriate to apply a simplified valuation technique for the risk margin, it should carry out separate assessments at least for each line of business. This means that a decision to use simplifications in one line of business should have no definitive impact on the decisions made for other lines of business. As an integral part of this assessment, the undertaking should consider what kind of simplified methods would be most appropriate for the given line of business. The chosen method should be proportionate to the nature, scale and complexity of the risks in the line of business in question.

3.371 When the undertaking has decided to use a simplified method for a given line of business, it should consider whether the method could be used for the projections of the overall SCR (for the given line of business) or if the relevant (sub-)risks should be projected separately. In this context, the undertaking should also consider whether it should carry out the simplified projections of future SCRs individually for each future year or if it is possible to calculate all future SCRs in one step – but still for a given line of business.

3.372 Based on the general principles and criteria referred to above, the following hierarchy could be seen as a possible decision basis regarding

[85] Cf. section 3.1.

the methods to be used for projecting future SCRs per line of business:

(1) make a full calculation of all future SCRs[86] without using simplifications;

(2) approximate the individual risks or sub-risks within some or all modules and sub-modules to be used for the calculation of future SCRs;

(3) approximate the whole SCR for each future year, e.g. by using a proportional approach; and

(4) estimate all future SCRs "at once", e.g. by using an approximation based on the duration approach.

(5) approximate the risk margin by calculating it as a percentage of the best estimate.

[86] Note that, where all future SCRs have been projected, it should be straightforward to calculate the risk margin according to the general formula set out in CEIOPS' Consultation Paper CP 42 on the calculation of the risk margin in technical provisions.

## 3.4. Reinsurance recoverables

### 3.4.1. Life reinsurance

3.373 The calculation of the amounts of recoverable from reinsurance contracts and special purpose vehicles shall comply with Article 76 to 80 (Article 81). This means that in accordance with CP 39 (Article 3.63) the calculation of the amount of recoverable from reinsurance contract of life insurance business should based on policy-by-policy approach[87].

3.374 According to CP 39_09 on methodologies to calculate the best estimate, the undertakings are allowed to calculate the probability-weighted average cash-flows of recoverables or probability-weighted average cash flows of net payments to policyholders. The cash flow of expected recoverables or net payments to policyholders should take into account the time difference between recoveries and direct payment and time value of money.

3.375 For the calculation of the probability-weighted average cash-flow of the recoverables or net payments to the policyholder the same simplifications as for the calculation of best estimate of life insurance policies could be applied.

3.376 The result from the calculation shall be adjusted to take account of the expected losses due to the default of the counterparty (Article 81). To adjust the result for expected loss of the default of counterparty the simplification proposed below could be applied.

### 3.4.2. Non-life reinsurance

3.377 This sub-section considers the use of simplified approaches for the determination of non-life reinsurance recoverables and technical provisions net of reinsurance.

3.378 The approaches considered represent Gross-to-Net techniques meaning that it is presupposed that an estimate of the technical provisions gross of reinsurance (compatible with the Solvency II valuation principles) is already available. The techniques are applied to derive estimates of reinsurance recoverables and the provisions net of reinsurance on basis of these gross estimates.

3.379 A special feature of the Gross-to-Net techniques is that they represent an indirect approach for calculating the value of reinsurance recoverables (the reinsurance assets), since following such techniques the value of reinsurance recoverables is derived in a subsequent step as the excess of the gross over the net estimate. Accordingly, this sub-section considers how such an indirect approach could be designed to be compatible with the Solvency II Framework and in particular Article 81 of the Level 1 text.

3.380 This sub-section is also intended to provide a conceptual framework for the use of Gross-to-Net techniques under Solvency II, supplementing

[87] Suitable model points are permitted in accordance with CP 39_09

CEIOPS's draft advice on the valuation of reinsurance recoverables contained in the consultation paper on Article 86(a).

3.381 Finally, it should be noted that where this sub-section addresses the issue of recoverables (and corresponding net valuations), this is restricted to recoverables from reinsurance contracts, and does not include consideration of recoverables from SPVs.

*Relevant implementing measures*

3.382 According to the last paragraph of Article 77(2) of the Level 1 text

*"[t]he best estimate shall be calculated gross, without deduction of the amounts recoverable from reinsurance contracts and special purpose vehicles".*

Moreover, with respect to the reinsurance recoverables the first paragraph of Article 81 states that

*"[t]he calculation by insurance and reinsurance undertakings of amounts recoverable from reinsurance contracts and special purpose vehicles shall comply with Articles 76 to 80".*

Hence the Level 1 text foresees that the calculation of technical provisions gross of reinsurance and the calculation of reinsurance recoverables (or reinsurance assets) should be carried out separately by applying compatible methodologies. However, Articles 76-80 of the Level 1 text contain no direct reference to the calculation of technical provisions net of reinsurance. [88]

3.383 A similar observation can be made regarding Article 86 on implementing measures and especially the part of this Article covering simplifications. According to point (h) the Commission shall adopt implementing measures laying down

*"simplified methods and techniques to calculate technical provisions, in order to ensure the actuarial and statistical methods referred to in points (a) and (d) are proportionate to the nature, scale and complexity of the risks supported by insurance and reinsurance undertakings including captive insurance and reinsurance undertakings".*

3.384 In the present context it should be noted that point (h) of Article 86 refers to point (a) of the same Article which again refers back to Article 77(2). As already noted the latter Article covers only the calculation of technical provisions gross of reinsurance. However, since the estimation of reinsurance recoverables should comply with Article 76-80, it seems likely that any implementing measures (including measures on simplifications) specified for the technical provisions gross of reinsurance will apply to the estimation of reinsurance recoverables as well.[89]

3.385 From the previous paragraphs it follows that a careful reading of the Level 1 text may lead to the conclusion that the technical provisions net of reinsurance should be calculated as the difference between the

[88] Note that within Pillar 1 of the Solvency II framework the value of technical provisions net of reinsurance will be needed, for example as an input parameter for the determination of the SCR using the standard formula.
[89] With respect to implementing measures for the reinsurance recoverables Article 86 only refers to "the methodologies to be used when calculating the counterparty default adjustment", cf. point (g) of this Article.

(estimated) technical provisions gross of reinsurance and the (estimated) reinsurance recoverables. However, from a practical perspective it seems (more) likely that the wording of the Level 1 text should not prevent methods of calculations – including simplifications – whereby the technical provisions net of reinsurance is estimated in a first step, while an estimate of the reinsurance recoverables is fixed as a residual (i.e. as the difference between the estimated technical provisions gross and net of reinsurance, respectively). Accordingly, this approach has been chosen in the following discussion of the Gross-to-Net techniques that may be applied in the context of non-life insurance.

*Gross-to-net techniques*

3.386 Annex E of this paper contains a detailed analysis of the gross-to-net techniques ("proxies") developed in the *Report on Proxies* elaborated by CEIOPS/Groupe Consultatif Coordination Group[90] as well as the gross-to-net techniques which were tested (based on the recommendations contained in this report) in the QIS4 exercise.

3.387 This description of gross-to-net techniques has been included purely for informational purposes; it is intended to provide an overview on the range and technical specificities of such methods developed so far. CEIOPS considers that further technical work may be relevant, for example as additional level 3 guidance.

#### 3.4.2.1. Analysis

3.388 This sub-section considers in general terms under which circumstances it would be appropriate to use gross-to-net techniques for a valuation of net technical provisions (and, following this, reinsurance recoverables) under the Solvency II framework, having regard to the proportionality assessment framework outlined in section 3.1.

3.389 It first considers the compatibility of such techniques with the valuation principles set out in the Level 1 text. Further to this, the potential scope of an application of gross-to-net techniques is analysed. Finally, it is considered which level of detail/granularity would generally be needed in an application of gross-to-net techniques.

3.390 In the advice, these considerations are used for setting general high-level criteria to be followed by an (re)insurance undertaking applying gross-to-net techniques under the Solvency II framework.

#### 3.4.2.2. Compatibility of Gross-to-Net Calculations with the Level 1 Text

*Reinsurance recoverables and net technical provisions*

3.391 As has been set out, the determination of reinsurance recoverables should follow the same principles as for the determination of gross technical provisions (i.e. it shall comply with Articles 76 to 80 of the Level 1 text), with an additional adjustment (imposed by Article 81) to take into account of expected losses due to counterparty defaults.

[90] CEIOPS/Groupe Consultatif Coordination Group: "Report on Proxies", July 2008.

3.392 In this context, the technical provisions net of reinsurance are given (defined) as the difference between the technical provisions gross of reinsurance and the reinsurance recoverables:

**Net provisions = gross provisions – reinsurance recoverables**

*Role of gross-to-net techniques in Solvency II Framework*

3.393 The technical "gross-to-net" methods considered in this sub-section are designed to calculate the value of net technical provisions in a direct manner, by converting best estimates of technical provisions gross of reinsurance to best estimates of technical provisions net of reinsurance. The value of the reinsurance recoverables is then given as the excess of the gross over the net valuation:

**Reinsurance recoverables = gross provisions – net provisions**

3.394 It is noted that the level 1 text contains no direct reference to any such gross-to-net methods. However, since a determination of the value of technical provisions net of reinsurance gives rise to a determination of reinsurance recoverables (and vice versa), an application of gross-to-net valuation techniques – and more broadly of any methods to derive net valuations of technical provisions – may be integrated into the Solvency II Framework by using a three-step approach as follows:

- **Step 1**: Derive valuation of technical provisions net of reinsurance.
- **Step 2**: Determine reinsurance recoverables as difference between gross and net valuations.
- **Step 3**: Assess whether valuation of reinsurance recoverables is compatible with Article 81.

In the following, these steps are examined in more detail.

*Step 1:<u>Derivation of technical provisions net of reinsurance</u>*

3.395 The starting point for this step is a valuation of technical provisions gross of reinsurance. For non-life insurance obligations, the value of gross technical provisions would generally be split into the following components per homogeneous group of risk or (as a minimum) lines of business:[91]

$PP_{Gross}$ = the best estimate of premiums provisions gross of reinsurance;
$PCO_{Gross}$ = the best estimate of claims provisions gross of reinsurance; and
RM = the risk margin.[92]

3.396 From this, a valuation of the best estimate technical provisions net of reinsurance within a given homogeneous risk group or line of business

[91] Note that according to Article 80 insurers shall segment their insurance obligations into homogeneous risk groups or – as a minimum – lines of business when calculating their technical provisions.
[92] This analysis assumes that the risk margin is not split further into a premium provision part and a claims provision part (following QIS4 specifications). It also assumes that the risk margin is calculated net of reinsurance.

may be derived by applying Gross-to-Net techniques to the best estimates components referred to above.[93]

3.397 The technical provisions net of reinsurance in the given homogeneous risk group or line of business would then exhibit the same components as the gross provisions, i.e.

$PP_{Net}$ = the best estimate of premiums provisions net of reinsurance;
$PCO_{Net}$ = the best estimate of claims provisions net of reinsurance; and
RM = the risk margin.

*Step 2:Determination of reinsurance recoverables as difference between gross and net valuations*

3.398 On basis of the results of step 1, the reinsurance recoverables (RR) per homogenous risk groups (or lines of business) may be calculated as follows (using the notation as introduced above):

$$\mathbf{RR = (PP_{Gross} - PP_{Net}) + (PCO_{Gross} - PCO_{Net})}$$

3.399 Note that implicitly this calculation assumes that the value of reinsurance recoverables does not need to be decomposed into best estimate and risk margin components.

*Step 3: Assessment of compatibility of reinsurance recoverables with Article 81*

3.400 In this step, it would need to be assessed whether the determination of the reinsurance recoverables in step 2 is consistent with Article 81 of the Level 1 text.

3.401 In particular, this would require an analysis as to whether the issues referred to in the second and third paragraph of Article 81, i.e. the time difference between direct payments and recoveries and the expected losses due to counterparty risks, were taken into account. Additional level 3 guidance may be provided.

3.402 To achieve consistency with the required adjustment related to expected losses due to counterparty defaults, it would generally be necessary to integrate an analogous adjustment into the determination of net of reinsurance valuation components in step 1. Such an adjustment would need to be treated separately (in the context of Article 86(g) as well as the relevant aspects of the SCR counterparty risk module) and would not be covered by one of the gross-to-net techniques discussed in this sub-section.

### 3.4.2.3. The Scope of Gross-to-Net Techniques

3.403 It follows from the summary of the QIS4-results that Gross-to-Net techniques[94] have been extensively used by all kind of participating non-life insurance undertakings (irrespectively of their size). This illustrates

[93] Alternatively, the best estimates net of reinsurance may also be derived directly, e.g. on basis of triangles with net of reinsurance claims data.
[94] Cf. annex B.

clearly the present difficulties of applying Article 81 to calculate reinsurance recoverables (reinsurance assets) in a direct manner.

3.404 Accordingly, it seems reasonable that an option to use simplified gross-to-net techniques – following their integration under the Solvency II Framework as illustrated in this advice - should apply to all non-life insurance undertakings, including undertakings being able to stipulate the best estimate of technical provisions on a gross basis by using adequate actuarial methods and statistical techniques.

3.405 However, any gross-to-net valuation technique to be used would need to lead to a valuation which is compatible with the Solvency II valuation principles and proportionate to the underlying risks. Therefore it can be expected that the Gross-to-Net methods to be applied would in general need to be more sophisticated than the Gross-to-Net proxies tested in QIS4. (This is especially the case for the proxy based on the ratio of net to gross provisions for RBNS-claims of a reference portfolio.)

3.406 Moreover, non-life insurance undertakings would be expected to use of Gross-to-Net methods in a flexible way be applying them to either premium provisions or provisions for claims outstanding or to a subset of lines of business or accident (underwriting) years, having regard to e.g. the complexity of their reinsurance programmes, the availability of relevant data, the importance (significance) of the sub-portfolios in question or by using other relevant criteria.

3.407 An undertaking would typically use a simplified Gross-to-Net technique when e.g.

- The undertaking has not directly estimated the net best estimate
- The undertaking has used a case by case approach for estimating the gross best estimate.
- The undertaking cannot ensure the appropriateness, completeness and accuracy of the data.
- The underlying reinsurance programme has changed

### 3.4.3. Degree of Detail and Corresponding Principles/Criteria

3.408 It seems unlikely that a Gross-to-Net simplified technique being applied to the overall portfolio of a non-life insurance undertaking would give reliable and reasonably accurate approximations of the best estimate of technical provisions net of reinsurance.[95] Accordingly, non-life insurance undertakings should in general carry out the Gross-to-Net calculations at a sufficiently granular level. In order to achieve this level of granularity a suitable starting point would be:

- to distinguish between homogenous risk groups or as a minimum lines of business;
- to distinguish between the premiums provisions and provisions for claims outstanding (for a given homogenous risk group or line of business); and

[95] A possible exception may be a monoline insurer that has kept its reinsurance programme unchanged over time.

- with respect to the provisions for claims outstanding, to distinguish between the accident years not finally developed and – if the necessary data is available and of sufficient quality – to distinguish further between provisions for RBNS-claims and IBNR-claims, respectively.

3.409 A further refinement that may need to be applied when stipulating the Gross-to-Net techniques would be to take into account the type of reinsurance cover and especially the relevant (i.e. most important) characteristics of this cover.

3.410 Below, the technical options being available to carry out Gross-to-Net valuations at a more granular level are analysed in more detail.

3.411 When applying such refinements, the following general considerations should be made:

- Whereas increasing the granularity of Gross-to-Net techniques will generally lead to a more risk-sensitive measurement, it will also increase their complexity, potentially leading to additional implementation costs for the undertaking. Therefore, following the principle of proportionality, a more granular approach should only be chosen where this is necessary regarding the nature, scale and complexity of the underlying risks (and in particular the corresponding reinsurance program).
- For certain kinds of reinsurance covers (e.g. in cases where the cover extends across several lines of business, so that it is difficult to allocate the effect of the reinsurance risk mitigation to individual lines of business or even homogeneous groups of risk, or where the cover is only with respect to certain perils of a LOB), increasing the granularity of Gross-to-Net techniques as described below will not suffice to derive an adequate determination of provisions net of reinsurance. In such cases, individual approaches tailored to the specific reinsurance cover in question would need to be used.
- As an alternative to Gross-to-Net calculations, it may be contemplated to use a direct calculation of net provisions based on triangular claims data on a net basis. However, it should be noted that such a technique would generally require adjustments of the underlying data triangle in order to take into account changes in the reinsurance program over time, and therefore would generally be rather resource intensive. Also, an application of such "direct" techniques may not yield a better quality valuation than an application of more granular Gross-to-Net techniques as discussed below.

### 3.4.4. Distinguishing between lines of business

3.412 There are several reasons for distinguishing between lines of business when stipulating Gross-to-Net techniques:

- An insurance undertaking's reinsurance programme may differ substantially between lines of business (where the undertaking is operating).

- Even if the undertaking's reinsurance programme is the same for all lines of business, the impact of this programme on the technical provisions may differ substantially between the lines of business due to e.g. differences between the relevant claims distributions and especially whether the line of business is exposed to large claims or not.

3.413 All five types of Gross-to-Net techniques briefly described in annex E.1 should in principle be able to capture the distinction between lines of business. However, for the Gross-to-Net technique based on historic accounting data only (i.e. type (1)), this is likely to depend on the reporting requirements in force. Moreover, the Gross-to-Net technique based on the premium model (i.e. type (5)) applies – for obvious reasons – only to the premium provisions.

### 3.4.5. Distinguishing between premium provisions and provisions for claims outstanding

3.414 For both the premium provisions and the provisions for claims outstanding it is assumed at the outset that the Gross-to-Net methods should be stipulated for the individual lines of business.

*Premium provisions*

3.415 With respect to the premium provisions, the relationship between the provisions on a gross basis (PPGross,k), the provisions on a net basis (PPNet,k) and the Gross-to-Net "factor" (GNk(ck)) – for line of business (or homogeneous risk group) no. k – can be represented in a somewhat simplified manner as follows:[96]

$$\mathbf{PP_{Net,k} = GN_k(c_k) \times PP_{Gross,k}},$$

where $\mathbf{c}_k$ is a parameter-vector representing the relevant characteristics of the reinsurance programme covering the CBNI claims related to line of business no. k at the balance sheet day.

3.416 With respect to the various types of Gross-to-Net techniques briefly described in annex E.1, it is only the alternative approaches (4) and (5) that in general are able to stipulate Gross-to-Net techniques to be used for converting best estimates of gross premium provisions to best estimates of net premiums provisions.

3.417 However, if the reinsurance programme for the current accident year (the current business year) is the same as the programme for the preceding year(s), type (2) or (3) – or a combination of these – may also be used in this context, in the context of this advice.

3.418 For lines of business where premiums, claims and technical provisions are related to the underwriting year (and not the accident year), the distinction between premium provisions and provisions for claims outstanding is not clear-cut. In these cases the technical provisions related to the last underwriting year comprise both premiums provisions and provisions for

[96] For the sake of simplicity it is assumed that the Gross-to-Net techniques in question can be represented by a multiplicative factor to be applied on the gross provisions.

claims outstanding[97] and the distinction between Gross-to-Net techniques for the two kinds of technical provisions makes no sense.

*Provisions for claims outstanding*

3.419 With respect to the provisions for claims outstanding, separate Gross-to-Net techniques should be stipulated for each accident year not finally developed (for a given line of business (or homogenous risk group)). Accordingly, the relationship between the provisions on a gross basis ($PCO_{Gross,k,i}$), the provisions on a net basis ($PCO_{Net,k,i}$) and the Gross-to-Net "factor" ($GN_{k,i}(\mathbf{c}_{,k,i})$) for line of business (or homogeneous risk group) no. k and accident year no. i, can be represented in a somewhat simplified manner as follows:

$$\mathbf{PCO_{Net,k,i} = GN_{k,i}(c_{k,i}) \times PCO_{Gross,k,i}},$$

where $c_{k,i}$ is a parameter-vector representing the relevant characteristics of the reinsurance programme for this combination of line of business and accident year.

3.420 With respect to the types of Gross-to-Net approaches described in annex E.1, type no. (2), (3) and (5) can be applied to stipulate techniques proxies for the individual accident years (for a given line of business), cf. also the description of the most advanced Gross-to-Net technique tested in QIS4.

3.421 However, some refinements of these methods may be considered in order to make the Gross-to-Net techniques more sophisticated:

a) stipulation of separate Gross-to-Net techniques for individual development years or a suitable grouping of the development years (for a given accident year);

b) stipulation of separate Gross-to-Net techniques for RBNS-claims and IBNR-claims;[98]

c) stipulation of separate Gross-to-Net techniques for "large" claims and "small" claims ("frequency" claims) – given some suitable thresholds for the separation of "large" and "small" claims; and

d) stipulation of separate Gross-to-Net techniques for proportional and non-proportional reinsurance programs.

3.422 A rationale for introducing separate techniques for the individual development years or groups of development years may be that claims reported and settled at an early stage (after the end of the relevant accident year) in general have a claims distribution that differs from the distribution of claims reported and/or settled at a later stage. Accordingly, the impact of a given reinsurance programme (i.e. the ratio between expected claims payments on a net basis and expected claims on a gross basis) will differ between development years or groups of development years.

3.423 A rationale for introducing separate techniques for RBNS-claims and IBNR-claims may be that the insurance undertakings in general will have more

[97] If the line of business in question contains multiyear contracts this will be the case for several of the latest underwriting years.

[98] For this purpose it should be clarified whether the so-called IBNER-claims should be included in the RBNS-claims or the IBNR-claims.

information regarding the RBNS-claims and should accordingly be able to stipulate the Gross-to-Net technique to be applied on the gross best estimate for RBNS-provisions in a more accurate manner. On the other hand the Gross-to-Net technique to be applied on the gross best estimate for IBNR-provisions is then likely to be stipulated in a less precise manner, especially if more sophisticated techniques are not available.

3.424 Finally, a rationale for making a split between "large" claims and "small" claims may be that the uncertainties related to expected claim amounts on a net basis for claims classified as "large" may in some (important) cases be small or even negligible compared to the uncertainties related to the corresponding claim amounts on a gross basis. However, this supposition depends (at least partially) on the thresholds for separation of "large" and "small" claims being fixed for the individual lines of business.

3.425 None of the Gross-to-Net techniques briefly described in annex E are able to capture all these refinements, even if some aspects related to refinements (a) and (b) are touched upon (in an indirect manner) when discussing the properties of the most advanced Gross-to-Net techniques tested in QIS4. Moreover, it would be relatively straightforward to adjust type no. (5) in order to capture refinement (c) and to some extent also refinement (a).

3.426 However, in order to take into account these (possible) refinements it will in general be necessary to develop more sophisticated techniques than those being described in annex E. On the other hand, these refinements should only be introduced if they in fact lead to an increased accuracy of the best estimate of provisions for claims outstanding net of reinsurance.

3.427 In this context, it may be argued that refinement (c) should be prioritised as this may be relevant for as least some of the commercial lines of business and is probably also the easiest refinement to implement. Before introducing this refinement it should also be considered whether the thresholds to be fixed in order to separate "large" and "small" claims could depend on the size of the undertaking (or the size of undertaking's portfolio within the line of business in question) or the nature of the reinsurance programme.

### 3.4.6. Simplified calculation of the adjustment for counterparty default

3.428 Article 81 of the Level 1 text stipulates that recoverables from reinsurance contracts or special purpose vehicles shall take account of expected losses due to default of the counterparty. This should be done in two steps. Firstly, the recoverables are calculated without an allowance for counterparty default. Secondly, an adjustment for counterparty default is applied to the result of the first step (see CEIOPS Advice CP 44_09, for details of the calculation of the adjustment).

3.429 In many cases, in particular if the counterparty is of good credit quality, the adjustment for counterparty default will be rather small compared to the reinsurance recoverables. At the same time, a sophisticated calculation of the adjustment can be a very complex task. In order to reduce the burden of the calculation of the adjustment on the undertaking, it appears appropriate to provide a simplification for the calculation of the adjustment. The simplified calculation can be defined as follows:

$$Adj_{CD} = -\max\left((1-RR)\cdot BE_{\mathrm{Re}c}\cdot Dur_{\mathrm{mod}}\cdot\frac{PD}{1-PD};0\right),$$

where

$Adj_{CD}$ = Adjustment for counterparty default

$RR$ = Recovery rate of the counterparty

$BE_{Rec}$ = Best estimate of recoverables taking not account of expected loss due to default of the counterparty

$Dur_{mod}$ = Modified duration of the recoverables

$PD$ = Probability of default of the counterparty for the time horizon of one year

3.430 A derivation of the formula can be found in the Annex F.

3.431 The simplification should only be applied if the adjustment can be expected to be small and there are no indications that the simplification formula leads to a significant underestimation.

3.432 Since the simplification depends to a certain extent on the values estimated for the parameters RR and PD, for the sake of harmonization and comparability, CEIOPS might develop level 3 guidance setting out appropriate values for these parameters, values which would apply those undertakings with insufficient resources to derive reliably RR and PD according a market consistent methodology.

3.433 Such values would be updated on regular basis to guarantee they are consistent with the information available in financial markets. The table included in annex G offers an example of how harmonization and comparability might be achieved with the relevant level 3 guidance.

## CEIOPS' Advice

### Simplifications regarding reinsurance recoverables, including adjustment for counterparty default

3.434 The determination of reinsurance recoverables should follow the same principles as for the determination of gross technical provisions (i.e. it shall comply with Articles 76 to 80 of the Level 1 text), with an additional adjustment (imposed by Article 81) to take into account of expected losses due to counterparty defaults.

3.435 As a simplification, reinsurance recoverables may be calculated in an indirect manner as the difference between the technical provisions gross of reinsurance and the technical provisions net of reinsurance given that the technical provisions net of reinsurance have been adjusted for the expected losses due to the counterparty default.

3.436 For the valuation of technical provisions gross and net of reinsurance,respectively, the same risk margin – based on a net calculation in accordance with the implementing measures on the risk margin–should be used, meaning that the calculation of the reinsurance recoverables (*RR*) could be further simplified as follows:

$RR = BE_{Gross} - BE_{Net}$, where

$BE_{Gross}$ = the best estimate gross of reinsurance; and

$BE_{Net}$ = the best estimate net of reinsurance.

Accordingly, the reinsurance recoverables should not include a risk margin component.

3.437 To calculate technical provisions net of reinsurance, (re)insurance undertakings should be allowed to apply gross-to-net techniques provided that:

- The criteria set out in this advice are met; and
- Further refinements have been made where this would be necessary to ensure that the gross-to-net technique applied is proportionate to the underlying risks.

The undertaking should assess the appropriateness of an application of gross-to-net techniques by conducting a proportionality assessment as outlined in section 3.1.

3.438 Within a given homogeneous risk group or line of business, the Gross-to-Net techniques shall be applied separately to each of the best estimate components gross of reinsurance, leading to the same best estimate components net of reinsurance as gross of reinsurance.

3.439 The reinsurance recoverables per homogenous risk groups (or lines of business) could then be calculated as the sum of the differences between the best estimate technical provisions gross and net of reinsurance for the premium provision and the claims provisions, respectively.

3.440 When applying Gross-to-Net techniques it should be assessed whether an allowance for the expected counterparty defaults is reflected in a satisfactory/sufficient manner in the best estimate net

of reinsurance.

3.441 The calculation of the best estimate net of reinsurance and of the reinsurance recoverables should be carried out at a level being sufficiently granular with respect to the impact of reinsurance programmes within the various homogenous risk groups or lines of business and with respect to the impact of changes in the reinsurance programm over time.

3.442 Where Gross-to-Net techniques are applied, the following conditions should be met:

- With respect to premium provisions, the applied Gross-to-Net techniques should as a minimum distinguish between lines of business.
- With respect to claims provisions, the applied Gross-to-Net techniques should as a minimum distinguish between lines of business and – for a given line of business – between the accident years not finally developed.

3.443 Appropriate level 3 guidance may be developed in respect the variables used in the simplifications regarding the adjustment of reinsurance recoverables to take into account the expected losses due counterparty default.

## 3.5. Quarterly calculations

3.444 According to Article 129(4) of the Level 1 text, the MCR needs to be calculated quarterly. This implies a quarterly calculation of technical provisions because this item is required

- for the calculation of the own funds that can be used to cover the MCR; and
- for the calculation of the MCR itself where the underlying formula is based on the best estimate of technical provisions.

3.445 The calculation of technical provisions between the annual reporting dates may give rise to additional practicably issues. For example, the data basis of the undertaking may not be adequate for this task. In non-life insurance, undertakings often collect data on an annual basis, i.e. ordered per accident year, underwriting year, run-off year etc. In order to make a full quarterly calculation of claims provisions, a data basis with a finer granularity, for example per accident quarter, underwriting quarter etc. is necessary. Undertakings may not have organised their data in this way in the past and it may take some time to do so. Approximations may be necessary in the meantime to produce the quarterly claims provisions.

3.446 Another example are calculations which are so resource intensive that – compared to a partial recalculation – their full repetition during the year may not be in proportion with the additional information the calculation provides. In these cases, it may be appropriate to update the key variables of the calculations (like interest rates) while other variables with little influence on the results may be approximated.

3.447 In the application of the proportionality principle, the particular challenges of quarterly calculations of technical provisions should be taken into account.

*Quarterly calculations specific to the risk margin*

3.448 As explained in the introduction to this section, quarterly calculations of the technical provisions (i.e. both the best estimate and the risk margin) are required due to the MCR-calculations. It may also be circumstances where an insurance undertaking will have to calculate its technical provisions even more frequently[99].

3.449 With respect to the risk margin, simplified calculations during the year could be allowed due to several reasons:

(a) the calculations are time consuming,

(b) the calculations are based on figures that are not easily available during the year.

In this context it should be stressed that the risk margin depends heavily on the (present and future) SCRs and that full calculations of the SCRs are in general not carried out during the year.

[99] It is worthwhile to clarify that the quarterly calculation of SCR needed for the floor and ceiling of the MCR can be carried out according to simplified methods.

3.450 It seems reasonable to base the simplified calculations of the risk margin to be carried out during the year on the risk margin calculated at the beginning of the year. Since no full calculations of the SCR are carried out during the year a likely candidate for these simplifications may be to fix the risk margin for an individual line of business at a given point in time during the forthcoming year (i.e. $CoCM_{lob}(t)$) as follows:

$$CoCM_{lob}(t) = (CoCM_{lob}(0)/BE_{Net,lob}(0))\cdot BE_{Net,lob}(t), \quad 0 < t < 1,$$

where

$CoCM_{lob}(0)$ = the risk margin as calculated at time $t = 0$ for the reference undertaking's portfolio of (re)insurance obligations in an individual line of business,

$BE_{Net,lob}(0)$ = the best estimate technical provisions net of reinsurance as assessed at time $t = 0$ for the reference undertaking's portfolio of (re)insurance obligations in an individual line of business; and

$BE_{Net,lob}(t)$ = the best estimate technical provisions net of reinsurance as assessed at time $t$ for the reference undertaking's portfolio of (re)insurance obligations in an individual line of business.

3.451 It may be inappropriate to apply this formula in cases where the best estimates are expected to decrease, in relative terms to the business, e.g. in cases of negative best estimates or best estimates close to zero. Furthermore, there may be situations, such as run-off undertakings, that may deserve specific analysis. Therefore, Level 3 guidance may be developed to define the situations where this formula may be used or where it should not be used, as for all the other admissible simplifications.

3.452 According to this simplification the ratio of the risk margin to the best estimate technical provisions (net of reinsurance) will stay constant during the year. It should, however, be noted that this approximation has some drawbacks. Since Solvency II allows for profit at inception, a strong increase of an undertaking's business may in the short term lead to both a lower best estimate and a higher duration of the obligations. In this case the simplification sketched in paragraph 3.440 leads to a lower risk margin, while an increased risk margin would be expected due to the increased duration of the liabilities. Accordingly, in this case it may be a better approximation to let the risk margin stay unchanged during the year (i.e. $CoCM_{lob}(t) = CoCM_{lob}(0)$).

3.453 A combination of the two approaches described in the previous paragraphs is also possible, e.g. by fixing the risk margin at the beginning of the year as a floor for the risk margin to be used during the year, that is

$$CoCM_{lob}(t) = max\{(CoCM_{lob}(0)/BE_{Net,lob}(0))\cdot BE_{Net,lob}(t);\ CoCM_{lob}(0)\}.$$

3.454 If it can be assumed that the relative distribution of insurance obligations among lines of business will be reasonably stable during the year, an alternative approach for calculating the risk margin during the year could

be to use the simplified calculation of the SCR to fix the overall risk margin during the year (*CoCM(t)*). This can be done e.g. in the following manner:

$$CoCM(t) = (CoCM(0)/SCR(0))\cdot SCR(t), \quad 0 < t < 1,$$

where *CoCM(0)* and *SCR(0)* is the overall risk margin and the SCR at the beginning of the year, respectively, while *SCR(t*) is the SCR calculated during the year (by a simplified method).

3.455 In a second step the overall risk margin could be allocated to the individual lines of business in the same proportion as at the beginning of the year, that is

$$CoCM_{lob}(t) = (CoCM_{lob}(0)/CoCM(0))\cdot CoCM(t), \quad 0 < t < 1.$$

3.456 This approach takes into account that the risk margin depends heavily on the SCR. However, it is the present and future SCRs related to the reference undertaking and not the SCRs for the original undertaking that are used in connection with the risk margin calculations. Accordingly, in this simplification it is implicitly assumed that the changes in the SCRs related to the original undertaking are reasonable proxies for the changes in the SCRs related to the reference undertaking.

3.457 All methods referred to above seem to have drawbacks and it may be premature at the present stage to recommend any specific method to be used in the calculations of the risk margin during the year.

3.458 However, as the undertakings are getting more experienced with how the calculation of technical provisions works under the Solvency II framework, including how the best estimate of technical provisions may vary during the year, simplified methods as those indicated in the previous paragraphs may be refined and probably make it easier to make recommendations with respect to the method(s) to be applied as default simplification(s).

## CEIOPS' Advice

### Quarterly calculations

3.459 In the application of the proportionality principle, the particular challenges of quarterly calculations of technical provisions should be taken into account.

3.460 *Risk margin. Simplified calculations during the year.* A likely candidate for these simplifications may be to stipulate the risk margin for an individual line of business at a given point in time during the forthcoming year (i.e. $CoCM_{lob}(t)$) as follows:

$$CoCM_{lob}(t) = CoCM_{lob}(0) \cdot BE_{Net,lob}(t)/BE_{Net,lob}(0), \quad 0 < t < 1,$$

where

$CoCM_{lob}(0)$ = the risk margin as calculated at time $t = 0$ for the reference undertaking's portfolio of (re)insurance obligations in an individual line of business,

$BE_{Net,lob}(0)$ = the best estimate technical provisions net of reinsurance as assessed at time $t = 0$ for the reference undertaking's portfolio of (re)insurance obligations in an individual line of business; *and*

$BE_{Net,lob}(t)$ = the best estimate technical provisions net of reinsurance as assessed at time $t$ for the reference undertaking's portfolio of (re)insurance obligations in an individual line of business.

3.461 It may be inappropriate to apply this formula in cases where the best estimates are expected to decrease, in relative terms to the business, e.g. in cases of negative best estimates or best estimates close to zero. Furthermore, there may be situations, such as run-off undertakings, that may deserve specific analysis. Therefore, level 3 guidance may be developed to define the features of the situations where this formula may or may be used or should not be used, as for all the other admissible simplifications.

## Annex A. Example to illustrate the first method of simplification to calculate the best estimate of incurred but not reported claims provision.

General formulation.

The final estimate of this technical provision is derived from the following expression, where just for illustrative purposes a three-year period of observation has been considered (the adaptation of the formula for longer series is immediate):

$$\text{IBNR reserve year } t = C_t \times N_t \quad ,$$

where

$C_t$ = average cost of IBNR claims, after taking into account inflation and discounting. This cost should be based on the average cost of claims reported in the year t. Since a part of the overall cost of claims reported in the year t comes from provisions, a correction for the possible bias should be applied.

and

$N_t = R_t * Av$, being

$$AV = \left[ \left(N_{t-1} / p_1\right) + \left(N_{t-2} / p_2\right) + N_{t-3} \right] / \left[ R_{t-1} + R_{t-2} + R_{t-3} \right]$$

Furthermore, in these expressions

$N_{t-i}$ = number of claims incurred but not reported at the end of the year t-i, independently of the accident year (to assess the number of IBNR claims all the information known by the undertaking till the end of the year t should be included).

$P_1$= percentage of IBNR claims at the end of year t-3 that have been reported during the year t-2

$p_2$= percentage of IBNR claims at the end of year t-3 that have been reported during the years t-2 and t-1

$R_{t-i}$= claims reported in year t, independently of accident year.

It should be noted that the sufficiency of this method should be regularly checked using run-off results.

Numeric example

Assuming as date of reference of the valuation December the 31st of 2008, the undertaking has the following information:

N_2007 = 90

N_2006 = 100

N_2005 = 100 (85 reported in 2006 and 10 reported in 2007)

furthermore

R_2008 = 10.500 ; R_2007 = 8.500

R_2006 = 8.200 ; R_2005 = 8.700

The overall cost of claims reported in 2008 amounts 11.000.000 €, from which 5.500.000 € are case reserves ( with an estimated bias = 0.9 ).

The estimated inflation for 2009, 2010 and 2011 is 5 per cent (every year). The discounting rate is 4 per cent for the same years.

The claims reported every year are paid in a 50% the year of reporting, the year after is paid the 35%, and the third year is paid the 15% (this is an estimation based on entity experience or market experience).

Solution

| | | | |
|---|---|---|---|
| Bias correction = | 6.111.111 | | |
| | 11.611.111 | | |
| 50% = | 5.805.556 | 6.095.833 | 5.861.378 |
| 35% = | 4.063.889 | 4.480.438 | 4.142.416 |
| 15% = | 1.741.667 | 2.016.197 | 1.792.392 |
| After bias correction and inflation+discounting= | | | 11.796.186 |
| Overall cost of claims reported in 2008 = | | | 11.796.186 |
| | | C2008 = | 1.123 |
| | | p1= | 0,85 |
| | | p2= | 0,95 |
| N2007/p1= | 106 | N2006/p2= | 105 |
| N2008= | 129 | | |
| IBNR reserve = | 144.501,20 € | | |

If the average cost of IBNR claims is different to the average cost of reported claims, $C_t$ can be adjusted.

This method needs at least four years of experience. Thius, in case of new undertakings or a new line of business this simplification does not apply.

## Annex B. Some technical aspects regarding the discount factors to be used in the calculation of the risk margin

B.1. The purpose of this annex is to explain in some detail the discount factors to be used in the calculation of the risk margin, cf. the general approach for these calculations described in subsection 3.3.1.

B.2. In a first step the usual formula for the calculation of the risk margin is presented. In a second step the corresponding scenario is described and thereby the appropriateness of the risk margin formula is verified.

### Definition of the risk margin

B.3. The following nomenclature is applied:

- Let the risk relating to the obligations run off within $n$ years. Thus, it is sufficient to consider the time period which spans from $t$=0 (valuation date) to $t$=$n$.

- Let $CoCM_0$ be the risk margin for the transferred insurance obligations at the time of transfer. After transfer, the obligations run off. This has an effect on the risk margin that the reference undertaking has to reserve. Let $CoCM_1,\ldots,CoCM_{n-1}$ be the Cost of capital margins at $t$=0,…,$n$ respectively.

- Let $SCR_0$, …,$SCR_{n-1}$ be the Solvency Capital Requirements of the reference undertaking in relation to the transferred insurance obligations at $t$=0,…,$n$ respectively.

- Let $CoC$ denote the Cost-of-Capital rate.

- Let $r_{(1,0)},\ldots,r_{(n,0)}$ be the relevant risk-free rates at $t$=0 for the maturities 1,…,$n$ respectively. Let $r_{(m,k)}$ ($k$=1,…,$n$ and $m$=1,…,$n$-$k$) be the corresponding risk-free forward rates at $t$=$k$ for maturity $m$.

B.4. The risk margin at $t$=0 can be calculated according to the formula as follows:

$$CoCM_0 = CoC \cdot \sum_{s=0}^{n-1} \frac{SCR_s}{(1 + r_{(s+1,0)})^{s+1}}.$$

B.5. Please note that owing to some conceptual changes the discounting of the margin may be a cause of irritation. In QIS3 the summand $SCR_s$ was discounted with the factor $1/(1+r_{(s,0)})^s$ instead of $1/(1+r_{(s+1,0)})^{s+1}$ (see II.1.14 of the QIS3 Technical Specifications). The QIS4 Technical Specifications did not stipulate the way of discounting in detail. But the QIS4 helper tab applied the formula defined above. The analysis of the capitalisation scenario will verify that the above definition is correct for the purposes of the Level 1 text.

B.6. The formula for the risk margin at $t$=0 implies a similar formula for the risk margin at $t$=$k$ as follows:

$$CoCM_k = CoC \cdot \sum_{s=k}^{n-1} \frac{SCR_s}{(1 + r_{(s+1,k)})^{s+1}}.$$

B.7. If the reference undertaking covers $CoCM_k$ with risk-free assets that match the cash-flow pattern of the formula, then these assets earn during the year from $t=k$ to $t=k+1$ an interest of

$$CoC \cdot \sum_{s=k}^{n-1} r_{(s,k)} \frac{SCR_s}{(1 + r_{(s+1,k)})^{s+1}},$$

and the unwinding of the margin in that year (including the interest) yields an expected profit of $CoC \cdot SCR_k$ as can easily be calculated

**The capitalisation scenario**

B.8. The reference undertaking receives the obligations as well as assets to cover best estimate and risk margin from the original insurer. The reference undertaking has no own funds to cover the SCR relating to the obligations. In order to meet the capital requirement, the reference undertaking requests external capital of the amount SCR0 for one year. The interest on this capital is CoC+r(1,0), so in return, the reference undertaking has to pay back the amount (1+CoC+r(1,0))·SCR0 at the end of the year.

B.9. Under the assumption that the obligations run off according to best estimate assumption, the position of the reference undertaking at the end of the year ($t=1$) is as follows:

- The development of the best estimate does not affect own funds: the assets covering the best estimate in t=0 plus the risk-free rate earned during the year equal the claims payments during the year and best estimate at the end of the year.
- The unwinding of the risk margin produces own funds of the amount $CoC \cdot SCR_0$.
- The assets covering $SCR_0$ earn a risk-free rate of $r_{(1,0)} \cdot SCR_0$.
- The repayment of the capital reduces own funds by $(1+CoC+r_{(1,0)}) \cdot SCR_0$.

To sum up, the own funds of the reference undertaking are reduced by the amount $SCR_0$, so that own funds are zero again.

B.10. Therefore, the reference undertaking is at $t=1$ in the same situation as at $t=0$. It has to raise new capital of the amount $SCR_1$ in order to meet the SCR. The process outlined above can be iterated until run-off of the liabilities. At $t=n$, the reference undertaking is relieved from the insurance obligation and no own funds will be left.

B.11. This proves that the formula stated in this advice is in line with the risk margin definition of the Level 1 text. In particular, the way of discounting

is accurate because the payment of the amount $CoC \cdot SCR_s$ is made at $t=s+1$.[100]

[100] Indeed, the reference undertaking could agree with the capital provider to pay the spread $CoC \cdot SCR_s$ in advance at $t=s$. But then the value of the spread would be $CoC \cdot SCR_s/(1+r_{(1,s)})$.

## Annex C. Further comments regarding simplifications for sub-modules under the life underwriting risk

C.1. In this annex an overview of the most common simplifications for life underwriting risk that can be used on level no. 2 of the basic decision hierarchy are given. These methods, used to assess the capital charge for the sub-risks under the life underwriting risk, are presented in more detail in CEIOPS Advice rgarding simplifications of the SCR. They can be used both to assess the present and the future capital charges for the sub-modules.

C.2. In order to be able to use the simplifications to assess the capital charge for future years, all the relevant input data – the duration of the liabilities, the total capital at risk for the mortality sub-risk, the best estimate of technical provision for the longevity sub-risk, the expected average biometrical intensities, and so on – would have to be estimated for each future year t during the liabilities lifetime.

C.3. Mortality risk: The capital charge for mortality risk can be taken as 15 per cent (the mortality shock rate) of the product of the following factors:

- the total capital at risk,
- an undertaking-specific expected average death rate over the next year (weighted by the sum assured),
- the modified duration of the liability cash-flows and
- the Projected Mortality Increase ($1.1^{((n-1)/2)}$), cf. the assumption that the average mortality rate of the portfolio, due to age, increases over the period corresponding to the length of the duration with 10 per cent a year.

C.4. Longevity risk: The capital charge for longevity risk can be taken as 25 per cent (the longevity shock rate) of the product of the following factors:

- the technical provisions (the best estimate) for contracts subject to longevity risk,
- an undertaking-specific expected average death rate over the next year (weighted by the sum assured),
- the modified duration of the liability cash-flows and
- the Projected Mortality Increase

C.5. Disability risk: The capital charge for disability risk can be taken as the sum of

- the capital requirement for an increase of 50 per cent in morbidity/ disability inception rates for the first year,
- the capital requirement for an increase of morbidity/disability inception rates by 25 per cent for all subsequent years and
- the capital requirement in respect of the risk that the duration of claims is greater than expected, represented by a 20 per cent decrease in the termination rates, where the individual elements are calculated as sketched below.

C.6. The individual elements sketched in the previous paragraphs should be calculated by using the following bases of calculation:

(a) For the increased morbidity/disability inception rates during the first year, the product of the following factors:

- the total disability capital at risk (in year one) and
- an undertaking-specific expected average rate of transition from healthy to sick over the first year (weighted by the sum assured/ annual payment).

(b) For the increased morbidity/disability inception rates during all subsequent years, the product of the following factors:

- the total disability capital at risk in year two,
- an undertaking-specific expected average rate of transition from healthy to sick over the second year (weighted by the sum assured/annual payment),
- the modified duration of the liability cash-flows diminished by one and
- the Projected Disability Increase ($1.1^{((n-2)/2)}$), cf. the assumption that the average disability rate of the portfolio, due to age, increases over the period corresponding to the length of the duration with 10 per cent a year.

(c) With respect to the risk that the duration of claims is greater than expected, 20 per cent the product of the following factors:

- technical Provisions for contracts subject to longevity risk,
- an undertaking-specific expected termination rate (i.e. average rate of transition from sick to healthy/dead over the next year),
- the modified duration of the liability cash-flows and
- the Projected Disability Increase ($1.1^{((n-1)/2)}$).

## Annex D. Additional comments regarding the formula for unavoidable market risk

D.1. The main steps in deriving the simplification formula for the unavoidable market risk are briefly explained in the following paragraphs.

D.2. The SCR for unavoidable interest rate risk at $t$=0 ($UM_{(int,0)}$) can be approximated by a duration approach as follows:

$$UM_{(int,0)} \approx BE_{Net}(0)\cdot Dur_{mod}\cdot \Delta r_n - BE_{Net}(0)\cdot n\cdot \Delta r_n = BE_{Net}(0)\cdot (Dur_{mod}-n)\cdot \Delta r_n$$

D.3. This calculation is based on the assumption that the liabilities are covered by assets with duration $n$ and market value $BE_{Net}(0)$. For reasons of simplicity the interest rate stress is not differentiated according to maturity; instead the stress that is defined for maturity $n$ is applied to all maturities.

D.4. For the risk at $t$=1 the calculation can be repeated as follows:

$$UM_{(int,1)} \approx BE_{Net}(0)\cdot (Dur_{mod}-1)\cdot \Delta r_n - BE_{Net}(0)\cdot n\cdot \Delta r_n$$

$$= BE_{Net}(0)\cdot (Dur_{mod}-n-1)\cdot \Delta r_n$$

In this step, the additional assumption is made that the duration of the insurance liabilities after one year are decreased by 1. Furthermore, it is assumed that the value of the best estimate does not change significantly during the first run-off year.

D.5. For the risk in the following years $t$, $1<t<Dur_{mod}-n$, the same approach is applied to derive an approximation of the unavoidable interest rate risk in the respective year, that is

$$UM_{(int,t)} \approx BE_{Net}(0)\cdot (Dur_{mod}-t)\cdot \Delta r_n - BE_{Net}(0)\cdot n\cdot \Delta r_n$$

$$= BE_{Net}(0)\cdot (Dur_{mod}-n-t)\cdot \Delta r_n$$

For these steps too the additional assumptions are made that the duration of the insurance liabilities after $t$ years will decrease by $t$ and the value of the best estimate will not change significantly during the first $t$ run-off years.

D.6. Once the duration of the insurance liabilities becomes lower than $n$, i.e. $Dur_{mod}-t<n$, no further interest rate risk needs to be taken into account.

D.7. Summing up the contributions for each year results in the approximated sum $UM_{RU,\text{lob},\geq 0}$ of the present and future SCRs covering the unavoidable market risk:

$$UM_{RU,lob,\geq 0} = max\{\sum_{t\geq 0}^{t\leq Dur_{mod}-n} UM_{(int,t)}\,;\, 0\}$$

$$= max\{\sum_{t\geq 0}^{t\leq Dur_{mod}-n} BE_{Net}(0)\cdot(Dur_{mod}-n-t)\cdot\Delta r_n;\, 0\}$$

$$= max\{0.5\cdot BE_{Net,lob}(0)\cdot(Dur_{mod,lob}-n)\ (Dur_{mod,lob}-n+1)\cdot\Delta r_n;\, 0\}$$

D.8. Note that – apart from approximating the yearly capital charge for unavoidable market risk – further simplifications have been introduced by summing the estimated capital charges without taking into account the time value of money, i.e. the estimated capital charges for unavoidable market risk at time *t* are summed without discounting them with the risk-free interest rate curve.

## Annex E. Gross-to-net techniques.

E.1. This annex contains an analysis of the gross-to-net techniques ("proxies") developed in the *Report on Proxies* elaborated by CEIOPS/Groupe Consultatif Coordination Group[101] as well as the gross-to-net techniques which were tested (based on the recommendations contained in this report) in the QIS4 exercise.

E.2. This description of gross-to-net techniques has been included purely for informational purposes; it is intended to provide an overview on the range and technical specificities of such methods developed so far. CEIOPS considers that further technical work may be relevant, for example as additional level 3 guidance.

### The Report on Proxies

E.3. Issues related to the use of Gross-to-Net proxies are discussed in some detail in the "Report on Proxies" elaborated by CEIOPS/Groupe Consultatif Coordination Group. At the outset Gross-to-Net proxies are defined as proxies that "transform a gross of reinsurance estimate into a net estimate"[102] and as such used in combination with proxies for stipulating the technical provisions gross of reinsurance. Moreover, it is stated in the report that

*"Gross-to-net proxies are used to convert best estimates of claims or premium provisions into best estimates net of reinsurance, in cases where there is not enough (technically feasible) data to directly derive net estimates."*[103]

E.4. The report on proxies contains a list of 10-12 Gross-to-Net proxies that have been considered by the national proxy expert groups.[104] A majority of the considered Gross-to-Net proxies is based on accounting data (in a broad sense), including:

(1) Historic accounting figures.[105]

(2) Gross and net cumulated cash-flows (paid claims) per accident (or underwriting) year.

(3) Gross and net provisions for reported but not settled (RBNS) claims (also referred to as case reserves) per accident (or underwriting) year.[106]

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101 CEIOPS/Groupe Consultatif Coordination Group:"Report on Proxies", July 2008, http://www.ceiops.eu/media/docman/public_files/consultations/Final%20Report%20on%20Proxies%20clean.pdf

102 "Report on Proxies", page 36.

103 "Report on Proxies", page 76. This statement may be interpreted as if the ultimate goal is to derive an estimate of the technical provisions net of reinsurance in a direct manner. It should, however, be clarified that this approach is in line with the last paragraph of Article 77(2) and Article 81.

104 "Report on Proxies", page 76-79.

105 It is not (always) explained what is meant by historic accounting figures in this context, i.e. whether these figures comprise gross and net technical provisions only or also gross and net claims cost.

106 In the following all references to accident years apply to underwriting years as well – unless otherwise stated explicitly

E.5. The considered proxies based on accounting figures include also combinations of case (2) and (3), e.g. proxies where cumulated paid claims and RBNS-provisions, both gross and net of reinsurance, are applied when calculating the IBNR-provisions net of reinsurance.

E.6. The application criteria for the various Gross-to-Net proxies referred to in the report are not always explained. However, some comments regarding these criteria may be given:

- With respect to the Gross-to-Net proxies based on historic accounting figures only it is in general not possible to distinguish between the individual accident years. However, it may be possible to distinguish between insurance classes or lines of business (depending on e.g. the reporting requirements in force).
- Therefore, in order for these proxies to lead to reasonable results, it would be necessary to assume that the reinsurance programme and probably also the composition of the portfolio is stable over time.
- On the other hand, Gross-to-Net proxies based on cumulated claims payments or provisions for RBNS claims (or both) can be stipulated for individual lines of business as well as for individual accident years (for a given line of business). In these cases it is not necessary to presuppose that the reinsurance programme is stable over time.
- The considered Gross-to-Net proxies are first and foremost designed for calculating provisions for claims outstanding ("post claims") net of reinsurance – whether these calculations distinguish between RBNS-provisions and IBNR-provisions or not. However, some of the considered proxies may be used when calculating the premium provisions ("pre claims") net of reinsurance, although the degree of accuracy/ precision may be less in these cases, cf. also the alternative proxies.
- It is tacitly assumed that the accounting figures referred to in cases (1)–(3) above are undertaking-specific and as such must be available for undertakings that want to apply these Gross-to-Net proxies. However, it should be possible to use market data (e.g. risk statistics for the overall market) – in combination with some basic characteristics of (simplified) reinsurance treaties – in order to establish Gross-to-Net proxies for individual lines of business and individual accident years (for a given line of business), cf. e.g. case (5) referred to below.

E.7. The list of Gross-to-Net proxies referred to in the report on proxies comprises also two proxies that go beyond the application of accounting data:

(4) The first of these alternative proxies applies the premium model for the line of business in question (based on e.g. separate estimation of claim frequencies and claim severities) in order to derive the percentage of the expected claims costs being reinsured and uses this information as a basis for stipulating the Gross-to-Net proxy.

(5) The other alternative proxy is using available market data (per line of business) regarding the (empirical) distribution of single claim amounts to establish ratios between:

i. the expected value of a (random) single claim net of reinsurance and
ii. the expected value of a (random) single claim gross of reinsurance

for a prescribed set of excess points of a simplified (pure) excess-of-loss treaty.

These ratios are then used in combination with e.g. suitable inter-polation-techniques to stipulate Gross-to-Net proxies for the following cases:

i. excess-of-loss covers only,
ii. combinations of proportional reinsurance covers and excess-of-loss covers.

E.8. These alternative Gross-to-Net proxies could be applied for the individual lines of business as well as for the individual accident years (for a given line of business).

**The QIS4 Technical Specifications**

E.9. With respect to QIS4, the report on proxies proposed to test only two different designs of the Gross-to-Net proxies, both of them based on accounting data (in a broad sense):[107]

- one based on the provisions for RBNS claims ("case reserves") and
- one based on cumulated cash flows (i.e. cumulated claims payments).

These testing proposals were incorporated into the Technical Specifications (TS) without further changes.[108]

E.10. This choice to narrow down the range of Gross-to-Net techniques for the purposes of QIS4 was made in order to keep the technical specifications sufficiently simple and practical.

E.11. The main aspects of these testing proposals are summarised below.

*Gross-to-Net-proxy based on provisions for RBNS-claims ("case reserves")*

E.12. This proxy uses a ratio of net over gross provisions of an available portfolio A in order to estimate the net provisions of another portfolio B ($NP_B$) based on the observable gross provisions of portfolio B ($GP_B$). In other words, the Gross-to-Net proxy (GN) is stipulated as

$$\mathbf{GN = NP_A/GP_A},$$

where $NP_A$ and $GP_A$ represents the net and gross provisions of portfolio A, respectively. Then this proxy is applied to calculate the net provisions for portfolio B as follows:

$$\mathbf{NP_B = GN \times GP_B}.$$

E.13. However, it is not clear from the QIS4 TS whether the purpose of this proxy is to calculate the overall net provisions for claims outstanding or only the net provisions for RBNS-claims

[107] "Report on Proxies", page 79.
[108] QIS4 Technical Specifications (MARKT/2505/08), page 85-88.

E.14. The following criteria should be fulfilled in order to apply this proxy:

- The benchmark portfolio (A) should be similar to the portfolio (B) for which the proxy is used, cf. the principle of substance over form.
- The ratio (GN) should be established by means of credible and sustainable data. This requires a data set exceeding at least two years.

E.15. With respect to the properties of this proxy the QIS4 TS state that[109]

*"ceded reinsurance varies with the size, the financial soundness and the risk aversion of a company, so that particular care is required when applying a ratio of net over gross from another benchmark portfolio. Such an approach should therefore only be used in cases where the benchmark portfolio is known to have a very similar nature as the own portfolio. Even if this is the case, however, the cession percentage for non-proportional reinsurance will heavily depend on the actual occurrence of large losses, and therefore be very volatile."*

*Gross-to-Net-proxy based on cumulated paid claims (cumulated cash-flows)*

E.16. This proxy derives an estimate of net provisions for claims outstanding by using the gross provisions for claims outstanding in combination with an estimate of the impact of the reinsurance covers for the individual accident years.[110]

E.17. With respect to the rationale for using this proxy, it is noticed that for past accident years the reinsurance structure for an individual year is known and will (likely) not change retroactively. Accordingly, a comparison of net over gross cumulated cash flows per line of business in the past – differentiated by accident year – may be used to derive an estimate of the impact of proportional and non-proportional reinsurance for the individual accident year (i.e. a Gross-to-Net proxy for the individual accident year).

E.18. For each line of business the Gross-to-Net proxies for the accident years not finally developed ($GN_i$) are stipulated as follows:

$$\mathbf{GN_i = A_{Net,i,n-i}/A_{Gross,i,n-i},}$$

where $A_{Gross,i,n-i}$ and $A_{Net,i,n-i}$ represent the cumulated paid claims gross and net of reinsurance, respectively, and n is the latest accident year with observed values of these cash-flows.

E.19. These proxies are then used to calculate the net provisions for claims outstanding for the individual accident years, that is

$$\mathbf{PCO_{Net,i} = GN_i \times PCO_{Gross,i},}$$

where $PCO_{Gross,i}$ and $PCO_{Net,i}$ represent the gross and net provisions for claims outstanding for accident year i, respectively.

E.20. In order to apply this proxy both gross and net cumulated paid claims (gross and net cash flows) per accident year need to be available for each line of business.

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109 QIS4 Technical Specifications, page 86.

110 The following description is somewhat simplified and shortened compared to the description given in QIS4 TS.

E.21. The QIS4 TS briefly explain some of the properties of this proxy:

- For newer accident years and especially the last accident year (where i=n) the stipulated proxy might be a bit too high due to the fact that the IBNR claims are likely to constitute a large part of the provisions for claims outstanding.[111] Accordingly, the stipulated proxy is likely to lead to an overestimation of the net provisions in these cases.
- The Gross-to-Net proxies referred to above concern the provisions for claims outstanding. For the premium provisions, i.e. the provisions for (covered but not incurred) claims related to the current accident (business) year (where i=n+1), a Gross-to-Net proxy can be stipulated by using the (anticipated) proportional part of the reinsurance cover for this year. This will be a conservative approach for the ceding (re)insurance undertaking, since the impact of the non-proportional reinsurance for the current accident (business) year is not taken into account.

**The QIS4 Results**

E.22. The use of Gross-to-Net proxies in QIS4 is summarised as follows in CEIOPS' QIS4-report (see the sub-section 7.2.5 on simplifications and proxies):[112]

*"Concerning reinsurance, only few undertakings were able to determine amounts relating to reinsurance recoverables (or net figures) by applying actuarial reserving techniques based on reinsured or net triangular claims data. Instead, many participants used triangle analysis techniques only for the calculation of best estimates gross of reinsurance, and derived the reinsurer's part of gross provisions by applying one of the two Gross-to-Net proxies. The wide use of Gross-to-Net proxies underlines that it is difficult for the undertakings to get data net of reinsurance.*

*However, some undertakings remarked that an application of this proxy[113] may lead to poor results in the case of excess loss covers, where the risk mitigating effect of the reinsurance cover would be underestimated. It was also remarked that the use of both types of Gross-to-Net proxies described in the specifications on the same portfolio sometimes resulted in materially different valuations.*

*A similar situation could be observed with regard to the determination of premium provisions, where only a few participants were capable of carrying out an actuarial projection of future cash flows arising from future claim events. …"*

E.23. Some further comments are given regarding the participating undertakings' experience with the Gross-to-Net proxies stipulated for QIS4-purposes (see sub-section 7.3.3 on best estimates in non-life insurance):[114]

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111 The underlying assumption seems to be that the gross amounts of IBNR-claims on average are higher than the average gross amounts of paid claims and RBNS-claims. Accordingly, the impact of the reinsurance cover is likely to be larger for IBNR-claims than for paid claims and RBNS-claims.

112 "CEIOPS' Report on its fourth Quantitative Impact Study (QIS4) for Solvency II", page 80.

113 CEIOPS' Report on QIS4 does not state which of tested proxies that these undertakings refer to.

114 CEIOPS' Report on QIS4, page 107.

*"The gross-to-net proxy was used by some undertakings as net claims data triangles are unsuitable for immediate application of actuarial reserving techniques since they often contain irregularities.*

*Undertakings within one country commented that it is difficult to use actuarial techniques to calculate the best estimate reinsurance provision taking into account all contractual details.*

*…*

*More guidance should be developed concerning the valuation of reinsurer's shares in technical provisions. To avoid over-reliance on very simple techniques such as the Gross-to-Net Proxy, guidance on other more sophisticated actuarial techniques which would be better aligned with the true risk mitigating effect of reinsurance covers should be sought."*

E.24. As a general summary regarding the experiences from QIS4, it may be stated that the need for Gross-to-Net proxies has been confirmed, cf. the statement that many insurance undertakings have problems with determining the cash flows related to reinsurance recoverables.

E.25. On the other hand, the experience from QIS4 highlights the need to introduce clear admissibility criteria for the use of such Gross-to-Net techniques in order to ensure that the valuation of technical provisions net of reinsurance will lead to consistent results across different undertakings and markets. Also, it seems necessary to develop actuarial guidance on a range of techniques for determining net provisions to avoid an over-reliance on a few proxy techniques.

E.26. In this context it should also be noticed that the problems of identifying the cash flows related to reinsurance arrangements seem to apply to all kinds of (non-life) insurance undertakings (i.e. independent of their size) – a fact that should be taken into account when deciding on the scope of Gross-to-Net techniques for Solvency II purposes.

## Annex F. Derivation of the simplification formula for the counterparty default adjustment

F.1. Starting point of the derivation is a simple deterministic model for the recoverables as follows:

$$BE_{Rec} = \sum_{t \geq 1} \frac{CF_t}{(1+r)^t},$$

where

$BE_{Rec}$ = Best estimate of recoverables taking not account of expected loss due to default of the counterparty

$CF_t$ = Expected cash-flow underlying the recoverable at the end of year $t$

$r$ = Risk-free rate (a flat curve is assumed)

F.2. Let $PD$ be the probability that the counterparty will default during the next year and let this probability be constant over time. Let further $RR$ be the recovery rate of the counterparty. The expected loss can be approximated as follows

$$Adj_{CD} \approx -\sum_{t \geq 1} \frac{(1-(1-PD)^t) \cdot (1-RR) \cdot CF_t}{(1+r)^t}$$

$$= -(1-RR) \cdot BE_{Rec} + (1-RR) \cdot \sum_{t \geq 1} \left( \frac{1-PD}{1+r} \right)^t \cdot CF_t$$

$$\approx -(1-RR) \cdot BE_{Rec} + (1-RR) \cdot \sum_{t \geq 1} \left( \frac{1}{1+s} \right)^t \cdot CF_t$$

where $s = r + \frac{PD}{1-PD}$. (The last approximation is based on the assumption that is $r/(1-PD) \approx r$, because $PD$ is small.)

F.3. This shows that

$$Adj_{CD} \approx -(1-RR) \cdot (BE_{Rec} - BE'_{Rec})$$

where $BE'_{Rec}$ is the best estimates of recoverables as defined above, but discounted with interest rate $s$ instead of $r$.

F.4. $BE'_{Rec}$ can be approximated by means of the duration approach as follows:

$$BE'_{Rec} \approx BE_{Rec} - Dur_{mod} \cdot (s-r) \cdot BE_{Rec}$$

$$= BE_{Rec} - Dur_{mod} \cdot \frac{PD}{1-PD} \cdot BE_{Rec},$$

where $Dur_{mod}$ denotes the modified duration of the recoverables, defined as

$$Dur_{\mathrm{mod}} = \frac{1}{BE_{\mathrm{Re}c}} \frac{1}{1+r} \sum_{t \geq 1} \frac{t \cdot CF_t}{(1+r)^t} .$$

F.5. Replacing $BE'_{Rec}$ with this approximation in the formula in paragraph F.3 yields the following result:

$$Adj_{CD} \approx -(1 - RR) \cdot Dur_{\mathrm{mod}} \cdot \frac{PD}{1 - PD} \cdot BE_{\mathrm{Re}c}$$

## Annex G. Illustrative example of further level 3 guidance to foster harmonization and comparability of the counterparty default adjustment

CEIOPS would released a table as follows to apply as part of the relevant level 3 guidance, where an undertaking has not sufficient resources to derive reliably RR and PD according a market consistent methodology.

CEIOPS would check, and review where appropriate, these values to guarantee they are, at any moment, consistent with the information available in financial markets.

Values of RR and PD in the table below are only for illustrative purposes. It is assumed that these values would be estimated (updated) according the observations of financial markets at the reference date.

| | Recovery rate | Probability of default(1) | Adjustment of best estimate of reinsurance recoverables and SPVs, acoording the duration of expected cash flows.<br>Expressed as a percentage of the best estimate.<br>( (1-RR) * PD / ( 1 – PD ) * Dur ) | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1 year | 2 year | 3 year | 4 year | 5 year |
| AAA | *50%* | *0,05%* | *0,03%* | *0,05%* | *0,08%* | *0,10%* | *0,13%* |
| AA | *45%* | *0,10%* | *0,06%* | *0,11%* | *0,17%* | *0,22%* | *0,28%* |
| A | *40%* | *0,20%* | *0,12%* | *0,24%* | *0,36%* | *0,48%* | *0,60%* |
| BBB | *35%* | *0,50%* | *0,33%* | *0,65%* | *0,98%* | *1,31%* | *1,63%* |
| BB | *20%* | *2,00%* | *1,63%* | *3,27%* | *4,90%* | *Non applicable* | |
| Others | *10%* | *10.0%* | *Simplification non applicable according 5 per cent threshold proposed in this advice* | | | | |

(1) Simplification non applicable according the 5 per cent threshold proposed in this advice

Premium provisions of annual insurance contracts may be considered as having a duration equivalent to that of the claims provision corresponding the claims occurred during the last year, plus one year.