APPENDICES TO TS17-08(10) AND TS17-08(200)

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1 Appendix 1 – Technical Provisions calculated as Best Estimate Provision plus Risk Margin

1.1 Introduction

1.1.1 Under the approach set out in CP16-04 section 3.8, the FSA's ultimate aim is that insurers are required to set up technical provisions which correspond to the economic value of the entity fulfilling its insurance obligations to policyholders and other beneficiaries arising over the lifetime of the entity's portfolio of insurance policies. The value of technical provisions should be equal to the sum of a best estimate provision and a risk margin, as described in this Appendix.

1.1.2 The best estimate provision should be calculated gross, without deduction of the amounts recoverable from reinsurance contracts and SPVs. Those amounts should be calculated separately. The valuation of recoverables is set out in paragraphs 1.2.82 to 1.2.115.

1.1.3 The calculation of the technical provisions should take account of the time value of money by using the relevant risk-free interest rate term structure which is specified in Section 1.4.

1.1.4 The FSA considers it important that the revised valuation and solvency capital adequacy assessment regime is proportionate to the characteristics of the Isle of Man's insurance industry and this will be a key aspect of developing the regime in consultation with industry. The actuarial and statistical methods used to calculate technical provisions should be proportionate to the nature, scale and complexity of the risks supported by the insurer. Guidance on the application of the proportionality principle and the specification of simplified methods can be found in Section 1.5. Possible simplified methods for the calculation of the risk margin are included in 1.3.21.

1.1.5 To achieve consistent and reliable economic values of insurance portfolios for solvency purposes, the value of technical provisions should not reflect an insurer's own credit standing.

1.1.6 However, the credit standing of a reinsurer should be taken into account when considering the solvency of a ceding (re)insurer even if the contractual cash flows are the same. The expected level of reinsurer default should be allowed for in valuing the reinsurance asset.

1.2 Best estimate provision (BEP)

Methodology for the calculation of the BEP

Appropriate methodologies for the calculation of the BEP

1.2.1 The BEP should correspond to the probability-weighted average of future cash flows taking account of the time value of money.

1.2.2 Therefore, the BEP calculation should allow for the uncertainty in the future cash flows. The calculation should consider the variability of the cash flows in order to ensure that the BEP represents the mean of the distribution of cash flow values. Allowance for uncertainty does not suggest that additional margins should be included within the BEP.

1.2.3 The BEP is the average of the outcomes of all possible scenarios, weighted according to their respective probabilities. Although, in principle, all possible scenarios should be considered, it may not be necessary, or even possible, to explicitly incorporate all possible scenarios in the valuation of the liability, nor to develop explicit probability distributions in all cases, depending on the type of risks involved and the materiality of the expected financial effect of the scenarios under consideration.

1.2.4 Cash flow characteristics that should, in principle and where relevant, be taken into consideration in the application of the valuation technique include the following:

1) Uncertainty in the timing, frequency and severity of claim events;
2) Uncertainty in claims amounts, including uncertainty in claims inflation, and in the period needed to settle and pay claims;
3) Uncertainty in the amount of expenses;
4) Uncertainty in the expected future developments that will have a material impact on the cash in- and out-flows required to settle the insurance and reinsurance obligations thereof (e.g. the value of an index/market values used to determine claim amounts). For this purpose future developments shall include demographic, legal, medical, technological, social, environmental and economic developments including inflation;
5) Uncertainty in policyholder behaviour;
6) Path dependency, where the cash flows depend not only on circumstances such as economic conditions on the cash flow date, but also on those circumstances at previous dates.

   A cash flow having no path dependency can be valued by, for example, using an assumed value of the equity market at a future point in time (and a consistent discount rate to produce a market-consistent value). However, a cash flow with path dependency would need additional assumptions as to how the level of the equity market evolved (the equity market's path) over time in order to be valued;
7) Interdependency between two or more causes of uncertainty.

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Some risk-drivers may be heavily influenced by, or even determined by, several other risk-drivers (interdependence). For example a change in a legal, tax or regulatory environment or the onset of a recession which could increase complaints or fines.

1.2.5 Insurers should use actuarial and statistical techniques for the calculation of the BEP which appropriately reflect the risks that affect the cash flows. These may include simulation methods, deterministic techniques and analytical techniques. Examples of these techniques can be found in Appendix 5.

1.2.6 For the estimation of non-life best estimates, deterministic and analytical techniques can be more appropriate.

Cash flow projections

1.2.7 The BEP should be calculated gross, without deduction of the amounts recoverable from reinsurance contracts and special purpose vehicles. Recoverables from reinsurance and special purpose vehicles should be calculated separately. In the case of co-insurance, the cash flows of each co-insurer should be calculated as their proportion of the expected cash flows without deduction of the amounts recoverable from reinsurance and special purpose vehicles.

1.2.8 Cash flow projections should reflect expected realistic future demographic, legal, medical, technological, social or economic developments over the lifetime of the insurance and reinsurance obligations.

1.2.9 Appropriate assumptions for future inflation should be built into the cash flow projection. Care should be taken to identify the type of inflation to which particular cash flows are exposed (e.g. consumer price index, salary inflation).

1.2.10 The cash flow projections, in particular for health insurance business, should take account of claims inflation and any premium adjustment clauses. It may be assumed that the effects of claims inflation and premium adjustment clauses cancel each other out in the cash flow projection, provided this approach undervalues neither the best estimate nor the risk involved with the higher cash flows involved after claims inflation and premium adjustment.

Recognition and derecognition of (re)insurance contracts for solvency purposes

1.2.11 The calculation of the BEP should only include future cash flows associated with obligations within the boundary of the contract. No future business should be taken into account for the calculation of technical provisions.

1.2.12 A reinsurance or insurance obligation should be initially recognised by insurers at a date determined by reference to the earlier of:

1) The date the insurer becomes a party to the binding contract that gives rise to the obligation; and
2) The inception date of the contract.

1.2.13 A contract should be derecognised as an existing contract only when the obligation specified in the contract is extinguished, discharged, cancelled or expires.

The boundary of an existing (re)insurance contract

1.2.14 The definition of the contract boundary should be applied in particular to decide whether options to renew the contracts, to extend the insurance coverage to another person, to extend the insurance period, to increase the insurance cover or to establish additional insurance cover gives rise to a new contract or belongs to the recognised contract. When the option belongs to the recognised contract the provisions for policyholder options should be taken into account.

1.2.15 All obligations relating to the contract, including obligations relating to unilateral rights of the insurer to renew or extend the scope of the contract and obligations that relate to paid premiums, should belong to the contract unless otherwise stated in the following paragraphs.

1.2.16 Any obligations which relate to insurance or reinsurance cover which might be provided by the insurer after any of the following dates do not belong to the contract, unless the insurer can compel the policyholder to pay the premium for those obligations:

1) The future date where the insurer has a unilateral right to terminate the contract;
2) The future date where the insurer has a unilateral right to reject premiums payable under the contract (except that obligations in respect of premiums already paid prior to that date should continue); or
3) The future date where the insurer has a unilateral right to amend the premiums or the benefits payable under the contract in such a way that the premiums fully reflect the risks.

1.2.17 Where an insurer has a unilateral right to amend, at a future date, the premiums or benefits of a portfolio of insurance or reinsurance obligations in such a way that the premiums of the portfolio fully reflect the risks covered by the portfolio, the insurer's unilateral right to amend the premiums or benefits of those obligations shall fall under point 3). For the purpose of this paragraph, a 'portfolio of insurance or reinsurance obligations' means a set of obligations for which the insurer can amend premiums and benefits under similar circumstances and with similar consequences.

1.2.18 For the purpose of 1.2.16 1) to 3), insurers and reinsurers should consider the right to terminate, reject premiums, or amend the premiums or benefits payable under the contract, as being unilateral, when neither the policyholder nor any third party can restrict the exercise of that right. For the purpose of this paragraph, third parties do not include supervisory authorities. In particular:

1) Where, in order to get the amendment of premiums and benefits into effect, the insurance or reinsurance undertaking is required to obtain an external assessment in accordance with the law or the terms or conditions of another agreement outside the insurance contract, the existence of such a requirement should limit the unilateral right of the undertaking only if the assessment gives the policy holder or any third party the right to interfere with the use of that right.
2) Insurers and reinsurers should not consider reputational risk or competitive pressures as limitations of the unilateral right.
3) Insurers and reinsurers should consider that Manx or other national laws or regulations limit their unilateral right only if these laws or regulations restrict, or give the policyholder or any third party the right to restrict, the exercise of that right. Note that it is the FSA's view that regulations such as the obligation to treat policyholders fairly are likely to restrict the exercise of this right in certain circumstances.

1.2.19 Insurers and reinsurers should disregard the right to unilaterally amend premiums or the benefits payable under the contract if the premiums or benefits payable depend solely on the decisions of the policy holder or the beneficiary.

1.2.20 Insurers and reinsurers should however ignore restrictions of the unilateral right and limitations of the extent by which premiums and benefits can be amended that have no discernible effect on the economics of the contract.

1.2.21 Some premium or benefit changes agreed upon at inception of the contract may depend on factors beyond the control of the undertaking (e.g. inflation, increase of salary). Such a change should not be considered an amendment in terms of contract boundaries provided that the same premium structure as agreed at the inception of the policy is used. For example, lapses of such policies should be considered as being policyholder behaviour in accordance with 1.2.80 to 1.2.81.

1.2.22 Where the insurer has a unilateral right as referred to in paragraph 1.2.16 that relates only to a part of the contract, the same principles as defined in paragraph 1.2.16 shall be applied to this part.

1.2.23 Insurers should regard premiums to fully reflect the risks covered by a portfolio of insurance or reinsurance obligations in accordance with 1.2.16 3), only where there is no scenario under which the amount of the benefits and expenses payable under the portfolio exceeds the amount of the premiums payable under the portfolio. For the purpose of this assessment, insurers should verify whether at the moment at which either premiums or benefits can be amended, there is no circumstance when the undertaking does not have the right to amend premiums or benefits such that the expected present value of the premiums exceeds the expected present value of benefits and expenses payable under the portfolio.

1.2.24 For the purpose of paragraphs 1.2.16, insurers shall recognise their ability to compel a policy holder to pay a premium only if the policyholder's payment is legally enforceable. For instance, the holding by the insurer of the Bank Identifier Code or credit card details of policyholders or of a direct debit mandate, shall not be characterised as a means for insurers to compel policyholders to pay the premiums in particular for contracts with scheduled future premiums.

1.2.25 (Re)insurers should, for any accepted reinsurance contracts, apply the specifications stated above independently from the boundaries of the underlying insurance or reinsurance contracts to which they relate. The boundary of a reinsurance contract may hence be different in the regulatory balance sheet of the buyer of the reinsurance when compared to the regulatory balance sheet of the seller of the reinsurance.

Time Horizon

1.2.26 The projection horizon used in the calculation of the BEP should cover the full lifetime of all the cash in- and out-flows required to settle the obligations related to existing insurance and reinsurance contracts on the date of the valuation, unless an accurate valuation can be achieved otherwise.

1.2.27 The determination of the lifetime of insurance and reinsurance obligations should be based on up-to-date, credible information and realistic assumptions about when the existing insurance and reinsurance obligations will be discharged or cancelled or expired.

Gross cash in-flows

1.2.28 To determine the BEP, the following non-exhaustive list of cash in-flows should be included:

1) Future premiums;
2) Receivables for salvage and subrogation;

1.2.29 The cash in-flows should not take into account investment returns (i.e. interests earned, dividends…).

1.2.30 Insurers and reinsurers should establish the future premium cash flows contained within the contract boundaries at the valuation date and include within the calculation of its best estimate those future premium cash flows which fall due after the valuation date.

1.2.31 Insurers and reinsurers should treat premiums which are due for payment by the valuation date as a premium receivable on its balance sheet until the cash is received.

Gross cash out-flows

1.2.32 The cash out-flows may include benefits to the policyholders or beneficiaries, expenses that will be incurred in servicing insurance and reinsurance obligations, and any other cash flow items such as:

1) Payment between the insurer or reinsurer and intermediaries related to insurance or reinsurance obligations;
2) Payments between the insurer or reinsurer and investment firms in relation to contracts with index-linked benefits;
3) Payments for salvage and subrogation to the extent they do not qualify as separate assets or liabilities in accordance with the specifications set out in Section 1 of the Technical Specifications.

Benefits

1.2.33 Examples of benefit cash out-flows are given below:

1) Claims payments;
2) Death benefits;
3) Disability benefits;
4) Surrender benefits;
5) Annuity payments;
6) Profit sharing bonuses.

Expenses

1.2.34 In determining the BEP, the insurer should take into account all cash flows arising from expenses that will be incurred in servicing all recognised insurance and reinsurance obligations over the lifetime thereof. This should include, inter alia:

1) Administrative expenses;
2) Investment management expenses;
3) Claims management expenses/handling expenses;
4) Acquisition expenses;
5) Overhead expenses included in the expenses mentioned above.

1.2.35 Expenses shall be projected on the assumption that the insurer will write new business in the future (assuming that it currently does so).

1.2.36 Insurers should consider their own analysis of expenses as well as any relevant data from external sources. Insurers should assess the availability of market data on expenses by considering the representativeness of any such external data relative to the portfolio and the credibility and reliability of that data.

1.2.37 Where average market information is used, consideration needs to be given as to the representativeness of the data used to form that average. For example, market information is not deemed to be sufficiently representative where the market information has material dispersion in representativeness of the portfolios whose data have been used to calculate such market information. The assessment of credibility considers the volume of data underlying the market information.

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1.2.38 Assumptions with respect to future expenses arising from commitments made on or prior to the date of valuation have to be appropriate and take into account the type of expenses involved. Insurers should ensure that expense assumptions allow for future changes in expenses and that such an allowance for inflation is consistent with the economic assumptions made. Future expense cash flows are usually assumed to vary with assumed rates of expense inflation in a reasonable manner.

1.2.39 Relevant market data needs to be used to determine expense assumptions which include an allowance for future cost increases. The correlation between inflation rates and interest rates should be taken into account. Insurers need to ensure that the allowance for inflation is consistent with the economic assumptions made, which could be achieved if the probabilities for each inflation scenario are consistent with probabilities implied by market interest rates. Furthermore, expense inflation must be consistent with the types of expenses being considered (e.g. different levels of inflation might be expected regarding office space rents, salaries of different types of staff, IT systems, medical expenses, etc.).

1.2.40 Any assumptions of an expected cost reduction should be realistic, objective and based on verifiable actual data and experience, and not simply on future planned actions, the feasibility and outcome of which are not certain.

1.2.41 For the assessment of the future expenses, insurers should take into account all the expenses that are directly related to the on-going administration of obligations related to existing insurance and reinsurance contracts, together with a share of the relevant overhead expenses. The share of overheads should be assessed on the basis that the insurer continues to write further new business (if it currently does). Overhead expenses should be apportioned between existing and future business based on recent analyses of the operations of the business, the identification of appropriate expense drivers and any relevant expense apportionment ratios. Cash flow projections should include, as cash out-flows, the recurrent overheads attributable to the existing business at the valuation date of the BEP.

1.2.42 In order to determine which expenses best reflect the characteristics of the underlying, insurers should consider the appropriateness of both market-consistent expenses and entity-specific expenses. If sufficiently reliable market-consistent expenses are not available, participants should use entity-specific information to determine expenses that will be incurred in servicing insurance and reinsurance obligations provided that the entity-specific information is assessed to be appropriate.

1.2.43 Expenses that are determined by contracts between the insurer and third parties should be taken into account based on the terms of the contract. In particular,

1) Commissions arising from insurance contracts have to be considered based on the terms of the contracts between the insurer and the sales persons; and
2) Expenses in respect of reinsurance are taken into account based on the contracts between the insurer and its reinsurers.

Non-life insurance obligations

1.2.44 The valuation of the best estimate for provisions for claims outstanding and for premium provisions should be carried out separately.

1.2.45 With respect to the best estimate for premium provisions, the cash-flow projections relate to claim events occurring after the valuation date and during the remaining in-force period (coverage period) of the policies held by the undertaking (recognised policies). The cash-flow projections should comprise all future claim payments and claims administration expenses arising from these events, cash-flows arising from the ongoing administration of the in-force policies and expected future premiums stemming from recognised policies falling within the contract boundary.

1.2.46 The best estimate of premium provisions from recognised insurance and reinsurance contracts should be given as the expected present value of future in- and out-going cash-flows, being a combination of, inter alia:

- cash-flows from future premiums falling within the contract boundary;
- cash-flows resulting from future claims events;
- cash-flows arising from allocated and unallocated claims administration expenses;
- cash-flows arising from ongoing administration of the in-force policies.

There is no need for the listed items to be calculated separately.

1.2.47 With regard to premium provisions, the cash in-flows could exceed the cash out-flows leading to a negative best estimate. This is acceptable and undertakings are not required to set to zero the value of the best estimate. The valuation should take account of the time value of money where risks in the remaining period would give rise to claims settlements into the future.

1.2.48 Additionally, the valuation of premium provisions should take account of future policyholder behaviour such as likelihood of policy lapse during the remaining period.

1.2.49 With respect to the best estimate for provisions for claims outstanding, the cash-flow projections relate to claim events having occurred before or at the valuation date – whether the claims arising from these events have been reported or not (i.e. all incurred but not settled claims). The cash-flow projections should comprise all future claim payments as well as claims administration expenses arising from these events.

1.2.50 In the case of non-life insurance and non-life reinsurance obligations, undertakings should allocate the expenses into homogenous risk groups, as a minimum by line of business according to the segmentation of their obligations used in the calculation of technical provisions. Undertakings should allocate the expenses of non-life insurance and reinsurance obligations to premium provisions and to provisions for claims outstanding.

1.2.51 Where non-life insurance policies give rise to the payment of annuities, the approach laid down in the following subsection on substance over form should be followed. Consistent with this, for premium provisions, its assessment should include an appropriate calculation of annuity obligations if a material amount of incurred claims is expected to give rise to the payment of annuities.

Principle of substance over form

1.2.52 When discussing valuation techniques for calculating technical provisions, it is common to refer to a distinction between a valuation based on life techniques and a valuation based on non-life techniques. The distinctions between life and non-life techniques are aimed towards the nature of the liabilities (substance), which may not necessarily match the legal form (form) of the contract that originated the liability. The choice between life or non-life actuarial methodologies should be based on the nature of the liabilities being valued and from the identification of risks which materially affect the underlying cash flows. This is the essence of the principle of substance over form.

1.2.53 Traditional life actuarial techniques to calculate the best estimate can be described as techniques that are based on discounted cash flow models, generally applied on a policy-by-policy basis, which take into account in an explicit manner risk factors such as mortality, survival and changes in the health status of the insured person(s).

1.2.54 On the other hand, traditional non-life actuarial techniques include a number of different approaches. For example some of the most common being:

- Methodologies based on the projection of run-off triangles, usually constructed on an aggregate basis;
- Frequency/severity models, where the number of claims and the severity of each claim is assessed separately;
- Methodologies based on the estimation of the expected loss ratio or other relevant ratios;
- Combinations of the previous methodologies.

1.2.55 There is one key difference between life and non-life actuarial methodologies: life actuarial methodologies consider explicitly the probabilities of death, survival, disability and/or morbidity of the insured persons as key parameters in the model, while non-life actuarial methodologies do not.

1.2.56 The choice between life or non-life actuarial methodologies should be based on the nature of the liabilities valued and on the identification of risks which materially affect the underlying cash flows.

1.2.57 In practice, in the majority of cases the form will correspond to the substance. However, for example for certain supplementary covers included in life contracts (e.g. accident) may be better suited for an estimation based on non-life actuarial methodologies.

1.2.58 The following provides additional guidance for the treatment of annuities arising in non-life insurance. The application of the principle of substance over form implies that such liabilities should be valued using methodologies usually applicable to the valuation of life technical provisions. Specifically, guidance is provided in relation to:

- The recognition and segmentation of insurance obligations for the purpose of calculating technical provisions (i.e. the allocation of obligations to the individual lines of business);
- The valuation of technical provisions for such annuities; and
- Possible methods for the valuation of technical provisions for the remaining non-life obligations.

1.2.59 The treatment proposed in these specifications for annuities should be extended to other types of liabilities stemming from non-life and health insurance whose nature is deemed similar to life liabilities (such as life assistance benefits), taking into consideration the principle mentioned in the previous paragraph.

Allocation to the individual lines of business

1.2.60 Where non-life and Non-SLT health insurance policies give rise to the payment of annuities, such liabilities should be valued using techniques commonly used to value life insurance obligations. Such liabilities should be assigned to the lines of business for annuities stemming from non-life contracts.

Valuation of annuities arising from non-life and Non-SLT health insurance contracts

1.2.61 Insurers and reinsurers should value the technical provisions to such annuities separately from the technical provisions related to the remaining non-life and health obligations. They should apply appropriate life insurance valuation techniques. The valuation should be consistent with the valuation of life insurance annuities with comparable technical features.

Valuation of the remaining non-life and health insurance obligations

1.2.62 The remaining obligations in the insurer's or reinsurer's non-life and Non-SLT health business (which are similar in nature to non-life insurance obligations) have to be valued separately from the relevant block of annuities.

1.2.63 Where provisions for claims outstanding to national accounting rules are compared to provisions for claims outstanding as calculated above, it should be taken into account that the latter do not include the annuity obligations.

1.2.64 Insurers and reinsurers may use, where appropriate, one of the following approaches to determine the best estimate of claims provisions for the remaining non-life or health obligations in a given non-life or Non-SLT health insurance line of business where annuities are valued separately.

Separate calculation of non-life liabilities

1.2.65 Under this approach, the run-off triangle which is used as a basis for the determination of the technical provisions should not include any cash flows relating to the annuities. An additional estimate of the amount of annuities not yet reported and for reported but not yet agreed annuities needs to be added.

Allowance of agreed annuities as single lump-sum payments in the run-off triangle

1.2.66 This approach also foresees a separate calculation of the best estimate, where the split is between annuities in payment and the remaining obligations.

1.2.67 Under this approach, the run-off triangle which is used as a basis for the determination of the technical provisions of the remaining non-life or health obligations in a line of business does not include any cash flows relating to the annuities in payment. This means the claims payments for annuities in payment are excluded from the run-off triangle.

1.2.68 However, payments on claims before annuitisation, i.e. the point in time where the insurer or reinsurer becomes obligated to pay the annuity, and payments at the time of annuitisation remain included in the run-off triangle. At the time of annuitisation, the best estimate of the annuity (valued separately according to life principles) is shown as a single lump sum payment in the run-off triangle, calculated as at the date of the annuitisation. Where proportionate, approximations of the lump sum could be used.

1.2.69 Where the analysis is based on run-off triangles of incurred claims, the lump sum payment should reduce the case reserves at the date of annuitisation.

1.2.70 On the basis of run-off triangles adjusted as described above, the participant may apply an appropriate actuarial reserving method to derive a best estimate of the claims provision of the portfolio. Due to the consideration of the run-off triangle, this best estimate would not include the best estimate related to the annuities in payment which would be valued separately using life principles (i.e. there would be no “double counting” in relation to the separate life insurance valuation), but it includes a best estimate for not yet reported and for reported but not yet agreed annuities.

Expert Judgement

1.2.71 Insurers shall choose assumptions based on the expertise of persons with relevant knowledge, experience and understanding of the risks inherent in the insurance or reinsurance business thereof (expert judgment). In certain circumstances expert judgement may be necessary when calculating the BEP, among others:

1) In selecting the data to use, correcting its errors and deciding the treatment of outliers or extreme events;

2) In adjusting the data to reflect current or future conditions, and adjusting external data to reflect the insurer's features or the characteristics of the relevant portfolio;
3) In selecting the time period of the data;
4) In selecting realistic assumptions;
5) In selecting the valuation technique or choosing the most appropriate alternatives existing in each methodology;
6) In incorporating appropriately to the calculations, the environments under which the insurer has to run its business.

Obligations in different currencies

1.2.72 The probability-weighted average cash flows should take into account the time value of money. The time value of money of future cash flows in different currencies is calculated using the risk-free term structure for the relevant currency. Therefore the BEP should be calculated separately for obligations in different currencies.

Assumptions underlying the calculation of the BEP

Assumptions consistent with information provided by financial markets

1.2.73 Assumptions consistent with information about, or provided by, financial markets include (non-exhaustive list):
1) Relevant risk-free interest rate term structure(s);
2) Currency exchange rates; and
3) Market inflation rates (consumer price index or sector inflation).

1.2.74 When insurers derive assumptions on future financial market parameters or scenarios, they should be able to demonstrate that the choice of the assumptions is appropriate and consistent with the valuation principles set out in Section 1.1 of the Technical Specifications.

Unbiased current assumptions

1.2.75 Unbiased current assumptions are derived from a combination of relevant, credible experience as well as judgment about its expected future development, e.g. inflation of expenses, that neither deliberately overstates nor understates the expected outcome. Reconsideration of data and assumptions should occur every time the technical provisions are valued, with revisions made as appropriate to ensure data and assumptions remain appropriate to current conditions. Consistent with reliability of outcome, subjectivity in valuation should be reduced as far as practicable. This may be achieved by using information available from effective internal control processes, market valuations and other relevant current or factual information, by applying professional standards and subjecting valuations to independent review.

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1.2.76 Observable data, such as interest rates, financial market prices and inflation rates may be expected to be different each time the current estimate is determined. In particular, cash flows are sensitive to inflation rates. Where assumptions are derived from observed values in the market, these should be the observed values current at the date of the valuation.

1.2.77 Regular experience analysis, considering the individual entity and relevant industry experience where appropriate, should be undertaken to support the assumptions used for insurance technical risks. Where assumptions depend on the results of such experience analyses, the most recent experience for the portfolio need not necessarily represent the most credible current assumption for that portfolio. Greater credibility may be achieved by the analysis of several years' experience, smoothing out fluctuations in experience and allowing appropriately for any trends in experience that may be evident. However, care should also be taken that historical experience remains relevant to current conditions.

1.2.78 Where the credibility of an insurer's own experience is low, for example for a small or new portfolio of insurance contracts, assumptions based on the relevant industry experience are likely to be more decision useful as a basis for projecting its cash flows.

1.2.79 The assumptions used should, in principle, reflect the characteristics of the portfolio rather than those of the particular insurer holding that portfolio. However, it is important to note that, in practice, the characteristics of the portfolio underwritten by an insurer may reflect aspects of an insurer's specific business practices, particularly with regard to its underwriting, claims handling and expenses. Company-specific information may be appropriate, for example, where the insurer's business model and practices are sufficiently substantiated as representative of the portfolio and similar information is used in market valuations.

Policyholders' behaviour

1.2.80 Insurers are required to identify policyholders' behaviour.

1.2.81 Any assumptions made by insurers with respect to the likelihood that policyholders will exercise contractual options, including lapses and full or partial surrenders, should be realistic and based on current and credible information. The assumptions should take account, either explicitly or implicitly, of the impact that future changes in financial and non-financial conditions may have on the exercise of those options.

Recoverables

Recoverables from reinsurance contracts and special purpose vehicles

1.2.82 The BEP should be calculated gross, without deduction of amounts recoverable from reinsurance contracts and special purpose vehicles. The value of these amounts should be calculated and shown separately.

1.2.83 The calculation by insurers of amounts recoverable from reinsurance contracts and special purpose vehicles should follow the same principles and methodology as presented in this section for the calculation of other parts of the technical provisions.

1.2.84 There is no need, however, to calculate a risk margin for amounts recoverable from reinsurance contracts and special purpose vehicles because a single net calculation of the risk margin should be performed rather than two separate calculations (i.e. one for the risk margin of the technical provisions net of recoverables from reinsurance and special purpose vehicles rather than one for the risk margin of the gross technical provisions and one for the risk margin of recoverables from reinsurance contracts and special purpose vehicles). Where insurers calculate a risk margin using an internal model, they can either perform one single net calculation or two separate calculations.

1.2.85 When calculating amounts recoverable from reinsurance contracts and special purpose vehicles, insurers should take account of the time difference between recoveries and direct payments.

1.2.86 Where, for certain types of reinsurance and special purpose vehicles, the timing of recoveries and that for direct payments of the insurer markedly diverge, this should be taken into account in the projection of cash flows. Where such timing is sufficiently similar to that for direct payments, the insurer may use the timing of direct payments.

1.2.87 The amounts recoverable from reinsurance contracts and special purpose vehicles shall be calculated consistently with the boundaries of the insurance and reinsurance contracts to which the amounts recoverable from reinsurance contracts and special purpose vehicles relate.

1.2.88 The amounts recoverable from special purpose vehicles, the amounts recoverable from finite reinsurance contracts and the amounts recoverable from other reinsurance contracts should each be calculated separately. The amounts recoverable from a special purpose vehicle should not exceed the aggregate maximum risk exposure of this special purpose vehicle to the insurer or reinsurer.

1.2.89 For the purpose of calculating the amounts recoverable from reinsurance contracts and special purpose vehicles, the cash flows should only include payments in relation to compensation of insurance events and unsettled insurance claims. Payments in relation to other events or settled insurance claims should not be accounted for as amounts recoverable from reinsurance contracts and special purpose vehicles. Where a deposit has been made for the mentioned cash flows, the amounts recoverable should be adjusted accordingly to avoid a double counting of the assets and liabilities relating to the deposit.

1.2.90 Debtors and creditors that relate to settled claims of policyholders or beneficiaries should not be included in the recoverable.

1.2.91 If payments from the special purpose vehicles to the insurer do not directly depend on the claims against the insurer ceding risks (for example if payments are made according to certain external indicators, such as an earthquake index), the amounts recoverable from these special purpose vehicles for future claims should only be taken into account to the extent it is possible for the structural mismatch between claims and amounts recoverable (basis risk) to be measured in a prudent, reliable and objective manner and where the underlying risks are adequately reflected in the calculation of the Solvency Capital Requirement.

1.2.92 Any compensation for past and future policyholder claims should only be taken into account to the extent it can be verified in a deliberate, reliable and objective manner.

1.2.93 Expenses which the insurer incurs in relation to the management and administration of reinsurance and special purpose vehicle contracts should be allowed for in the BEP, calculated gross, without deduction of the amounts recoverable from reinsurance contracts and special purpose vehicles. No allowance for expenses related to the internal processes should be made in the recoverables.

Counterparty default adjustment

Definition of the adjustment

1.2.94 The result from the calculation of the previous section should be adjusted to take account of expected losses due to default of the counterparty. This adjustment should be calculated and shown separately and should be based on an assessment of the probability of default of the counterparty, whether this arises from insolvency, dispute or another reason, and the average loss resulting there from (loss-given-default). For this purpose, the change in cash flows shall not take into account the effect of any risk mitigating technique that mitigates the credit risk of the counterparty. These risk mitigating techniques shall be separately recognised without increasing the amount recoverable from reinsurance contracts and special purpose vehicles.

1.2.95 The adjustment should be calculated as the expected present value of the change in cash flows underlying the amounts recoverable from that counterparty, resulting from a default of the counterparty at a certain point in time.

1.2.96 This calculation should take into account possible default events over the lifetime of the rights arising from the corresponding reinsurance contract or special purpose vehicle and the dependence on time of the probability of default.

Probability of default

1.2.97 The probability of default (PD) of special purpose vehicles should be calculated according to the average credit quality step of assets held by the special purpose vehicle, unless there is a reliable basis for an alternative calculation.

1.2.98 The determination of the adjustment for counterparty default should take into account possible default events during the whole run-off period of the recoverables.

1.2.99 The assessment of the probability of default and the loss-given-default of the counterparty should be based upon current, reliable and credible information. Among the possible sources of information are: credit spreads, credit quality steps, judgements, information relating to the supervisory solvency assessment, and the financial reporting of the counterparty. The applied methods should guarantee market consistency. The insurer should not rely on information of a third party without assessing that the information is current, reliable and credible.

1.2.100 In particular, the assessment of the probability of default should be based on methods that guarantee the market-consistency of the estimates of the PD.

1.2.101 Some criteria to assess the reliability of the information might be, for example, neutrality, prudency and completeness in all material aspects.

1.2.102 The insurer may consider for this purpose methods generally accepted and applied in financial markets (i.e. based on CDS markets), provided the financial information used in the calculations is sufficiently reliable and relevant for the purposes of the adjustment of the recoverables from reinsurance.

1.2.103 In the case of reinsurance recoverable from an SPV, the probability of default of special purpose vehicles should be calculated according to the average credit quality step of assets held by the special purpose vehicle, unless there is a reliable basis for an alternative calculation. When the undertaking has no reliable source to estimate its probability of default (i.e. when there is a lack of credit quality step) the following rules should apply:

1) SPV authorised under IOM or EU regulations, or a regime accepted as equivalent by the IOM FSA: the probability of default should be calculated according to the average rating of assets held by the SPV to guarantee the recoverable
2) Other SPV: should be treated as unrated.

1.2.104 Where possible in a reliable, objective and prudent manner, point-in-time estimates of the probability of default should be used for the calculation of the adjustment. In this case, the assessment should take the possible time-dependence of the probability of default into account. If point-in-time estimates are not possible to calculate in a reliable, objective and prudent manner or their application would not be proportionate, through-the-cycle estimates of the probability of default might be used.

1.2.105 A common assumption about probabilities of default is that they are not constant over time. In this regard it is possible to distinguish between point-in-time estimates which try to determine the current default probability and through-the-cycle estimates which try to determine a long-time average of the default probability.

1.2.106 In many cases, only through-the-cycle estimates may be available. For example, the credit quality steps of rating agencies are usually based on through-the-cycle assessments. Moreover, a sophisticated analysis of the time dependence of the probability of default may be disproportionate in most cases. Hence, through-the-cycle estimates might be used if point-in-time estimates cannot be derived in a reliable, objective and prudent manner or their application would not be in line with the proportionality principle. If through-the-cycle estimates are applied, it can usually be assumed that the probability of default does not change during the run-off of the recoverables.

1.2.107 The assessment of the probability of default should take into account the fact that the cumulative probability increases with the time horizon of the assessment.

1.2.108 For example, clearly the probability that the counterparty defaults during the next two years is higher than the probability of default during the next year.

1.2.109 Often, only the probability of default estimate,$\mathbf{PD}$, during the following year is known. For example, if this probability is expected to be constant over time, then the probability $\mathbf{PD_t}$ that the counterparty defaults during year $\mathbf{t}$ can be calculated as:

$$PD_t = PD \cdot (1 - PD)^{t-1}$$

1.2.110 This does not preclude the use of simplifications, where the effect of using them is not material.

Recovery Rate

1.2.111 The recovery rate (RR) is the share of the debts that the counterparty will still be able to honour in case of default.

1.2.112 If no reliable estimate of the recovery rate of a counterparty is available, no rate higher than 50% should be used.

1.2.113 The degree of judgement that can be used in the estimation of the recovery rate should be restricted, especially where owing to a low number of defaults, little empirical data about this figure in relation to reinsurers is available, and hence, estimations of recovery rates are unlikely to be reliable.

1.2.114 The average loss resulting from the default of a counterparty should include an estimation of the credit risk of any risk-mitigating instruments that the counterparty provided to the insurer ceding risks to the counterparty.

1.2.115 However, insurers should consider the adjustment for the expected default losses of these mitigating instruments, i.e. the credit risk of the instruments as well as any other risk connected to them should also be allowed for. This allowance may be omitted where the impact is not material. To assess this materiality, it is necessary to take into account the relevant features, such as the period of effect of the risk mitigating instrument.

1.3 Risk Margin

Definition of the risk margin and general methodology for its calculation

1.3.1 Usually, technical provisions consist of the BEP and the risk margin. The risk margin is included in technical provisions in order to ensure that the value of technical provisions represents the economic value of the insurer fulfilling its insurance obligations to policyholders and other beneficiaries arising over the lifetime of the insurer's portfolio of insurance policies.

1.3.2 The risk margin will be calculated by determining the cost of providing an amount of eligible own funds equal to the Solvency Capital Requirement ("SCR") necessary to support the insurance and reinsurance obligations over the lifetime thereof, at the appropriate confidence level (1 in 200, 1 in 100, 1 in 50 or 1 in 10). The rate used in the determination of the cost of providing that amount of eligible own funds is called the Cost-of-Capital rate.

1.3.3 The calculation of the risk margin is based on the following transfer scenario:

1) The whole portfolio of insurance and reinsurance obligations of the insurer that calculates the risk margin ("original insurer") is taken over by another insurer ("reference insurer");
2) The transfer of insurance and reinsurance obligations includes any reinsurance contracts and arrangements with special purpose vehicles relating to these obligations;
3) The reference insurer does not have any existing insurance or reinsurance obligations or any own funds before the transfer takes place;
4) The SCR of the reference insurer captures (only):
    a) Underwriting risk with respect to the transferred business;
    b) Credit risk with respect to reinsurance contracts, arrangements with special purpose vehicles, intermediaries, policyholders and any other material exposures which are closely related to the insurance and reinsurance obligations;
    c) Operational risk.
5) After the transfer, the reference insurer raises eligible own funds equal to the SCR necessary to support the insurance and reinsurance obligations over the lifetime thereof, at the appropriate confidence level;
6) After the transfer, the reference insurer therefore has assets to cover its SCR and the technical provisions net of the amounts recoverable from reinsurance contracts and special purpose vehicles;
7) Without prejudice to the transfer scenario, the reference insurer will adopt future management actions that are consistent with the assumed future management actions of the original insurer.

1.3.4 The SCR necessary to support the insurance and reinsurance obligations over the lifetime thereof should be equal to the SCR of the reference insurer in the scenario set out above, at the appropriate confidence level.

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1.3.5 As the original insurer transfers its whole portfolio to the reference insurer, the SCR of the reference insurer, and consequently the risk margin, reflects the level of diversification of the original insurer. In particular, it takes into account the diversification between lines of business.

1.3.6 The calculation of the risk margin should be based on the assumption that the reference insurer at time t = 0 (when the transfer takes place) will capitalise itself to the required level of eligible own funds, i.e.

$$EOF_{RI}(0) = SCR_{RI}(0)$$

Where:

- $EOF_{RI}(0)$ is the amount of eligible own funds raised by the reference insurer at time t=0 (when the transfer takes place); and
- $SCR_{RI}(0)$ is the SCR at time t=0 as calculated for the reference insurer, at the appropriate confidence level.

The cost of providing this amount of eligible own funds equals the Cost-of-Capital rate times this amount.

1.3.7 The assessment referred to in the previous paragraph applies to the eligible own funds to be provided by the reference insurer in all future years.

1.3.8 The transfer of insurance obligations is assumed to take place immediately. Hence, the method for calculating the overall risk margin (RM) can in general terms be expressed in the following manner:

$$RM = CoC \cdot \sum_{t \geq 0} \frac{EOF_{RI}(t)}{(1 + r_{t+1})^{t+1}} = CoC \cdot \sum_{t \geq 0} \frac{SCR_{RI}(t)}{(1 + r_{t+1})^{t+1}}$$

Where:

- RM is the risk margin;
- $SCR_{RI}(t)$ is the SCR for year t as calculated for the reference insurer, at the appropriate confidence level;
- r_t is the basic risk-free rate for maturity t;
- CoC is the Cost-of-Capital rate.

1.3.9 All SCRs that are to be used in the risk margin calculation (i.e. all SCRRI(t) for t ≥ 0) should in principle be calculated as follows:

$$SCR_{RI}(t) = BSCR_{RI}(t) + SCR_{RI,op}(t)$$

Where:

- $BSCR_{RI}(t)$ is the basic SCR for year t as calculated for the reference insurer, at the appropriate confidence level;
- $SCR_{RI,op}(t)$ is the partial SCR regarding operational risk for year t as calculated for the reference insurer, at the appropriate confidence level (zero for 1 in 10, for QIS4 purposes);

1.3.10 The Basic SCR ($\mathbf{BSCR_{RI}(t)}$ for all $\mathbf{t \geq 0}$) should be calculated by using the relevant SCR shock scenarios at the appropriate confidence level.

1.3.11 The calculation of the risk margin should be carried out on a best efforts basis for QIS4.

The Cost-of-Capital rate

1.3.12 The Cost-of-Capital rate is the annual rate to be applied to the capital requirement in each period. Because the assets covering the capital requirement themselves are assumed to be held in marketable securities, this rate does not account for the total return but merely for the spread over and above the risk-free rate.

1.3.13 The Cost-of-Capital rate will be calibrated by the FSA in a manner that is consistent with the assumptions made for the reference insurer. In practice this means that the Cost-of-Capital rate should be consistent with the capitalisation of the reference insurer that corresponds to the SCR. The Cost-of-Capital rate therefore will not depend on the actual solvency position of the original insurer. For the purposes of the QIS4 exercise a Cost-of-Capital rate of 5% should be used. This is lower than the 6% currently specified by EIOPA for Solvency II purposes, to reflect the fact that Isle of Man insurers are not subject to taxation of investment returns on capital.

1.3.14 The risk margin should guarantee that sufficient technical provisions for a transfer are available in all scenarios. Hence, the Cost-of-Capital rate will be calibrated to a long-term average rate, reflecting both periods of stability and periods of stress.

Level of granularity in the risk margin calculations

1.3.15 The risk margin should be calculated per line of business. A straight forward way to determine the margin per line of business is as follows: first, the risk margin is calculated for the whole business of the entity, allowing for diversification between lines of business. In a second step the margin is allocated to the lines of business.

1.3.16 The risk margin for the whole portfolio of insurance and reinsurance obligations shall be equal to the following:

$$RM = CoC \cdot \sum_{t \geq 0} \frac{SCR_{RI}(t)}{(1 + r_{t+1})^{t+1}}$$

Where:

- CoC denotes the Cost-of-Capital rate;
- The sum covers all integers including zero;
- $SCR_{RI}(t)$ denotes the solvency capital requirement of the reference insurer after t years;
- r_{t+1} denotes the relevant basic risk-free interest rate for the maturity of $t + 1$ years.

1.3.17 The basic risk-free interest rate $\mathbf{r_{t+1}}$ shall be chosen in accordance with the currency used for the financial statements of the insurer.

1.3.18 Insurers shall allocate the risk margin for the whole portfolio of insurance and reinsurance obligations to the relevant lines of business. The allocation shall adequately reflect the contributions of the lines of business to the Solvency Capital Requirement of the reference insurer over the lifetime of the whole portfolio of insurance and reinsurance obligations.

1.3.19 The risk margin per line of business should take the diversification between lines of business into account. Consequently, the sum of the risk margin per line of business should be equal to the risk margin for the whole business. The allocation of the risk margin to the lines of business should be done according to the contribution of the lines of business to the overall SCR during the lifetime of the business.

1.3.20 The contribution of a line of business can be analysed by calculating the SCR under the assumption that the insurer's other business does not exist. Where the relative sizes of the SCRs per line of business do not materially change over the lifetime of the business, insurers may apply the following simplified approach for the allocation:

$$RM_{lob} = \frac{SCR_{RI,lob}(0)}{\sum_{lob} SCR_{RI,lob}(0)} \cdot RM$$

Where:

- RM_{lob} is the risk margin allocated to line of business (lob);
- $SCR_{RI,lob}(0)$ is the SCR of the reference insurer for line of business (lob) at $t = 0$;
- RM is the risk margin for the whole business.

Simplifications for the calculation of the risk margin of the whole business

1.3.21 If a full projection of all future SCRs is necessary in order to capture the participating insurer's risk profile the insurer is expected to carry out these calculations.

1.3.22 Participating insurers should consider whether or not it would be appropriate to apply a simplified valuation technique for the risk margin. As an integral part of this assessment, the insurers should consider what kind of simplified methods would be most appropriate for the business. The chosen method should be proportionate to the nature, scale and complexity of the risks of the business in question.

1.3.23 When an insurer has decided to use a simplified method, it should consider whether the method could be used for the projections of the overall SCR or if the relevant (sub-)risks should be projected separately. In this context, the insurer 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.

A hierarchy of simplifications

1.3.24 Based on the general principles and criteria referred to above, the following hierarchy should be used as a decision basis regarding the choice of (non-simplified and simplified) methods for projecting future SCRs:

1) Make a full calculation of all future SCRs without using simplifications;
2) Approximate the individual risks or sub-risks within some or all shock scenarios 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;
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.

1.3.25 In this hierarchy the calculations get simpler with each step.

1.3.26 When choosing the calculation method, it is not required that the complexity of the calculations should go beyond what is necessary in order to capture the material characteristics of the insurer's risk profile.

1.3.27 The distinction between the levels in the hierarchy outlined above is not always clear-cut. For example, regarding the distinction between the simplification on level 2 and level 3, a proportional method (based on the development of the best estimate technical provisions) applied for an individual shock scenario relevant for the calculation of future SCRs for the reference insurer could be seen as belonging to either level 2 or level 3.

Specific simplifications

1.3.28 The simplifications allowed for when calculating the SCR should in general carry over to the calculation of the risk margin.

Simplifications for individual shock scenarios (level 2 of the hierarchy)

1.3.29 A more sophisticated approach to the simplifications would be to focus on the individual shock scenarios in order to approximate the individual risks and/or sub-risks covered by the relevant shock scenarios.

1.3.30 In practice this would require that the participating insurer look closer at the risks and sub-risks being relevant for the following shock scenarios:

- Non-life underwriting risk;
- Counterparty default risk with respect to ceded reinsurance and SPVs; and
- Market risk,

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

1.3.31 In the following paragraphs some proposals for such simplifications are put forward and the main aspects of the simplifications are briefly explained.

Counterparty default risk

1.3.32 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.

1.3.33 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 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 the reinsurers' share of best estimates to the level of the total capital charge for reinsurers' default risk in year 0.

Simplifications for the overall SCR for each future year (level 3 of the hierarchy)

1.3.34 A representative example of a simplification belonging to level 3 of the hierarchical structure outlined in these specifications is based on an assumption that the future SCRs are proportional to the best estimate technical provisions for the relevant year – the proportionality factor being the ratio of the present SCR to the present best estimate technical provisions (as calculated for the reference insurer).

1.3.35 According to this representative example of the proportional method, the reference insurer's SCR for year t is fixed in the following manner:

$$SCR_{RI}(t) = \frac{SCR_{RI}(0) \cdot BE_{Net}(t)}{BE_{Net}(0)}, \qquad t = 1,2,3, \ldots$$

Where:

- $SCR_{RI}(0)$ is the SCR as calculated at time *t=0* for the reference insurer's portfolio of (re)insurance obligations;
- $BE_{Net}(0)$ is the best estimate technical provisions net of reinsurance as assessed at time *t=0* for the insurer's portfolio of (re)insurance obligations; and
- $BE_{Net}(t)$ is the best estimate technical provisions net of reinsurance as assessed at time *t* for the insurer's portfolio of (re)insurance obligations.

1.3.36 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 life underwriting risk is the same (life underwriting risk);
- The average credit standing of reinsurers and SPVs is the same (counterparty default risk);
- The market risk in relation to the net best estimate is the same (market risk); and

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

1.3.37 An insurer that intends to use this simplification should consider to what extent the assumptions referred to above are fulfilled. If some or all of these assumptions do not hold, the insurer should carry out 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 insurer is encouraged to use a more sophisticated calculation method.

1.3.38 The insurer may also be able to apply the simplification in a piece-wise manner across the years. For instance, if the 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.

1.3.39 When using the simplification described in the previous paragraphs, some considerations should be given to the manner in which the best estimate technical provisions net of reinsurance have been calculated. 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, $\mathbf{BE_{Net}(t)}$, as compared to the best estimate gross of reinsurance, $\mathbf{BE_{Gross}(t)}$, at time t=0, this does not necessarily mean that all future estimates of the best estimate net of reinsurance will be equally reliable. In such cases the simplified method sketched above may be biased.

1.3.40 Regarding the scenario-based adjustments for the loss absorbing capacity of technical provisions to be taken into account when projecting the future SCRs, it is likely to be (very) difficult to develop reliable scenarios to be applied to these projections. Accordingly, it may in practice be difficult to find other workable solutions than allowing this component to develop in line with the best estimate technical provisions net of reinsurance. The participating insurer should, however, make some assessments of the potential bias caused by this simplification.

1.3.41 A simplification similar to the one outlined in the previous paragraphs may also be applied at a more granular level, i.e. for individual shock scenarios. However, it should be noted that the number of calculations to be carried out will in general be proportional to the number of shock scenarios for which this simplification is applied. Moreover, insurers should consider 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" (level 4 of the hierarchy)

1.3.42 A representative example of a simplification belonging to level 4 of the hierarchical structure is using the modified duration of the liabilities in order to calculate the present and all future SCRs in one single step:

$$RM = \left(\frac{CoC}{(1+r_1)}\right) \cdot Dur_{mod}(0) \cdot SCR_{RI}(0)$$

Where:

- $SCR_{RI}(0)$ is the SCR as calculated at time *t=0* for the reference insurer's portfolio of (re)insurance obligations;
- $DUR_{mod}(0)$ is the modified duration of reference insurer's (re)insurance obligations net of reinsurance at *t=0*; and
- CoC is the Cost-of-Capital rate.

1.3.43 The 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 reinsurer and SPVs remain the same over the years (counterparty default risk);
- The modified duration is the same for obligations net and gross of reinsurance (counterparty default risk);
- The market risk in relation to the net best estimate remains the same over the years (market risk); and
- The loss absorbing capacity of the technical provisions in relation to the net best estimate remains the same over the years (adjustment).

1.3.44 An insurer that intends to use this simplification should consider to what extent the assumptions referred to above are fulfilled. If some or all of these assumptions do not hold, the insurer should carry out a qualitative assessment of the materiality of the deviation from the assumptions. 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 insurer should either adjust the formula appropriately or is encouraged to use a more sophisticated calculation.

1.3.45 Where $\mathbf{SCR_{RI}(0)}$ includes material sub-risks that will not exist over the whole lifetime of the portfolio, for example market risk, the calculation can often be improved by:

- Excluding these sub-risks from $SCR_{RI}(0)$ for the above calculation;
- Calculating the contribution of these sub-risks to the risk margin separately; and
- Aggregating the results (where practicable allowing for diversification).

A simple method based on percentages of the best estimate (level 5 of the hierarchy)

1.3.46 According to this simplification the risk margin, $\mathbf{CoCM}$, should be calculated as a percentage of the best estimate technical provisions net of reinsurance (at t=0), that is:

$$CoCM = \alpha_{lob} \cdot BE_{Net}(0)$$

Where:

- $BE_{Net}(0)$ is the best estimate technical provisions net of reinsurance as assessed at time *t=0* for the insurer's portfolio of (re)insurance obligations; and
- α_{lob} is a fixed percentage to be used for a given line of business, the insurer should take into account that this percentage is likely to increase if the modified duration of the insurance liabilities – or some other measure of the run-off pattern of these liabilities – increases.

1.3.47 Insurers should give due consideration to the very simplistic nature of this approach, and it should be used only where it has been demonstrated that none of the more sophisticated risk margin approaches in the above hierarchy can be applied.

1.3.48 When insurers rely on this method for the calculation of the risk margin, they will need to justify and document the rationale for the percentages used by line of business. This justification and rationale should consider any specific characteristics of the portfolios being assessed. Insurers should not use this method when negative best estimate values exist.

1.4 Discounting

For currencies where the relevant risk-free interest rate term structures are provided

1.4.1 For liabilities expressed in currencies listed in TS section 2.6.8, we will provide insurers with a complete risk-free interest rate term structure derived from the relevant swap yield curve, if available.

1.4.2 For durations less than one year, the annual discount rate is the same as the one year rate.

1.4.3 For a given currency and valuation date, each insurer should use the same relevant risk-free interest rate term structure.

1.4.4 Investment expenses should be allowed for in the cash flows underlying the calculation of technical provisions and not in the risk-free interest rates used to discount technical provisions.

For currencies where the relevant risk-free interest rate term structure is not provided

1.4.5 Where for a certain currency, the risk-free interest rate term structure is not provided, insurers should discuss the approach to take with the FSA at the earliest possible opportunity.

1.5 Proportionality and simplification

Introduction

1.5.1 This subsection aims at providing a description of the way proportionality should be approached in the context of a valuation of technical provisions, to ensure that actuarial and statistical methodologies applied are proportionate to the nature, scale and complexity of the underlying risks.

Requirements for application of proportionality principle

Selection of valuation methodology

1.5.2 Insurers shall use methods to calculate technical provisions which are proportionate to the nature, scale and complexity of the risks underlying their insurance and reinsurance obligations.

1.5.3 In determining whether a method of calculating technical provisions is proportionate, insurers shall carry out an assessment which includes:

1) An evaluation of the nature, scale and complexity of the risks underlying their insurance and reinsurance obligations;
2) An evaluation in qualitative or quantitative terms of the error introduced in the results of the method due to any deviation between the following:
   a) The assumptions underlying the method in relation to the risks;
   b) The results of the assessment referred to in point 1).

1.5.4 The assessment referred to in point 1) in paragraph 1.5.3 above shall include all risks which affect the amount, timing or value of the cash in- and out-flows required to settle the insurance and reinsurance obligations over their lifetime. For the purpose of the calculation of the risk margin, the assessment shall include all risks as referred to in 1.3.3 over the lifetime of the underlying insurance and reinsurance obligations. The assessment shall be restricted to the risks that are relevant to that part of the calculation of technical provisions to which the method is applied.

1.5.5 A method shall not be considered to be proportionate to the nature, scale and complexity of the risks if the error referred to in point 2) of paragraph 1.5.3 above is material, unless:

1) No other method with a smaller error is available and the method is not likely to result in an underestimation of the amount of technical provisions; or
2) The method leads to an amount of technical provisions of the insurer which is higher than the amount that would result from using a proportionate method; and the method does not lead to an underestimation of the risk inherent in the insurance and reinsurance obligations that it is applied to.

1.5.6 The error referred to in point 2) of paragraph 1.5.3 above shall be considered to be material if it leads to a misstatement of technical provisions or their components that could influence the decision-making or judgement of the intended user of the information relating to the value of technical provisions.

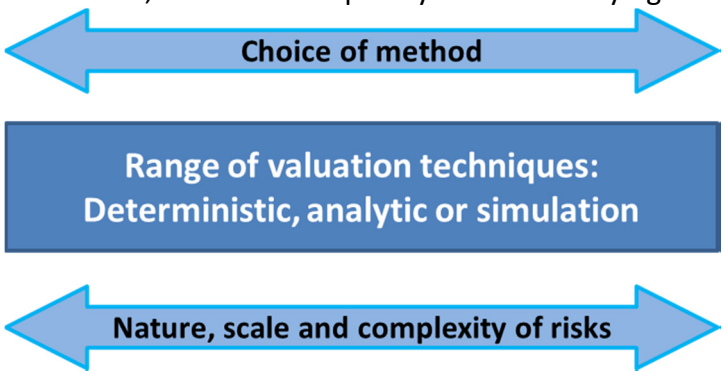
1.5.7 The principle of proportionality requires that the insurer should be allowed to choose and apply a valuation method which is:

1) Suitable to achieve the objective of deriving a market-consistent valuation according to the principles underlying the valuation for solvency purposes; but
2) Not more sophisticated than is needed in order to reach this objective (proportionate to the nature, scale and complexity of the risks).

1.5.8 This does not, however, mean that an application of the principle of proportionality is restricted to small and medium-sized insurers, 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.

Selection of valuation methodology

1.5.9 The principle of proportionality applies generally when a valuation methodology is chosen, allowing insurers and reinsurers the flexibility to select a technique which is proportionate to the nature, scale and complexity of the underlying risks:



Proportionality assessment – a three step process

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

1) Assess the nature, scale and complexity of underlying risks;
2) Check whether the valuation methodology is proportionate to risks as assessed in Step 1), having regard to the degree of model error resulting from its application;
3) Back test and validate the assessments carried out in Steps 1) and 2).

Step 1) – Assessment of the nature, scale and complexity of risks

1.5.11 In this step, insurers and reinsurers 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 2) and should serve as a guide to identify where simplified methods are likely to be appropriate.

Which risks?

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1.5.12 The scope of risks which should be included in the analysis will depend on the purpose and context of the assessment. 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.

Nature and complexity

1.5.13 The nature and the 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, i.e. whether or not a risk is complex can be seen as a property of the risk which is part of its nature.

1.5.14 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;[1]
- The nature of the occurrence or crystallisation of the risk in terms of frequency and severity;
- The nature of the development of claims payment over time;
- The extent of potential policyholder loss, especially in the tail of the claims distribution;
- The type of business from which the risks originate, i.e. direct business or reinsurance business;
- The degree of dependency between different risk types, including the tail of the risk distribution; and
- The risk mitigation instruments applied, if any, and their impact on the underlying risk profile.

1.5.15 The first three bullet points in the previous paragraph are in particular related to the complexity of risks generated by 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).

[1] This only refers to the randomness (volatility) of the future cash flows. Uncertainty which is related to the measurement of the risk (model 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.

1.5.16 Insurers and reinsurers 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:

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

1.5.17 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. For example, where losses are the result of interaction of a larger number of different factors, the degree of complexity of the modelling would also be expected to increase.

Scale

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

1.5.19 For example, where insurers and reinsurers assess that the impact of inflation risk on the overall risk profile of the portfolio is small, they 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.

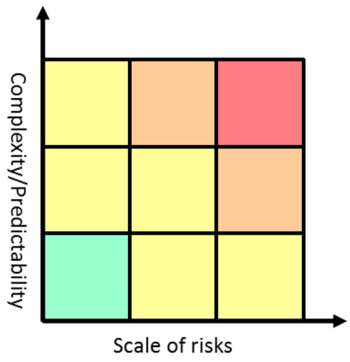
1.5.20 Related to this, a measurement of scale may also be used to introduce a distinction between material and non-material risks. Introducing materiality in this context would provide some insurer-specific threshold or cut-off point below which it would be regarded as justifiable to use simplifications for certain risks.

1.5.21 Insurers and reinsurers should use an interpretation of scale which is best suited to their specific circumstances and to the risk profile of its portfolio. Nevertheless the assessment of scale should lead to an objective and reliable assessment. To measure the scale of risks, further than introducing an absolute quantification of the risks, insurers and reinsurers 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.

Contribution of the three indicators and overall assessment

1.5.22 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.

1.5.23 In terms of nature and complexity, the assessment should seek to identify the main qualities and characteristics of the risks, and should lead to an evaluation of the degree of their complexity and predictability. In combination with the "scale" criterion, insurers and reinsurers 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":



1.5.24 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.

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Step 2) – Assessment of the model error

1.5.25 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 provisions should be regarded as proportionate if the resulting estimate is not expected to diverge materially from the current transfer value

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

Materiality in the context of a valuation of technical provisions

1.5.27 In order to clarify the meaning of materiality, insurers and reinsurer should consider the definition of materiality used in International Accounting Standards (IAS)2:

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

1.5.28 When determining how to address materiality, insurers and reinsurers 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. Insurers and reinsurers may adjust their assessment of materiality to the particular situation of a quantitative assessment exercise which usually requires a lower degree of accuracy than financial and supervisory reporting.

1.5.29 In ensuring the most appropriate level of granularity in the assessment of materiality, for the purposes of the calculation of technical provisions, the following should be taken into account:

1) There are different levels at which the assessment could be carried out, namely the individual homogeneous risk groups, the individual lines of business or the business of the insurer as a whole;
2) A risk which could be immaterial with regard to the business of the insurer as a whole may still have a significant impact within a smaller segment;
3) Technical provisions should not be analysed in isolation but any effect on own funds and thus on the total balance sheet as well as SCR should be taken into account in the assessment.

[2] Materiality is defined in the glossary of the international Accounting Standards Board's "Framework for the Preparation and Presentation of Financial Statements"

Assessment of the uncertainty in the valuation

1.5.30 Due to the uncertainty of future events, any modelling of future cash flows (implicitly or explicitly contained in the valuation methodology) will be imperfect, leading to a certain degree of inaccuracy and imprecision in the measurement (or model error). Regardless of what methods should 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 error implicit in the calculations. Where simplified approaches are used to value technical provisions, this could potentially introduce additional uncertainty because they are generally based on some kind of simplifying assumptions regarding the risks which are modelled (e.g. independency of some risks, proportionality between different risk-factors, neglecting future development, etc.).

1.5.31 Insurers and reinsurers are not required to specify the precise amount of the error, which in practice could be difficult. Hence insurers and reinsurers are not required to re-calculate the value of its technical provisions using a more complex method in order to demonstrate that the difference between the result of the chosen method and the result of a more complex method is immaterial. Instead, it is sufficient if there is reasonable assurance that the error implied by the application of the chosen method (and hence the difference between those two amounts) is immaterial.

1.5.32 Such an assessment of the error may be carried out by expert judgement or by more sophisticated approaches, for example:

- Sensitivity analysis in the framework of the applied model:

  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:

  Apply different methods to give insight to 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.[3] Such information may assist in quantitatively describing the sources of uncertainty;
- Back-testing

  Compare the results of the estimation against experience which may help to identify systemic deviations due to deficiencies in the modelling;
- Quantitative assessment scenario as benchmark.

Approach in cases where error is expected to be material

1.5.33 Where the intended use of a valuation technique is expected to lead to a material degree of error, insurers and reinsurers should, where feasible, apply a more appropriate valuation method among the alternatives available.

[3] This would not include the uncertainty arising from a mis-specification of the model itself.

1.5.34 Where it is unavoidable for insurers and reinsurers to use a valuation method which leads to a material error, the insurer or reinsurer should document this and consider the implications with regard to the reliability of the valuation and their overall solvency position.

1.5.35 In particular, insurers and reinsurers should assess whether a material level of error is adequately addressed in the determination of the SCR and the setting of the risk margin in the technical provisions.

1.5.36 Where the use of a valuation technique results in a material increase in the level of uncertainty associated with 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.

Possible simplifications

1.5.37 Simplifications proposed in these specifications will only be applicable under the framework contained above to define the proportionality principle regarding technical provisions

Outstanding reported claim provision. First simplification

1.5.38 Description. This simplification applies to the calculation of the best estimate of reported claims by means of considering the number of claims reported and the average cost thereof. Therefore it is a simplification applicable when it does not deliver material model error in the estimate of frequency and severity of claims, and their combination. This simplification can be used to calculate outstanding claims provision and provision for incurred but not reported claims as a whole, adding to $\mathbf{N_i}$ the IBNR claims calculated as $\mathbf{N_t}$.

1.5.39 Calculation. The calculation is rather straightforward:

$$\sum_i (N_i * A_i - P_i)$$

where:

- N_i is the number of claims reported, incurred in year i
- A_i is the average cost of claims closed in year i
- P_i are payments for claims incurred in year i
- N_i and P_i are known, while A_i 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.

1.5.40 Criteria for application. In addition to the general requirements set out in these specifications, the above method is an allowable simplification when the size of claims incurred in a year has a small variance, or the number of claims incurred in a year is big enough to allow the average cost to be representative.

1.5.41 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.

1.5.42 It should be noted that this method does not seem appropriate in situations where only few development years or occurrence years (for example less than 4) 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 is not available.

Outstanding reported claim provision. Second simplification

1.5.43 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. 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.

1.5.44 Description. This method involves summing 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 to the features of the claims portfolio and the undertaking internal structure and capabilities.

1.5.45 Scope. Further to the general requirements set out in these specifications, the undertaking should develop written documentation on:

- procedures applicable to assess the initial valuation of a claim when little 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.

1.5.46 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 to 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 for the portfolio of the undertaking;
- 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 to 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 IBNR and an ULAE provision.

1.5.47 Criteria for application. Further to the general requirements set out in these specifications, 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.

1.5.48 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 (see these specifications regarding data quality).

Incurred but not reported claims provision. First simplification

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

1.5.50 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):

$$IBNR_{reserve\ year\ t} = N_t * C_t$$

where:

- C_t is the 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 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

$$N_t = \frac{R_t}{R_{t-1} + R_{t-2} + R_{t-3}} * \left(\frac{N_{t-1}}{p_1} + \frac{N_{t-2}}{p_2} + N_{t-3}\right)$$

Furthermore, in these expressions:

- N_{t-i} is the 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 is the percentage of IBNR claims at the end of year t-3 that have been reported during the year t-2
- p_2 is the percentage of IBNR claims at the end of year t-3 that have been reported during the years t-2 and t-1

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- R_t are claims reported in year t, independently of accident year.
- R_{t-i} are claims reported in year t-i, independently of accident year.

1.5.51 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.

1.5.52 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.

Incurred but not reported claims provision. Second simplification

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

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

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

where:

- $PCO\_reported_{LOB}$ is the provision for reported claims outstanding
- $factor_{LOB\_U}$ is factor specific for each LOB and undertaking.

1.5.55 Criteria for application. Further to the general requirements to set out the use of simplifications, this method may be applied only where it is possible to reliably apply the first simplification due to an insufficient number of years of experience. 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.

Simplification for claims settlement expenses

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

1.5.57 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 is a simple average of R_i (e.g. over the last two exercises), and
- R_i = Expenses / (gross claims + subrogations).

$IBNR$ is the provision for IBNR
$PCO\_reported$ is the provision for reported claims outstanding
a is a percentage of claim provisions

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1.5.58 Criteria for application. Further to the general requirements set out in these specifications, this method is an allowable simplification when expenses can reasonably expected to be 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.

Simplification for premium provision

1.5.59 The simplification to derive the best estimate for premium provision is based on an estimate of the combined ratio in the line of business in question. The following input information is required:

1.5.60 estimate of the combined ratio (CR) for the line of business during the run-off period of the premium provision;

1.5.61 present value of future premiums for the underlying obligations (as to the extent to which future premiums fall within the contract boundaries);

1.5.62 volume measure for unearned premiums; it relates to business that has incepted at the valuation date and represents the premiums for this incepted business less the premiums that have already been earned against these contracts (determined on a pro rata temporis basis).

1.5.63 The best estimate is derived from the input data as follows:

$$BE = CR * VM + (CR - 1) * PVFP + AER * PVFP$$

Where:

- BE is the best estimate of premium provision
- CR is an estimate of combined ratio for line of business on a gross of acquisition cost basis i.e. CR = (claims + claim related expenses) / (earned premiums gross of acquisition expenses)
- VM is the volume measure for unearned premium. It relates to business that has incepted at the valuation date and represents the premiums for this incepted business less the premium that has already been earned against these contracts. This measure should be calculated gross of acquisition expenses
- $PVFP$ is the present value of future premiums (discounted using the prescribed term structure of risk-free interest rates) gross of commission
- AER is an estimate of acquisition expenses ratio for line of business

The combined ratio for an accident year (occurrence year) is defined as the ratio of expenses and incurred claims in a given line of business or homogenous group of risks over earned premiums. The earned premiums should exclude prior year adjustment. The expenses should be those attributable to the premiums earned other than claims expenses. Incurred claims should exclude the run-off result, that is they should be the total for losses occurring in year y of the claims paid (including claims expenses) during the year and the provisions established at the end of the year.

Alternatively, if it is more practicable, the combined ratio for an accident year may be considered to be the sum of the expense ratio and the claims ratio. The expense ratio is the ratio of expenses (other than claims expenses) to written premiums, and the expenses are those attributable to the written premiums. The claims ratio for an accident year in a given line of business or homogenous group of risks should be determined as the ratio of the ultimate loss of incurred claims over earned premiums.

Best efforts approach for QIS4

1.5.64 We request companies to complete the QIS4 exercise on a "best efforts basis". By this we mean that if companies opt to calculate technical provisions on a best estimate plus risk margin basis they should carry out the calculations specified in this Technical Specification as accurately as is feasible at this stage. This Technical Specification sets out a range of possible approaches to the determination of technical provisions, and companies should aim to use the most appropriate approach given the guidance on proportionality set out in this Section 1.5. If such an approach is not possible for technical, data, or other reasons, companies may adopt a more approximate approach for QIS4 provided that they provide details of why the more approximate approach was required and the possible scale of the impact on results.

Reinsurance recoverables

1.5.65 With respect to the principle of proportionality, undertakings may be allowed to use methods to derive the net best estimate from the gross best estimate without an explicit projection of the cash-flows underlying the amounts recoverable from reinsurance contracts.

1.5.66 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 Isle of Man risk-based valuation principles) is already available. Following such techniques the value of reinsurance recoverables is derived in a subsequent step as the excess of the gross over the net estimate.

1.5.67 Finally, it should be noted that where this subsection 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.

1.5.68 From a practical perspective it is understood that Isle of Man risk based regulatory framework does not prevent methods of calculation – including simplifications – whereby the technical provisions net of reinsurance are 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

Analysis

1.5.69 This subsection includes the general high-level criteria to be followed by an insurer or reinsurer applying gross-to-net techniques to guarantee its compatibility with the Isle of Man risk based regulatory framework.

Compatibility of Gross-to-Net Calculations with the Isle of Man risk based framework

1.5.70 The technical "gross-to-net" methods considered in this subsection 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:

$$Reinsurance\ recoverables = gross\ provisions - net\ provisions$$

1.5.71 An application of gross-to-net valuation techniques – and more broadly of any methods to derive the best estimate of technical provisions net of reinsurance– may be integrated into the IOM risk based regulatory framework by using a three-step approach as follows:

- Step 1: Derive the best estimate of technical provisions net of reinsurance.
- Step 2: Determine reinsurance recoverables as the difference between the best estimate values gross and net of reinsurance, respectively.
- Step 3: Assess whether this valuation of reinsurance recoverables is compatible with the Isle of Man risk based regime.

Step 1:Derivation of technical provisions net of reinsurance

1.5.72 The starting point for this step is a valuation of technical provisions gross of reinsurance. 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:

- PP_{Gross} is the best estimate of premium provisions gross of reinsurance;
- PCO_{Gross} is the best estimate of claims provisions gross of reinsurance; and
- *RM* is the risk margin.

1.5.73 From this, a valuation of the best estimate technical provisions net of reinsurance within a given homogeneous risk group or line of business may be derived by applying Gross-to-Net techniques to the best estimates components referred to above.4

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

1.5.74 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} is the best estimate of premium provisions net of reinsurance;
- PCO_{Net} is the best estimate of claims provisions net of reinsurance; and
- RM is the risk margin.

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

1.5.75 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):

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

1.5.76 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. Moreover, it needs to be assessed whether the value of the reinsurance recoverables (RR) as calculated above need to be adjusted due to (expected) counterparty defaults.

Step 3: Assessment of compatibility of reinsurance recoverables with the Isle of Man risk based regulatory framework

1.5.77 In this step, it would need to be assessed whether the determination of the reinsurance recoverables in step 2 is consistent with the Isle of Man risk based regulatory framework.

1.5.78 In particular, this would require an analysis as to whether;

- when calculating amounts recoverable from reinsurance contracts and special purpose vehicles, insurers and reinsurers shall take account of the time difference between recoveries and direct payments.
- The result from that calculation shall be adjusted to take account of expected losses due to default of the counterparty. That adjustment shall be based on an assessment of the probability of default of the counterparty and the average loss resulting therefrom (loss-given-default).

1.5.79 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 and would not be covered by one of the gross-to-net techniques discussed in this subsection.

The Scope of Gross-to-Net Techniques

1.5.80 Non-life insurance undertakings would be expected to make use of Gross-to-Net methods in a flexible way, by 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.

1.5.81 An undertaking would typically use a simplified Gross-to-Net technique, for example, when:

- 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.

Degree of Detail and Corresponding Principles/Criteria

1.5.82 It seems unlikely that a Gross-to-Net simplified technique being applied to the overall portfolio of a non-life insurance undertaking would provide reliable and reasonably accurate approximations of the best estimate of technical provisions net of reinsurance. 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 premium provisions and provisions for claims outstanding (for a given homogenous risk group or line of business); and
- 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 (Reported But Not Settled) and IBNR-claims (Incurred But Not Reported), respectively.

1.5.83 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.

1.5.84 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 undertakings. 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.

Distinguishing between premium provisions and provisions for claims outstanding

1.5.85 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

1.5.86 With respect to the premium provisions, the relationship between the provisions on a gross basis ($\mathbf{PPGross, k}$) the provisions on a net basis ($\mathbf{PPNet, k}$) and the Gross-to-Net "factor" ($\mathbf{GNK(ck)}$) for line of business (or homogeneous risk group) no. $\mathbf{k}$ – can be represented in a somewhat simplified manner as follows:[5]

$$PPNet, k = GNk(c_k) * PPGross, k$$

where 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.

[5] 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.

1.5.87 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 claims outstanding6 and the distinction between Gross-to-Net techniques for the two kinds of technical provisions makes no sense.

Provisions for claims outstanding

1.5.88 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 $\mathbf{PCO_{Gross,k,i}}$ the provisions on a net basis $\mathbf{PCO_{Net,k,i}}$ and the Gross-to-Net "factor" $\mathbf{GN_{k,i}(c_{k,i})}$ 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:

$$PCO_{Net,k,i} = GN_{k,i}(c_{k,i}) * PCO_{Grsoss,k,i}$$

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.

1.5.89 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.

1.5.90 A rationale for introducing separate techniques for RBNS-claims and IBNR-claims may be that insurance undertakings in general will have more 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.

1.5.91 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.

[6] If the line of business in question contains multiyear contracts this will be the case for several of the latest underwriting years.

2 Appendix 2 - Principles for recognising risk mitigation techniques in the SCR standard formula

2.1 Principle 1: Economic effect over legal form

2.1.1 Risk mitigation techniques should be recognised and treated consistently, regardless of their legal form or accounting treatment, provided that their economic or legal features meet the requirements for such recognition.

2.1.2 Where risk mitigation techniques are recognised in the SCR calculation, any material new risks shall be identified, quantified and included within the SCR. Where the risk mitigation technique actually increases risk, then the SCR should be increased.

2.1.3 The calculation of the SCR should recognise risk mitigation techniques in such a way that there is no double counting of mitigation effects.

2.2 Principle 2: Legal certainty, effectiveness and enforceability

2.2.1 The transfer of risk from the undertaking to the third party shall be effective in all circumstances in which the undertaking may wish to rely upon the transfer. Examples of factors which the undertaking shall take into account in assessing whether the transaction effectively transfers risk and the extent of that transfer include:

- whether the relevant documentation reflects the economic substance of the transaction;
- whether the extent of the risk transfer is clearly defined and beyond dispute;
- whether the transaction contains any terms or conditions the fulfilment of which is outside the direct control of the undertaking. Such terms or conditions may include those which:
    - would allow the third party unilaterally to cancel the transaction, except for the non-payment of monies due from the undertaking to the third party under the contract;
    - would increase the effective cost of the transaction to the undertaking in response to an increased likelihood of the third party experiencing losses under the transaction;
    - would oblige the undertaking to alter the risk that had been transferred with the purpose of reducing the likelihood of the third party experiencing losses under the transaction;
    - would allow for the termination of the transaction due to an increased likelihood of the third party experiencing losses under the transaction;
    - could prevent the third party from being obliged to pay out in a timely manner any monies due under the transaction; or
    - could allow the maturity of the transaction to be reduced.

2.2.2 An undertaking shall also take into account circumstances in which the benefit to the undertaking of the transfer of risk could be undermined. For instance, where the undertaking, with a view to reducing potential or actual losses to third parties, provides support to the transaction, including support beyond its contractual obligations.

2.2.3 In determining whether there is a transfer of risk, the entire contract shall be considered. Further, where the contract is one of several related contracts the entire chain of contracts, including contracts between third parties, shall be considered in determining whether there is a transfer of risk. In the case of reinsurance, the entire legal relationship between the cedant and reinsurer shall be taken into account in this determination.

2.2.4 The undertaking shall take all appropriate steps, for example a sufficient legal review, to ensure and confirm the effectiveness and ongoing enforceability of the risk mitigation arrangement and to address related risks. 'Ongoing enforceability' refers to any legal or practical constraint that may impede the undertaking from receiving the expected protection. In the case of financial risk mitigation, the allowance in the SCR of the 'counterparty default risk' derived from the 'financial risk mitigation technique' does not preclude the necessity of satisfying the 'ongoing enforceability'.

2.2.5 In the case of financial risk mitigation, instruments used to provide the risk mitigation together with the action and steps taken and procedures and policies implemented by the undertaking shall be such as to result in risk mitigation arrangements which are legally effective and enforceable in all jurisdictions relevant to the arrangement and, where appropriate, relevant to the hedged asset or liability.

2.2.6 Procedures and processes not materialized in already existing financial contracts providing protection at the date of reference of the solvency assessment, shall not be allowed to reduce the calculation of the SCR with the standard formula.

2.3 Principle 3: Liquidity and certainty of value

2.3.1 To be eligible for recognition, the risk mitigation techniques shall be valued in line with the principles laid down for valuation of assets and liabilities, other than technical provisions. This value shall be sufficiently reliable and appropriate to provide certainty as to the risk mitigation achieved.

2.3.2 Regarding the liquidity of the financial risk mitigation techniques, the following applies:

- the undertaking should have written internal policy regarding the liquidity requirements that financial risk mitigation techniques should meet, according to the objectives of the undertaking's risk management policy;
- financial risk mitigation techniques considered to reduce the SCR have to meet the liquidity requirements established by the undertaking; and
- the liquidity requirements shall guarantee an appropriate coordination of the liquidity features of the hedged assets or liabilities, the liquidity of the

financial risk mitigation technique, and the overall policy of the undertaking regarding liquidity risk management.

2.4 Principle 4: Credit quality of the provider of risk mitigation

2.4.1 Providers of risk mitigation instruments should have an adequate credit quality to guarantee with appropriate certainty that the undertaking will receive the protection in the cases specified by the contracting parties.

2.4.2 Credit quality should be assessed using objective techniques according to generally accepted practices.

2.4.3 The assessment of the credit quality of the provider of protection shall be based on a joint and overall assessment of all the features or contracts directly and explicitly linked to the financial risk mitigation technique. This assessment shall be carried out in a prudent manner, in order to avoid any overstatement of the credit quality.

2.4.4 The correlation between the values of the instruments relied upon for risk mitigation and the credit quality of their provider shall not be unduly adverse, i.e. it should not be materially positive (known in the banking sector as 'wrong way risk'). As an example, exposures in a company belonging to a group should not be mitigated with CDS provided by entities of the same group, since it is very likely that a failure of the group will lead to falls in the value of the exposure and simultaneous downgrade or failure of the provider of protection. This requirement does not refer to the systemic correlation existing between all financial markets as a whole in times of crisis.

2.5 Principle 5: Direct, explicit, irrevocable and unconditional features

2.5.1 Financial risk mitigating techniques can only reduce the capital requirements if:

- they provide the undertaking with a direct claim on the protection provider;
- they contain an explicit reference to specific exposures or a pool of exposures, so that the extent of the cover is clearly defined and incontrovertible;
- they are not subject to any clause, the fulfilment of which is outside the direct control of the undertaking, that would allow the protection provider to unilaterally cancel the cover or that would increase the effective cost of protection as a result of certain developments in the hedged exposure; and
- they are not subject to any clause outside the direct control of the undertaking that could prevent the protection provider from its obligation to pay out in a timely manner in the event that a loss occurs on the underlying exposure

3 Appendix 3 - Association of credit assessments with credit quality steps

The credit assessments of an External Credit Assessment Institution (ECAI) are to be associated with the following credit quality steps:

Credit quality step	Standard & Poor's/Fitch	Moody's	AM Best
0	AAA	Aaa	A++
1	AA	Aa	A+
2	A	A	A
3	BBB	Baa	A-
4	BB	Ba	B++ to B
5 -6	Lower than BB/ unrated	Lower than BB/ unrated	Lower than B/ unrated

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4 Appendix 4 – Lines of business

A. Non-life insurance obligations

1. Motor vehicle liability insurance

Insurance obligations which cover all liabilities arising out of the use of motor vehicles operating on land (including carrier's liability).

2. Other motor insurance

Insurance obligations which cover all damage to or loss of land vehicles (including railway rolling stock).

3. Marine, aviation and transport insurance

Insurance obligations which cover all damage or loss to sea, lake, river and canal vessels, aircraft, and damage to or loss of goods in transit or baggage irrespective of the form of transport. Insurance obligations which cover liabilities arising out of the use of aircraft, ships, vessels or boats on the sea, lakes, rivers or canals (including carrier's liability).

4. Fire and other damage to property insurance

Insurance obligations which cover all damage to or loss of property other than those included in the lines of business 2 and 3 due to fire, explosion, natural forces including storm, hail or frost, nuclear energy, land subsidence and any event such as theft.

5. General liability insurance

Insurance obligations which cover all liabilities other than those in the lines of business 1 and 3.

6. Credit and suretyship insurance

Insurance obligations which cover insolvency, export credit, instalment credit, mortgages, agricultural credit and direct and indirect suretyship.

7. Legal expenses insurance

Insurance obligations which cover legal expenses and cost of litigation.

8. Assistance

Insurance obligations which cover assistance for persons who get into difficulties while travelling, while away from home or while away from their habitual residence.

9. Miscellaneous financial loss

Insurance obligations which cover employment risk, insufficiency of income, bad weather, loss of benefit, continuing general expenses, unforeseen trading expenses, loss of market value, loss of rent or revenue, indirect trading losses other than those mentioned above, other financial loss (non-trading) as well as any other risk of non-life insurance not covered by the lines of business 1 to 8 or 10 to 12.

10. Medical expense insurance

Medical expense insurance obligations where the underlying business is not pursued on a similar technical basis to that of life insurance, other than obligations included in the line of business 12.

11. Income protection insurance

Income protection insurance obligations where the underlying business is not pursued on a similar technical basis to that of life insurance, other than obligations included in the line of business 12.

12. Workers' compensation insurance

Health insurance obligations which relate to accidents at work, industrial injury and occupational diseases and where the underlying business is not pursued on a similar technical basis to that of life insurance.

B. Proportional non-life reinsurance obligations

The lines of business 13 to 24 shall include proportional reinsurance obligations which relate to the obligations included in lines of business 1 to 12 respectively.

C. Non-proportional non-life reinsurance obligations

25. Non-proportional casualty reinsurance

Non-proportional reinsurance obligations relating to insurance obligations included in lines of business 1 and 5.

26. Non-proportional marine, aviation and transport reinsurance

Non-proportional reinsurance obligations relating to insurance obligations included in line of business 3.

27. Non-proportional property reinsurance

Non-proportional reinsurance obligations relating to insurance obligations included in lines of business 2, 4 and 6 to 9.

28. Non-proportional health reinsurance

Non-proportional reinsurance obligations relating to insurance obligations included in lines of business 10 to 12.

5 Appendix 5 – Examples of techniques for the calculation of the best estimate of technical provisions

5.1 Simulation techniques

5.1.1 Rather than considering all possible future scenarios, insurers and reinsurers can choose a suitably large number of scenarios which are representative of all possible future ones. This approach is referred to as a "simulation technique".

5.1.2 For certain life insurance liabilities, in particular the future discretionary benefits relating to participating contracts or other contracts with embedded options and guarantees, simulation may lead to a more appropriate and robust valuation of the best estimate liability.

5.1.3 Examples of simulation techniques:

- Monte-Carlo simulations: the value of the liabilities is calculated in a large number of scenarios where one or more assumptions are changed in each scenario. By simulating the behaviour of the random variable(s) in a very large number of scenarios, the model produces a distribution of possible outcomes so that a probability weighted average can be calculated ("mean of the distribution").
    - For example, the nature of the financial options and guarantees embedded in some life (re)insurance contracts, particularly those with profit participation, is such that a set of deterministic best estimate assumptions may not be sufficient to produce a best estimate liability. The application of closed form analytical solutions to value the options and guarantees may also be limited, if it is difficult to find market hedges that replicate the cash-flows under the contract, for example to reflect the use of management actions or the effects of path dependency. A deterministic or an analytical technique may therefore not be suitable for valuing such contracts, and a simulation technique may be needed.
    - Stochastic variation in non-market assumptions such as lapses and option take-up rates can have a material influence on the valuation of options and guarantees. One possible approach used is to assume that they are highly correlated with interest rates/market value which allows the insurer to include the relationship within the liability models without an additional stochastic variable.
- Bootstrapping: one of the most extended uses of bootstrap within actuarial work is associated with estimation of claims provisions. Starting from a model that explains how losses are paid, it consists of resampling residuals from that model and obtaining a large sample of estimated provisions required to pay future outstanding losses.
- Simulating losses above a certain threshold and up to a certain limit is also a frequently used technique by (re)insurers to calculate an estimated expected loss in respect of a given excess of loss programme.

- Bayesian approaches, where explicit prior assumptions are blended with observations resulting in an estimate for the ultimate claim.

5.2 Analytical techniques

5.2.1 The insurer or reinsurer may be able to use a valuation technique based on closed form solutions. Such techniques are referred to as analytical techniques and are based on the distribution of future cash-flows.

5.2.2 For the estimation of non-life best estimate liabilities as well as life insurance liabilities that do not need simulation techniques, deterministic and analytical techniques can be more appropriate.

5.2.3 Examples of analytical techniques:

- Techniques which use an assumption that future claim amounts follow a given mathematical distribution (e.g. Bayesian). These techniques calculate an undiscounted probability weighted average set of cash-flows without explicitly considering each potential scenario. An example may be the Mack method, also known as the distribution free chain ladder.

5.3 Deterministic techniques

5.3.1 The insurer or reinsurer may also be able to use a technique where the projection of the cash-flows is based on a fixed set of assumptions. The uncertainty is captured in some other way for example through the derivation of the assumptions. This is referred to below as a “deterministic approach”.

5.3.2 For the estimation of non-life best estimate liabilities as well as life insurance liabilities that do not need simulation techniques, deterministic and analytical techniques can be more appropriate.

5.3.3 At the current point in time, stochastic reserving techniques, especially in non-life insurance, are not considered as necessary valuation techniques to calculate best estimate values. The application of deterministic techniques and judgement can be far more important than the mechanical application of simulation methods.

5.3.4 Insurers and reinsurers may consider deterministic techniques appropriate in circumstances such as:

- Where an alternative technique may require the calibration of parameters for which only inadequate data is available.
- Where the nature of the liability is complex but the complexity does not materially affect the result or the complexity cannot be captured better by other techniques.
- Where the nature of the liability is sufficiently simple or for other reasons the nature is such that cash-flow projections based on best estimate assumptions result in a best estimate liability.

5.3.5 Examples of deterministic techniques:

- Actuarial methods such as Chain ladder, Bornhuetter-Ferguson, average cost per claim method, etc…
- Stress and scenario testing; for example, adjusting data for inflation and allowing inflation to vary, thus producing sensitivities around this parameter.
- Influential observations or outliers have been allowed for appropriately, for example via case by case reserving.
- Systematic as well as other random features are being captured through sensitivity testing, diagnostics or other techniques (this could be stochastic).
- Where a calculation relies on assumptions of an even spread of risk over the policy year and this is not the case (e.g. seasonality such as due to weather or hurricane season) the proportions should be adjusted.
- The use of relevant assumptions or other external/portfolio specific data as an input to the calculation when there is lack of data or as a benchmark for comparison.

5.4 Combination of techniques

5.4.1 An insurer or reinsurer may use a combination of approaches when calculating the best estimate. For example:

- The insurer or reinsurer may use a valuation technique which fails to include one or more causes of uncertainty. The excluded/additional cause of uncertainty could then be valued accurately as a separate set of cash-flows or measured through the use of validation tools and appropriate adjustments made.
- The insurer or reinsurer may identify that much of the cause of uncertainty arises from one or more risk with the remaining risks making a much smaller contribution to the uncertainty. In this example, the insurer or reinsurer may choose to use a valuation technique which combines a simulation approach for the former risk with either a deterministic or analytical approach for the latter risk provided the loss of accuracy is sufficiently small.

6 Appendix 6 – Regions for the calculation of the factor for geographical diversification

	Region	Territories that the region consists of
1	**Northern Europe**	Denmark (except Greenland), Estonia, Finland, Guernsey, Iceland, Ireland, Isle of Man, Jersey, Latvia, Lithuania, Norway, Sweden, United Kingdom (except Anguilla, Bermuda, British Virgin Islands, Cayman Islands, Falkland Islands, Gibraltar, Montserrat, Pitcairn Islands, Saint Helena, Turks and Caicos Islands)
2	**Western Europe**	Austria, Belgium, France (except French Guiana, French Polynesia, Guadeloupe, Martinique, Mayotte, New Caledonia, Réunion, Saint Barthélemy, Saint Martin, Saint Pierre and Miquelon, Wallis and Futuna), Germany, Liechtenstein, Luxembourg, Monaco, Netherlands (except Aruba, Bonaire, Curaçao, Saba, Sint Eustatius, Sint Maarten), Switzerland
3	**Eastern Europe**	Belarus, Bulgaria, Czech Republic, Hungary, Moldova, Poland, Romania, Russia, Slovakia, Ukraine
4	**Southern Europe**	Albania, Andorra, Bosnia and Herzegovina, Croatia, Cyprus, the former Yugoslav Republic of Macedonia, Gibraltar, Greece, Italy, Malta, Montenegro, Portugal, San Marino, Serbia, Slovenia, Spain, Vatican City State
5	**Central and Western Asia**	Armenia, Azerbaijan, Bahrain, Georgia, Iraq, Israel, Jordan, Kazakhstan, Kuwait, Kyrgyzstan, Lebanon, Oman, Qatar, Saudi Arabia, Syria, Tajikistan, Turkey, Turkmenistan, United Arab Emirates, Uzbekistan, Yemen
6	**Eastern Asia**	China, Japan, Mongolia, North Korea, South Korea, Taiwan
7	**South and South-Eastern Asia**	Afghanistan, Bangladesh, Bhutan, Brunei, Burma/Myanmar, Cambodia, India, Indonesia, Iran, Laos, Malaysia, Maldives, Nepal,

		Pakistan, Philippines, Singapore, Sri Lanka, Thailand, East Timor, Vietnam
8	**Oceania**	American Samoa, Australia, Cook Islands, Fiji, French Polynesia, Guam, Kiribati, Marshall Islands, Micronesia, Nauru, New Caledonia, New Zealand, Niue, Northern Mariana Islands, Palau, Papua New Guinea, Pitcairn Islands, Samoa, Solomon Islands, Tonga, Tuvalu, Vanuatu, Wallis and Futuna
9	**Northern Africa**	Algeria, Benin, Burkina Faso, Cameroon, Cape Verde, Central African Republic, Chad, Côte d'Ivoire, Egypt, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Libya, Mali, Mauritania, Morocco, Niger, Nigeria, Saint Helena, Senegal, Sierra Leone, South Sudan, Sudan, Togo, Tunisia
10	**Southern Africa**	Angola, Botswana, Burundi, Comoros, Democratic Republic of the Congo, Djibouti, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Kenya, Lesotho, Madagascar, Malawi, Mauritius, Mayotte, Mozambique, Namibia, Congo, Réunion, Rwanda, São Tomé and Príncipe, Seychelles, Somalia, South Africa, Swaziland, Uganda, Tanzania, Zambia, Zimbabwe
11	**Northern America excluding the USA**	Bermuda, Canada, Greenland, Saint Pierre and Miquelon
12	**Caribbean and Central America**	Anguilla, Antigua & Barbuda, Aruba, Bahamas, Barbados, Belize, Bonaire, British Virgin Islands, Cayman Islands, Costa Rica, Cuba, Curaçao, Dominica, Dominican Republic, El Salvador, Grenada, Guadeloupe, Guatemala, Haiti, Honduras, Jamaica, Martinique, Mexico, Montserrat, Nicaragua, Panama, Puerto Rico, Saint Barthélemy, Saba, Saint Kitts and Nevis, Saint Lucia, Saint Martin, Saint Vincent and the

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		Grenadines, Sint Eustatius, Sint Maarten, Trinidad and Tobago, Turks and Caicos Islands, US Virgin Islands
13	**Eastern South America**	Brazil, Falkland Islands, French Guiana, Guyana, Paraguay, Suriname, Uruguay
14	**Northern, Southern and Western South America**	Argentina, Bolivia, Chile, Colombia, Ecuador, Peru, Venezuela
15	**North-east USA**	Connecticut, Delaware, District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont
16	**South-east USA**	Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Puerto Rico, South Carolina, Tennessee, Virginia, West Virginia
17	**Mid-west USA**	Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, Oklahoma, South Dakota, Wisconsin
18	**Western USA**	Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Texas, Utah, Washington, Wyoming
19	**Unallocated Region**	Not directly allocated to any of regions 1 to 18. Need to be careful not to include business from a region with business already allocated.

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7 Appendix 7 – Health Catastrophe Risk – geographical segmentation and risk factors for the mass accident risk scenario

Country *s*	r_s – ratio of persons affected by the mass accident in country *s*
Austria	0.30%
Belgium	0.25%
Bulgaria	0.30%
Croatia	0.40%
Cyprus	1.30%
Czech Republic	0.10%
Denmark	0.35%
Estonia	0.45%
Finland	0.35%
France	0.05%
Germany	0.05%
Greece	0.30%
Hungary	0.15%
Iceland	2.45%
Ireland	0.95%
Italy	0.05%
Latvia	0.20%
Lithuania	0.20%
Luxembourg	1.05%
Malta	2.15%
Netherlands	0.15%
Norway	0.25%
Poland	0.10%
Portugal	0.30%
Romania	0.15%
Slovakia	0.30%
Slovenia	0.40%
Spain	0.10%
Sweden	0.25%
Switzerland	0.25%
United Kingdom	0.05%

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