# Directive of the Swiss Association of Actuaries on the determination of sufficient technical reserves for life in accordance with ISO-FINMA

**Valid for annual financial statements of Swiss life insurance companies as of 31 December 2024**

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# 1 Introduction

The dispatch on the amendment of the Insurance Supervision Act, ISA, which came into force on 1 January 2006, already stated that technical reserves serve to maintain the solvency of the insurance undertaking. According to Section 1 (2), the purpose of the ISA is to protect insured persons against abuses and the insolvency risks of insurance undertakings. It stipulates in Section 16 (1) that the insurance undertaking is obliged to form sufficient technical reserves for the entire business activity. According to Section 21 of the Insurance Supervision Ordinance (ISO), financial security is determined on the basis of solvency and technical reserves. It is incumbent upon the responsible actuary to determine sufficient technical reserves. Proof of sufficient technical reserves and sufficient risk capital complement each other. The safety margin necessary for sufficient technical reserves must ensure that the obligations arising from insurance contracts can be met without offsetting risk capital.

This Directive is intended to assist the actuary in this central task of determining sufficient reserves. It is **binding for actuaries who are responsible for forming sufficient reserves for the Swiss life insurance business in accordance with ISO-FINMA**, although deviations from this Directive may be made in justified cases.
The Directive deals in detail with what are called "simple" products. This Directive does not apply to life reinsurance.

# 2 Principles of ISO-FINMA

In accordance with Article 28 ISO-FINMA "Principles for determining technical reserves", technical reserves are sufficient if the obligations arising from the insurance contracts can be fulfilled on a permanent basis. In Article 28 it is stated that:

1. *For life insurance, the assumptions and methods used to determine technical reserves are to be determined in such a way that there is sufficient certainty that the obligations arising from the insurance contracts can be fulfilled on a permanent basis.*
2. *Technical reserves must be calculated in such a way that, at a minimum, the obligations arising from the insurance contracts are covered with sufficient security by a suitable investment portfolio in the amount of the technical reserves.*

The following principles must be observed:

- The technical reserve set aside in individual contracts must in any case be at least as large as it would have been if it had been determined using the assumptions and methods valid at the beginning of the contract.
- At least once a year on the balance sheet date, a review is to be carried out to determine whether the technical reserves are sufficient.
- The technical reserves must be sufficient for each sub-portfolio.
- The reserves must be determined without offsetting acquisition costs that have not yet been repaid.
- Safety margins must be built in to take into account the uncertainties in the assumptions and methods used to determine the technical reserves.
- In order to determine sufficient technical reserves, it is necessary to take into account the possibility of a very unfavourable change in behaviour by policyholders or insured persons. A particularly unfavourable development must be taken into account when the contract starts.
- Simple traditional products can be modelled in a simplified way by calculating their technical reserves as a value of the future cash flows using a conservative technical interest rate and conservative biometric principles.
- If insurance products contain complex financial obligations, these obligations must generally be included using stochastic models.
- Any rising cost factors and decreasing risk diversification in relation to the run-off of an insurance company or a large sub-portfolio must be taken into account.

# 3 Sufficient reserves principles

Obligations arising from life insurance contracts usually have a long contract duration, which can often span decades. The valuation of adequate technical reserves shall take account of these circumstances. The uncertainties that may arise in such a longer-term future phase shall be taken into account in the assumptions and methods used to calculate sufficient technical reserves. For the future insurance term of an insurance contract, estimates must be made for developments of capital market parameters or for biometric parameters or for the behaviour of policyholders or for future cost expenditures, and their adverse deflections must be included in the calculation.

The basis for determining sufficient technical reserves is a faithful estimate of all parameters that influence the settlement of obligations from insurance contracts (capital market, biometrics, costs, customer behaviour and management rules). This estimate should be as realistic as possible and should take into account all information available at the time of valuation. In addition, the uncertainties for the future development of these parameters must be taken into account with a sufficient level of security. Adequate technical reserves, thus, consist of a best estimate for the settlement of the obligations arising from the insurance contracts and an appropriate risk margin so that the obligations arising from the insurance contracts can be fulfilled on a permanent basis.

The following principles must be observed when determining the **best estimate**:

- In order to allocate investments to the sub-portfolios to be valued separately in accordance with Article 40 ISO-FINMA, a consistent link must be established with an effectively available investment portfolio and its management during the settlement period.
- The methodology for the valuation of reserves must be consistent with the accounting valuation principles for the valuation of investments.
- The faithful estimation of the parameters for determining the best estimate (capital market parameters, parameters for the biometric basis, cost parameters and parameters for customer and management behaviour) must take into account the entire settlement period of the obligations and should not include implicit margins.

The level of the **risk margin** is decisive for determining sufficient reserves. The following criteria and principles should be used to determine the risk margin:

- The risk margin must cover adverse deflections of the above best-estimate parameters with sufficient certainty.
- The determination of the possible adverse deflections should be derived from the available empirical values (historical scenarios and volatilities) and, where appropriate, other suitable sources of information and adapted appropriately to present and future circumstances.

The risk margin is to be understood as the margin of assurance for the uncertainties of the assumptions and methods for determining sufficient technical reserves in accordance with Article 29 ISO-FINMA "Prudence in assumptions and methods". The sum of the best estimate and risk margin per sub-portfolio, thus, results in sufficient technical reserves within the meaning of Article 40 ISO-FINMA "Division into sub-portfolios" and/or Section 54 (1) ISA. In order to guarantee financial security in accordance with Section 21 ISO, additional fluctuation reserves may have to be formed.

# 4 Distinction between simple and complex products

## 4.1 Simple products

Simple products include the classic life insurance products for which the guaranteed benefits are fixed in terms of amount and whose amount is, therefore, a deterministic value. Only the time of payment is a stochastic value, depending on the status of the insured person.
The savings premium is invested in a collective investment, and the insurer determines the investment strategy. Depending on the course of business, the insurer may distribute surpluses in addition to the guaranteed benefits.
Simple products defined in this way include pure risk insurance, classic mixed insurance and traditional life annuities.
Deterministic methods can be used to evaluate the guaranteed performance of such products by weighting and discounting the expected future cash flows with appropriate probabilities.
Unit-linked insurance policies without financial guarantees represent another group of simple products. The savings capital is invested on an individual contract basis, and the benefits correspond exactly to the value of the underlying assets. The evaluation of such products may also be carried out using deterministic methods.

## 4.2 Complex products

Complex products include all insurance products that contain financial guarantees that depend on the performance of the underlying assets or indices. The savings capital is invested in whole or in part on an individual contract basis.
Typically, complex products come with various options for policyholders, such as choice of investment strategy (either free or from predefined options), investment change options, guarantee increase options (eg in case of good investment performance), lump sum or annuity choice option. Less commonly, products may also include insurer options, such as the ability to adjust benefits or investment strategies in certain situations.

The complex products include what are called "variable annuities" or unit-linked insurance with a survival guarantee.

When valuing complex products, stochastic models must generally be used to adequately reflect the value of guarantees and options. Typically, simulation models must be implemented. If suitable closed approximation formulas exist, they may be used. An important aspect in the valuation of these products is the modelling of the behaviour of policyholders and potentially of the insurer.
A complex product can be conceptually represented in many cases as the sum of a unit-linked insurance policy without any guarantee (ie a simple product) and the options and guarantees.

The evaluation of complex products is not dealt with in detail in this Directive.

# 5 Basic principles for the reservation and review of technical reserves

## 5.1 General approach

In accordance with the review of technical reserves required by ISO-FINMA (Section 2: Life insurance: Review of technical reserves), the current reserves are compared with the sufficient reserves determined using a suitable procedure. This section describes three fundamentally equivalent methods which, when appropriately calibrated, may be used to derive sufficient reserves for this comparison. If the necessary reserve is higher than the existing reserve, the reserve shall be increased at a level which compensates for the deficit.

The same procedures should be used both for the review of reserves and for the evaluation of the deficit and the actual increase in reserves.

In general, the calculation for the necessary reserve for a sub-portfolio may be described as follows:

$$Reserve_{necessary} = \sum_{t=0}^{\infty} (Benefits_t + Costs_t - Premiums_t) \cdot v^{t+k}$$

where

| | |
|---|---|
| t | Time in years |
| $Benefits_t$ | Cash flow for benefits in year t, which include insurance benefits, buy-back benefits and reinsurance costs |
| $Costs_t$ | Costs of ongoing administration and support in years t |
| $Premiums_t$ | Premium income in year t |
| v | Discount factor for cash flow of year t |
| k | Timing factor to take into account the accrual of cash flows during the year (eg k=0.5, if cash flows occur on average in the middle of the year) |

In contrast, the (net) balance sheet reserve of the TB sub-portfolio is usually composed of the following:

$$Balance\ sheet\ reserve^{TB} = Actuarial\ reserves^{TB} + Premium\ transfer^{TB} - Deferred\ acquisition\ costs^{TB}$$

The necessary increase in the reserve is then calculated as:

$$Accrual\ increase^{TB} = max\left(Reserve_{necessary}^{TB} - Balance\ sheet\ reserve^{TB}; 0\right)$$

All three procedures below for assessing and verifying reserves are based on the same best-estimate assumptions of the respective parameters and calculation bases but use different approaches for determining the sufficient safety margins (a detailed description of two of the three procedures is then given in the following chapters):

- Safety margins:
  Sufficient safety margins on best estimate are defined for each estimation parameter by safety margins per calculation basis and tariff/product, and the reserves for the sub-portfolio to be valued are aggregated accordingly via addition.
- Scenario approach:
  Based on best-estimate reserves for (sub-) portfolios, scenario-based stress tests fine-tuned to the appropriate estimation parameters are used to determine the stress resistance of the reserves for these (sub-) portfolios in order to be assessed as sufficient.
- Stochastic simulation:
  Appropriate distributions are calibrated over all the parameters and calculation bases considered. The distribution of the reserve requirement is determined empirically from the joint distribution of all parameters and calculation bases with suitable dependencies between the parameters. The sufficient reserve can then be determined as a suitable quantile (possibly still dependent on the duration of the guarantees). This approach is particularly suitable for variable annuities.

The main difference between the approach via safety margins and the scenario approach is that the approach via safety margins first refers to the calculation bases per tariff/product and individual contract and from this very granular point of view is only aggregated to (sub-) portfolios via addition – the individual tariff/the individual product is, thus, the focus of considerations. Conversely, the scenario approach starts from the question of how changes in individual or several parameters simultaneously would affect the (sub-) portfolio and only then translates these scenarios into margins on the basis of the calculations and parameters of the individual tariffs/products.

Depending on the question and application, the safety margin approach may be advantageous, or the scenario approach: The advantage of the safety margin approach is, for example, that it is based on the same principle and comparable assumptions as the tariff/product calculation bases. Changes in the assumptions (best estimate as well as safety margins) may, thus, be directly transferred to new tariffs and products. However, there is the question of the correlation between the different safety margins, and there is the possibility of overestimating the individual safety margins. The scenario approach, on the other hand, has the advantage of providing a more comprehensive reserve risk assessment of (sub-) portfolios and is particularly suitable for calculation bases that are not well defined due to cross-balance sheet reference values on sub-portfolios, such as the return on investment.

As just illustrated, it might be wise to choose the most suitable approach for different parameters or calculation bases.

As already mentioned in Chapter 4, the approach to stochastic simulation refers primarily to "complex products" (eg variable annuities), which will not be discussed below. The other two methods must be used for classic products. Details of these two procedures are given in later chapters.

**Example: pure risk insurance**

Tariff reserves are determined on the basis of the prospective calculation as the difference between the present value of benefits and the present value of premiums. The present values take into account both cost rates and the probability of death depending on age and term. The discount rate for cash value formation is typically based on the current technical interest rate. When determining tariffs, all three calculation bases take into account costs, probability of death and interest rate safety buffers.

## 5.2 Safety margins

As described above, the objective of the methodology with safety margins, analogous to the procedures for deriving first-order rate bases, is to establish sufficient reserve bases with which the relevant obligations can be measured at a given point in time, taking into account the contractual financing. More up-to-date measurements and findings on the calculation bases, payments already received (eg sales remuneration) and knowledge of future premiums in their currency amount can be taken into account.

For example, the safety margin for biometric calculation bases may be divided into a

- Fluctuation margin to sufficiently reserve the uncertainty regarding risk compensation in the portfolio and a
- Change and error margin to sufficiently reserve future trends and developments or estimation errors of the company's own best-estimate principles.

Particular importance must be attached to the question of the correlation of the individual margins in order to prevent undesirable cumulative effects due to overestimation of the individual margins. Considerations on the choice of safety margins are given in Chapter 8.1.

**Example continuation: pure risk insurance**

A flat-rate margin of 15% is applied to the probability of death for fluctuations, changes and errors. With the best-estimate probability of death increased by a factor of 1.15, the reserve is newly determined and compared with the tariff reserve.

## 5.3 Scenario approach

Here too, the starting point is the current best-estimate assumptions for each calculation basis. The risk margin may be determined on the basis of sensitivities or stress scenarios whereby in many cases an aggregation of sensitivities to the adverse deflections of individual estimated parameters that have a significant influence on the settlement of the reserves may be a sufficient basis for determining the risk margin. The inclusion of capital market-, company- or product-specific scenarios should be considered in particular if the complexity of the product or investment portfolio or special situations, such as a run-off of a portfolio, require it. As described above, two basic approaches are possible:

- Sensitivities: For a sufficiently granular sub-portfolio, scenarios are defined as sensitivities per parameter for all relevant calculation bases. Appropriate safety margins are determined for the parameters under consideration, similar to the considerations for the method with safety margins, which describe the deviations from the best estimate for scenario-based adverse deflections in the medium-term and distant future. The additional reserve requirement for the results of the sensitivity measurements is determined using an appropriate aggregation method.
- Stress scenarios: Based on historical developments or worst-case assumptions about future developments, all parameters and calculation bases affected by these developments are adjusted consistently. The changes in the reserve are determined for the totality of the changes, including possible cross-connections between individual parameters, using a suitable aggregation method.

A sufficient reserve can only be concluded by appropriate aggregation of the individual sensitivities/scenarios and dependencies between the sensitivities/scenarios. Considerations for the scenario approach are given in Chapter 8.2.

**Example continuation: pure risk insurance**

Sensitivity: For all classic insurance products, a flat-rate increase of 10%, for example, is applied to the current best-estimate assumption.
Stress scenario: For all insurance products, a flat-rate cost inflation of 1% p.a., for example, is applied to the current best-estimate assumption. Consistent with this, it is assumed that the best-estimate yield curve will also offset this inflation. Death probabilities are not adjusted in this stress scenario.

## 5.4 Division into sub-portfolios

ISO-FINMA requires a minimum division into sub-portfolios for the annual review of technical reserves in both the group and individual insurance business (see Annex 1 to ISO-FINMA, "Sub-portfolios for the annual review of technical reserves in life insurance"). Technical reserves must be sufficient for each of these sub-portfolios. In addition, according to point 26, it is mandatory that: "Portfolios of a significant size within these sub-portfolios must be considered as separate sub-portfolios if their technical reserve is significantly lower than the sufficient reserve over a longer period of time."

Separate partial sub-portfolios must be formed if cross subsidisation across partial sub-portfolios is not sustainably ensured. The main criterion for this is the lapse risk in the case of surrenderable sub-portfolios, ie that cross subsidisation across the partial sub-portfolios could be jeopardised by different lapse behaviour, eg in the case of different interest rate guarantees.

Therefore, at least the features of actuarial interest rate, mortality table and tariff generation must be taken into account for the formation of partial sub-portfolios in the case of surrenderable sub-portfolios.

For sub-portfolios for which *ia* no (individual) lapse is expected (eg current old-age and survivors' pensions, current disability benefits), however, no further partial sub-portfolios need to be formed.

Sub-portfolios of insignificant size can be grouped together with other appropriate sub-portfolios.
Different components of an insurance product may be included in a single sub-portfolio provided that the reserve of one component is not significantly lower than the sufficient reserve.

In addition, partial sub-portfolios for which investments or hedges in the capital market exist independently of the other sub-portfolios must be considered separately.

# 6 Reserve bases for biometrics, costs, lapses etc

## 6.1 Introduction

When reviewing the technical reserves for a sub-portfolio, reserve review bases for biometrics, costs, lapses etc are applied. These include conservative estimates

- Of biometric probabilities, such as
  - The probability of death of an active or disabled person,
  - The probability of reactivation of a disabled person, or
  - The probability that a person is married at the time of death,
- Of biometric expected values of demographic random variables, such as
  - The expected age of a person's spouse, or
  - The expected number of children of a person.
- Of expected values for the development of costs
- Of lapse probabilities
- Of expected reinsurance costs
- As well as expected values for other special parameters, especially in group insurance

In the safety margins method, the reserve review bases are based on corresponding best estimates designated as **second-order bases** and are derived from these by building in safety margins (whereby the margin can also be zero for individual bases).

The aim of sections 6.2 to 6.8 is to provide actuarial recommendations for the preparation of second-order bases. The building in of safety margins is covered in section 8.1.1.

## 6.2 Second-order biometric bases

### 6.2.1 Statistical database

Wherever possible, the second-order bases must be established on the basis of observations of the sub-portfolio for which the technical reserves are to be determined.
If the scope or quality of the resulting database is not adequate to derive sufficiently reliable estimates, or if there is no experience in the sub-portfolio about the quantity to be estimated, plausible statistics of similar portfolios may be used.

These are for example

- Community statistics of the companies of the Swiss Insurance Association or
- Surveys by the Federal Statistical Office.

If statistics of similar portfolios are used, it must be checked whether the resulting second-order bases are adequate for the sub-portfolio under consideration. If there are significant deviations, appropriate adjustments must be made (in accordance with point 6.2.3).

The observation period shall be chosen in such a way that events or developments which are likely to be permanently relevant and applicable to the variable to be estimated are optimally incorporated into the data collected. Past events and developments that could lead to a falsification of the estimate should, if possible, not be included. This means, for example, in the event of a substantial and relevant adjustment of the conditions for the corresponding insurance, that the start of the observation period should not be before the effective date of this change.
If, when selecting the observation period, it is not possible to avoid known one-off effects or past developments that are no longer current from being included in the database, these influences must be suitably compensated for when deriving the second-order bases (in accordance with point 6.2.2).

If the derivation of the second-order bases is based entirely or partly on a company-owned database, the correctness of the data must be checked. This plausibility check may consist, for example, of a sufficiently comprehensive sample check or may be carried out on the basis of parameters that can be easily verified, such as average, minimum or maximum values.

The data is counted in such a way that the estimate is not falsified. If, for example, personal data from different IT systems (such as for inventory management and benefit processing) are cumulated, then a uniform and consistent counting method must be ensured[1].

Available, actuarially recognised sets of rules, such as the guidelines for the compilation of the community statistics of the companies of the Swiss Insurance Association, can be used for counting if they are applicable.

### 6.2.2 Compensation of raw statistics

By counting (measuring) the database, raw statistics are obtained, which contain observations of the quantities to be estimated. If, for example, death probabilities are to be determined, then the corresponding raw statistics include the mortality rates observed during the observation period.

The second-order bases result from the raw statistics

- By adjusting known events and trends included in the database which distort the estimate as well as
- By compensating for the random fluctuations.

If the database includes one-off events or trends that falsify the estimate, then they must be suitably compensated for. In particular, account must be taken of the effects of late entries[2].

The compensation of random fluctuations is carried out with the help of recognised mathematical methods, such as the Whittaker and Henderson method or with splines.

If it is necessary to extend the second-order bases to areas without sufficient statistical experience (such as marginal age ranges in mortality tables), extrapolations may be applied.

### 6.2.3 Checking and adjusting the bases

If second-order bases are not based exclusively on the insurer's own statistics because the scope of the corresponding database was not adequate to derive sufficiently reliable estimates (cf. 6.2.1), a check is made before their application as to whether they are adequate for the portfolios under consideration.
For this purpose, the expected values according to the basis to be checked are compared with the corresponding observed values. For example, second-order probabilities of death can be checked by comparing the expected number of deaths with the number of deaths actually observed. If, for example, the bases have been corrected for one-off effects (according to point 6.2.1), this must be taken into account appropriately during the review.
If statistically significant deviations occur between expected and observed values, the second-order bases must be adjusted appropriately. The adjustment must be made using recognised mathematical methods (such as credibility methods) that take into account the statistical relevance of the deviations.

Second-order bases used for the determination of technical reserves must be reviewed periodically. The principles and methods described above are applied.

### 6.2.4 Special bases

When determining technical reserves for life annuities, death probabilities must be applied which depend not only on gender and age but also on the generation (ie year of birth) of the pensioners. The basis for the determination of such generation-dependent reservation review bases is corresponding second-order mortality probabilities, which contain assumptions about the future development of mortality. These assumptions are based on recognised mathematical models (such as the Nolfi half-life model or the Lee and Carter model). If other characteristics such as smoking status or occupational groups are used for pricing, this must also be taken into account in the reservation review bases.

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[1] This means, for example, that there is no need to mix policy and personal statistics.
[2] By late entries, we mean insurance-relevant events, such as the occurrence of a claim or the reactivation of a disabled person, which are communicated to the insurance company late and are, thus, recorded late in the IT systems. Late entries may lead to an incomplete database and, thus, to an estimation error.

## 6.3 Second-order cost parameters

The second-order cost parameters are also to be determined on a company-specific basis. Since the existing portfolio is to be valued without future new business, no one-off acquisition costs are to be taken into account, only running costs. These running costs also include depreciation of capitalised investments (eg IT systems), but the depreciation of goodwill that was provided as a result of the takeover of a company is not to be taken into account here. As a rule, the actual costs of the past financial year must be used to determine the cost parameters. If extraordinary one-off costs (e.g. restructuring costs, costs for the integration of an acquired company) were incurred in this financial year, these can be deducted for the determination of the cost parameters whereby the definition of "extraordinary costs" should be handled restrictively. Future planned cost savings may only be taken into account insofar as they are already being implemented, and the planned savings are very likely to be achieved.

For the definition of running costs, a going-concern assumption should be made in the existing business model, ie only the one-off costs incurred in connection with new contracts (and contract increases), such as acquisition fees (incl. additional compensation and social benefits associated with the acquisition fees) and costs for underwriting and policy creation, should be deducted from the total costs for the determination of running costs.

The following sample compilation is intended to illustrate this breakdown:

**One-off costs when taking out insurance**

- Acquisition fees
- Additional compensation in connection with new business (for consultants, brokers, sales managers etc)
- Cost of social benefits on top of these compensations
- Policy creation costs (part of customer service costs, general agency internal service costs, call centre costs, IT costs etc)
- Costs for underwriting/health check

**Running costs in the existing business model (without reference to the portfolio)**

- Costs associated with sales management and control
- Costs of the general agencies (excluding part for "final support")
- Costs for market performance development and marketing
- Project costs
- IT costs that are not merely related to contract management (eg for new products, customer relationship management)
- Most of the financial functions
- Most of the management
- Etc

**Running costs for contract processing only**

- Costs of policy administration (personnel and IT)
- Cost of the benefits service
- Portfolio compensation
- Small part of the financial functions
- Small part of management
- Etc

These total running costs, which do not only include those costs that are required for merely processing the contract, are then to be distributed to individual products by means of a suitable model, and from this, second-order cost parameters are to be determined for each product (eg unit costs, costs in % of the premium, costs in % of the sum insured etc).

In the going-concern assumption, it can be assumed that these ongoing costs will decrease synchronously with the decrease in the portfolio since future new business will always bear a larger part of the fixed costs. Likewise, there is always the possibility that the ongoing costs of the existing business model, which have no direct relation to merely processing of contracts, will be adjusted to a possibly shrinking volume.

If, on the other hand, a company is already in run-off, this assumption is not permissible, ie a closer examination must be made as to which part of the costs is variable and, thus, also declines with the decrease in the portfolio, and a closer check must also be made as to which part of the costs is fixed, regardless of the size of the portfolio, and, thus, becomes increasingly important in relation to the still existing portfolio.

The going-concern assumption must be checked regularly. Under certain circumstances, it may be appropriate to set up corresponding cost reserves before the actual run-off.

The inflation-related increase must be taken into account in the evolution of cost parameters over time. At least those costs that serve purely to process the contract (with the exception of portfolio compensation) must be increased annually by the expected long-term inflation. For the remaining running costs, it can be assumed that they will increase at most in proportion to the total business volume (including future new business) so that the parameters for this part of the costs remain constant.

## 6.4 Second-order lapse probabilities

In individual insurance, lapse is understood to mean both lapse of the contract and exemption from premiums. In group insurance, lapses include contract terminations but not terminations of service since it is assumed that the number of insured persons within a contract remains constant.

For the determination of the second-order bases for lapses, essentially the same principles apply as those described in the chapter "Second-order biometric bases".
In particular, the bases should be based on the company's own observations whereby even finer subdivisions must be made for lapses if the lapse behaviour is obviously different (eg different lapse probabilities for single-premium and annual-premium insurance).

## 6.5 Expected reinsurance costs

The expected value of the reinsurance balance normally represents a loss for the insurance company, which is why these costs must be taken into account in the review of the technical reserves if they are material.

## 6.6 Second-order special parameters for group life

### 6.6.1 Introduction

In group insurance, there are various parameters that will change in the future as they (such as the mandatory conversion rate) depend on legal adjustments, are determined externally on the basis of capital market parameters (such as the minimum interest rate of FSOPP – Federal Statute on Occupational Pension Plans – retirement credits) or can be freely determined by the company (such as parameters in the extra-mandatory insurance etc). In particular, when reviewing or setting up a reserve for future conversion rate losses, a variety of these parameters must be determined, which is why the determination of these parameters is discussed in this chapter.
In addition to the principles listed below, the same principles generally apply to the determination of the necessary parameters as for the second-order biometric bases (see Chapter 6.2).

### 6.6.2 Interest on retirement credits

Uniform or separate assumptions may be made for the interest on the projection of retirement credits for mandatory and extra-mandatory retirement credits. If uniform assumptions are used, at least the mandatory assumptions must be used.

For the determination of the mandatory parameter, either a separate calculation method can be used, which is consistent with the determination of the long-term expected returns for the determination of the technical actuarial interest rate, or the (70/7/7) method.

A direct method or an indirect method can be selected for the extra-mandatory parameter. With the direct method, the parameter is determined on the basis of expected returns and business policy considerations whereby consistency with the other parameters (mandatory interest rate, mandatory and extra-mandatory conversion rate, technical actuarial interest rate) must be ensured.

With the indirect method, a premium or discount is applied to the mandatory interest rate on the basis of business policy considerations. Consistency must also be ensured with this method.

### 6.6.3 Conversion rates

At the time of projection, various conversion rates or bases of calculation with regard to interest rate and mortality are used to determine conversion rate losses.

1. Statutory conversion rate
2. Tariff-based conversion rates
3. Actuarial conversion rate

The losses result from the conversion of the retirement credits at the time of retirement as the difference between the actuarial conversion rate and the statutory or tariff-based conversion rates.

The actuarial conversion rate must be determined using the same reservation review bases as for the other reserves (best estimate plus safety margins).

Reductions in the statutory conversion rate may only be taken into account after a definitive adoption of the amendment to the law. For the determination of the future tariff-based and actuarial conversion rates, the expected interest rate and the expected mortality development may be taken into account. If a reduction is assumed for the future conversion rates, the statutory, contractual and operational conditions must be taken into account.

The conversion rates are only applied to those retirement credits that are expected to be annuitised. An assumption must be made here about the pension or capital withdrawal rate whereby the same principles apply as for the biometric bases (see Chapter 6.2).

### 6.6.4 Discounting and loss probabilities for conversion rate losses

The discounting of future conversion rate losses should be based on the same interest rate that is used to review the reserves.

The probability of the actual occurrence of the anticipated conversion rate losses can be taken into account by using survival probabilities up to the retirement age of the insured persons. The capital mortality probabilities required for this purpose are determined in accordance with the biometric principles described in Chapter 6.2.

### 6.6.5 Duration of the consideration of conversion rate losses

For example, the following two approaches are available with regard to the duration of taking into account the expected conversion rate losses:

One option is to take into account the expected annuitisation losses of all insured persons who belong to the portfolio at the time of calculation. When discounting the expected annuitisation losses, (increased) lapse probabilities can be included, which take into account the insurer's ability to actively terminate contracts.

Another approach is to take into account only those annuitisation losses that are expected within a limited period of time from the date of review. The duration of this period may be based on the average remaining contract term of the sub-portfolio or may be directly based on the remaining term of the individual contracts.

### 6.6.6 Reserve for inflation risk

A separate reserve ("inflation fund" or "inflation reserve") is formed for the risk of inflation in accordance with Section 36 of the FSOPP. The inflation underlying the calculation of the reserve should be based on historical scenarios, taking into account the real rate of return.

## 6.7 Insurer options

In the area of group insurance, in particular, the insurer has various options, such as to increase premiums or to terminate contracts. By exercising these options, various risks – such as future conversion rate losses in group insurance – may be reduced.

The consideration of such insurer options in the review of reserves is permissible provided that there is a realistic probability that they can be exercised "in an emergency".

If such adjustment options of the insurer (whether in terms of premiums or benefits) are taken into account in the review of the reserves, it must also be checked whether any resulting extraordinary termination options for the customers have a negative impact.

## 6.8 Policyholder options

Many life insurance contracts provide for various options in favour of policyholders or insured persons. In group insurance, for example, these are

- The choice between a lump-sum withdrawal or an annuity,
- The choice between early, scheduled or deferred retirement,
- The possibility of contract termination (lapse), in particular, without interest risk deduction,
- Purchases and early withdrawals, or
- An increase in sums insured.

In individual insurance, for example, these are

- The possibility of an early redemption or a premium exemption (lapse), or
- Reinsurance guarantees.

If the exercise of an option leads or could lead to a non-negligible higher risk for the life insurer, the options must be included in the calculation of the reserves.

A characteristic feature of these options is often that their exercise and value depend on other parameters such as the interest rate level.

Examples of interest-dependent options in simple classic insurance policies:

- If the customer in group insurance has the choice of also buying back the reserves for current pensions when the contract is terminated or whether these remain with the insurer, the customer tends to take them with them when interest rates are high while they tend to leave them with the insurer when interest rates are low.
- In group insurance, the customer is relatively free to choose when to terminate their contract. A lack of an interest rate risk deduction can lead to losses when options are exercised and interest rates rise, as the customer must be paid "nominal values" while the market values of the investments to be liquidated may be below these nominal values. On the other hand, rising interest rates may lead to lower reserve requirements elsewhere (eg for current pensions), which would make it necessary to check which effect predominates.

For the review of the technical reserves of simple classic insurance policies without special options, it is usually not necessary to model a dependency of the lapse on other parameters, such as the interest rate level.

If special options are included in a simple classic product or if it is a complex product, scenarios should be used to check the extent to which a correlation between interest rates and lapses, for example, has a significant effect on the reserve requirement. If such a dependency has a significant effect, it must either be modelled appropriately when checking the technical reserves, or a separate reserve must be made for this risk.

The lapse risk must also be taken into account when offsetting gains and losses between different portfolios. For example, no profits on asset portfolios may be offset against losses on pension portfolios in group insurance as it could be the case that in the event of a lapse the assets disappear but the pensions remain with the insurance company.

# 7 Best estimator of future return on investments

## 7.1 Introduction

When reviewing the technical reserves for a portfolio, a yield vector shall be used to discount expected future obligations, which includes conservative estimates of the expected future returns on the corresponding investments of tied assets. It is based on a corresponding best-estimate return vector (second order) and is derived from this by offsetting safety margins.

In Chapter 7.2 below, we first provide actuarial recommendations for the creation of the best estimate yield vector. The determination of the safety margins will then be discussed later in Chapter 8.1.2.

## 7.2 Derivation of the best-estimate yield vector

In order to determine the best-estimate yield vector, the expected future development of the return on investments allocated to the statutory reserves that are to be reviewed must be estimated. The starting point is, therefore, the investments of tied assets in the life insurer's statutory balance sheet. It should be noted that the investments in a statutory balance sheet, ie also the investments allocated to the tied assets, are valued on the basis of carrying values.

With the entry into force of the Transparency Ordinance of 1 April 2004 and in accordance with ISO Section 77, group life business and individual life business in particular must be considered separately. Accordingly, a best-estimate yield vector must also be drawn up at least separately for group and individual life business on the basis of the corresponding separate tied assets.

### 7.2.1 Determination of relevant reserves and assets

Technical reserves are those which are formed in accordance with ISO Section 54, or according to the business plan form D and are to be covered by the debit amount of the tied assets in accordance with ISO Section 56 (1) point a. As a rule, the individual assets are not allocated to specific technical reserves.

If there are significant reserves that are matched by specific, precisely defined assets, these reserves and the corresponding assets must be accounted for separately. This could, for example, concern products (such as those known as index-linked insurance or "tranche products") to which specific assets are allocated.

The total carrying amounts of the remaining tied assets will generally exceed the total of the remaining technical reserves included in the projection for settlement. In a second step, therefore, the total carrying amounts of the remaining tied assets are scaled so that they correspond to the total of the remaining technical reserves (see Article 28 ISO-FINMA "Principles for determining technical reserves". This ensures that any excess coverage of the target amount does not lead to an increase in yields.

These remaining assets define the assets relevant for the review of sufficient reserves and their allocation as of the balance sheet date. The best-estimate yield vector is derived on the basis of this asset distribution. This yield vector must be determined in such a way that its application to the statutory assets generates the best-estimate cash flows. A distinction must be made here as to whether the portfolio under consideration is closed (ie in a "run-off" mode) or not. If it is not a closed portfolio, the continuation of business principle (ie the assumption of the going-concern principle) is applied.

In order to estimate the future yields, the asset portfolio must be settled and the balance of the cash flow of assets and the technical cash flow from premiums, benefits and costs reinvested to the extent that the reserves are covered by the carrying amount of the assets. To simplify matters, the projected individual contractual reserves may be used instead of the sufficient reserves. Insofar as the investments are not specifically allocated to individual (partial) sub-portfolios, this can be done at the level of the individual tied assets and the corresponding insurance contracts and does not have to be determined per sub-portfolio.

The company's own investment strategy must be taken into account, and the asset distribution as well as reinvestments can be carried out under the going-concern principle in accordance with the current or strategic investment strategy.

With a growing asset volume as well as the transition from the current to the strategic asset distribution, it must be taken into account that new investments or reinvestments in real assets (tangible assets such as shares and properties) are also required to comply with the predefined asset distribution. The returns on these new investments or reinvestments should not be based on the carrying value returns of the current portfolio but on current market conditions as is the case with fixed-interest investments.

In accordance with the going-concern approach, the current or planned strategy may be used for the duration of reinvestments in the area of fixed-income investments. Exceptions are reinvestments, eg for partial sub-portfolios to which the company's own, specific assets are allocated or for tied assets of portfolios that are in the run-off as a whole. In these exceptional cases, if reinvestment is required, the reinvestment period should not be longer than the remaining term of the corresponding insurance contracts.

In order to derive the best-estimate return vector of the investment portfolio, you must first estimate the return vectors of the individual asset classes (cf. point 7.2.3) and accumulate them in an appropriate manner to form a best-estimate yield vector weighted by asset classes (cf. point 7.2.4).

### 7.2.2 Notes on the procedural approach

The valuation principle of guaranteed obligations of traditional business must be viewed in the context of statutory accounting. The liabilities side of a statutory balance sheet must always be considered in conjunction with the assets side. For reasons of consistency, a different treatment (for example, a valuation of the assets side at carrying amounts and a valuation of the liabilities side at market values) must be avoided.

Various principles are derived from this aspect.

When determining the best-estimate yield vector weighted by asset class, the expected return on the actual investment portfolio used to cover the respective obligations (in accordance with point 7.2.1) must be taken into account. A separate best-estimate yield vector may be determined for sub-portfolios with obligations that are replicated by corresponding assets.

When valuing an asset class, the valuation method that is deemed valid in accordance with the statutory accounting system must be used. The application of an amortised cost principle for bonds, for example, makes it possible to present stable and calculable returns in the statutory accounts even if market interest rates fluctuate. The stabilisation of yields at a predictable level is necessary due to the business model of traditional life insurance according to which annual guarantees must be provided at a constant level during the term of the contracts, and statutory gains or losses are allocated asymmetrically to customers or shareholders.

In the case of properties and shares, expected returns (best estimates) must be assumed. In these asset classes, the valuation reserves resulting from the lowest-value principle can be included in the estimates, if necessary.

### 7.2.3 Returns on each asset class

In our subsequent considerations, we limit ourselves to the main asset classes of fixed-income investments, shares and properties. The other asset classes must be treated in the same way.

It is possible that within the listed asset classes, a refinement is made into sub-categories and that a separate best-estimate yield vector is derived for each of these sub-categories. In this case, the individual yield vectors of the sub-categories are cumulated into a best-estimate yield vector of the asset class. The cumulation is weighted according to the allocation of the sub-categories within the asset class under consideration.

**Fixed-income investments**

The category of fixed-income investments primarily comprises bonds, such as
- Swiss Federal bonds and bonds (such as cantonal bonds) with a similarly low default risk,
- Foreign government bonds,
- Corporate bonds or high-yield bonds,

But also similar investments such as
- Mortgages or
- Policy loans.

The expected yield vector for fixed-income investments is based on the expected cash flow divided by the carrying amount of the corresponding current investment portfolio. The cash flow consists of expected interest income and amortisation expenses.

When determining the expected cash flow for fixed-income investments, the default risk must be taken into account. In the case of fixed-income investments in foreign currencies, the currency risk must also be taken into account in an appropriate form. Possible hedging costs must also be taken into account.

Maturing fixed-income investments are re-invested in the same or different asset class in accordance with the current or strategic asset allocation. The re-investment interest rate can be based on the forward rates of low-risk investments and a spread. If the current or strategic asset allocation includes investments in foreign currencies, an additional premium may be applied in justified cases (eg due to higher expected yields in the euro area). On the other hand, currency risk and hedging costs must also be taken into account by means of an appropriate discount.

**Shares**

In addition to shares, this asset class also includes investment funds.

The determination of the expected return can generally be based on the expected carrying value returns, including hidden reserves.

One possible approach for determining the best-estimate yield vector for a share is to use the best-estimate yield curve for low-risk investments (for example for Swiss Federal bonds) as underlying assets and to increase appropriate best-estimate margins (spreads).

Another approach is to use historical time series to determine the yield for this asset class.

It is also possible to combine the two approaches.

In general, hedging costs should be taken into account when determining the best-estimate yield vector.

**Properties**

This asset class essentially comprises owner-occupied properties and properties that are used by third parties either commercially or privately.

The expected yield on properties should generally be based on carrying value returns.

The cash flows defined in the discounted cash flow method (DCF) for calculating the market value of a property can be used as a basis. The advantage of using the DCF market values is that these are also used as a basis for the imputation values of properties in tied assets and are, therefore, audited by the external auditors.

The market value of a property is calculated according to the DCF method as follows:

$$Market\ value = \sum_{t=0}^{\infty} \frac{Cash\ flow_t}{(1+i)^t}$$

Cash flows: These mainly consist of current rental income and ongoing expenses for operating, maintenance (upkeep) and repair costs (refurbishments: value-enhancing and value-retaining).

i: Discount interest rate

For the determination of the carrying value return, it can be assumed that the value-enhancing repair costs, which are capitalised in the carrying value view, compensate for the age-related depreciation as they are usually made on the carrying amounts according to the Swiss Code of Obligations (OR). The expected cash flows can, thus, be taken directly from the DCF valuation of the properties or should at least be checked for plausibility with these if other sources are used for the expected cash flows.

The expected yield vector for properties is then based on the respective expected cash flow divided by the carrying amount of the respective current asset portfolio.

$$Return\ on\ carrying\ value_t = \frac{Cash\ flow_t}{Carrying\ value_0}$$

Similarly, the return is calculated in relation to the market value (market value return) of the properties:

$$Return\ on\ market\ value_t = \frac{Cash\ flow_t}{Market\ value_0}$$

Correspondingly, the carrying value return can be derived from the market value return, which is necessary if the market value return (such as in the minimum requirement test) is limited to a maximum amount:

$$Return\ on\ carrying\ value_t = Return\ on\ market\ value_t \cdot \frac{Market\ value_0}{Carrying\ value_0}$$

Instead of a yield vector, an average value from this observation can also be used as a constant yield.

Any foreseeable extraordinary measures that will have an impact on the cash flow or carrying value in the foreseeable future must be taken into account in an appropriate form

Any valuation reserves may be included in the yield estimate if their realisation is realistic, with regard to the strategic asset allocation, and any new investment is also taken into account for the return estimate.

**Alternative assets**

This asset class essentially comprises private equity, hedge funds and other asset classes that cannot be allocated to any other category. These classes may be treated similarly to shares but use an adjusted risk premium and safety margin to account for their own volatility and risks.

One possible approach for determining the best-estimate yield vector for alternative investments is to use the expected yield curve for low-risk investments of the same reference currency (for example, Swiss Federal bonds for CHF) as the underlying asset and to increase it by an appropriate risk-bearing margin (risk premium). The latter can be calculated as a factor ***s*** (Sharpe ratio) multiplied by the alternative investments' own standard deviation.

$$Expected\ return\ on\ alternative\ assets = Expected\ risk - free\ interest + \boldsymbol{s} \cdot \sigma_{Alternative\ asset}$$

The Sharpe ratio ***s*** calibration may be performed using yield and volatility assumptions for shares in the best-estimate scenario as a solution to the following equation:

$$Expected\ return\ on\ shares = Expected\ risk - free\ interest + \boldsymbol{s} \cdot \sigma_{Shares}$$

The Sharpe ratio is defined as the difference between the expected return on the shares and the expected risk-free interest rate at the balance sheet date divided by the standard deviation of the shares at the balance sheet date:

$$\boldsymbol{s} = \frac{Expected\ return\ on\ shares - Expected\ risk - free\ interest}{\sigma_{Shares}}$$

If a fixed return is used for the shares, this may also be simplified (assuming that the expected risk-free interest rate is zero) as follows (if the risk-free interest rate is positive, this slightly underestimates the return):

$$Expected\ return\ on\ alternative\ assets = Expected\ return\ on\ shares \cdot \frac{\sigma_{Alternative\ asset}}{\sigma_{Shares}}$$

The separate derivation of a best-estimate yield vector in the case of alternative investments is not mandatory provided that the alternative investment asset class does not represent a significant proportion of the tied assets. In this case, alternative investments can be allocated to other existing asset classes, eg shares.

**Convertible bonds**

In order to determine the best-estimate return vector of convertible bonds, a breakdown must be made into a bond component and a share component.

If convertible bonds contribute to a significant portion of the tied assets, they should be allocated on an individual investment basis according to their main risk characteristics. For example, the equity delta, i.e. the participation of the convertible bond in the price fluctuations of the underlying share, can be used as an approximation for this main risk characteristic.

*Example:*
*Convertible bond with:*

- *Carrying value = nominal value = CHF 100*
- *Market value CHF 110*
- *Maturity 5 years*
- *Coupon 1%*
- *Equity delta 0.6*

*This convertible bond could be allocated to two notional investments:*

- *Share with:*
  - *Carrying value = CHF 60 (= 100 x 0.6)*
  - *Market value = CHF 66 (= 110 x 0.6)*
- *Bond with:*
  - *Carrying value = CHF 40 (=100 x (1 – 0.6))*
  - *Nominal value = CHF 40 (=100 x (1 – 0.6))*
  - *Market value = CHF 44 (=100 x (1–0.6))*
  - *Maturity 5 years*
  - *Coupon = 1% <u>of the recalculated nominal value</u> (this avoids hidden double counting of the coupon)*
  - *Rating and other characteristics such as original convertible bond*

If convertible bonds do not represent a significant portion of the tied assets, the allocation may simply be made so that the aggregate volatility equals the volatility of the convertible bond after taking into account correlation effects between bonds and shares. If sufficient data is available to determine the latter, the volatility of the convertible bond should be determined on a company-specific basis. Otherwise, the volatility of the convertible bond can be determined using an index. Volatility and correlations of shares and bonds can be found, for example, in the last available SST parameterisation.

The bond component is to be treated separately in accordance with the notes on fixed-interest investments. The equity component is to be treated separately in accordance with the notes on the shares.

**Hedging instruments**

In general, income from hedging instruments (such as swaptions) may be taken into account when determining best-estimate yield vectors or when analysing scenarios.

The hedging costs of fixed-income investments, shares and other investments should already be included in the separately determined yield curves of the respective asset classes.

### 7.2.4 Accumulation of asset class returns

Based on the asset allocation weighted by carrying value, a resulting best-estimate yield vector for the entire underlying asset portfolio may be determined from the individually determined best-estimate yield vectors (yield curves) of the respective asset classes.

This yield vector must be reduced, if not already done, by the asset management costs, which can be based on the future expected costs under the assumption of a going concern.

The best-estimate yield vector, reduced by the expected asset management costs, may be used to determine valuation rates for the review of reserves. In determining these valuation rates, it may also be taken into account that not all reserves require interest.

For the sake of simplicity, best-estimate yield vectors (as well as the resulting valuation rates for the review of reserves) may be converted to a constant implicit interest rate per sub-portfolio without any material deviation from the application of the yield vector. This may be done, for example, by searching for the constant implicit interest rate at which the sum of the discounted cash flows yields the same amount as the discount based on the interest vector (present-value cash flows with constant interest rate = present-value cash flows with yield vector).

# 8 Safety margins

## 8.1 Safety margins in the individual bases

Safety margins must be included for the review of technical reserves although there are basically different options for this. This may be done globally at the level of the individual reserve or individually at the level of the individual parameters, probabilities or assumptions. Safety can also be achieved by setting fluctuation reserves.

This chapter makes recommendations for the case and presents possible methods if safety is built into the individual level of each parameter.

### 8.1.1 Building safety margins into the bases for biometrics, costs, lapses etc

#### 8.1.1.1 General

The safety margins to be built into second-order bases have the function of cushioning adverse developments whether due to random fluctuations or due to changes in the environment.

The amount of margin to be built into the individual bases, therefore, depends on how high the fluctuations are that are to be expected for this parameter in the future, ie in a base for which strong fluctuations are to be expected, a correspondingly higher safety margin must be built in than in a base for which hardly any fluctuations are to be expected.

It must also be taken into account that there is a different number of bases that is applied depending on the insurance coverage. For example, for death risk insurance in individual insurance, only the biometric base mortality is required while for disability insurance the biometric bases disability probability, average degree of disability, reactivation probability and mortality are required. Since not all of these bases are normally fully (positively) correlated with each other, less safety must be built into the individual base as the number of bases used increases in order to achieve the same level of safety.

A possible procedure for the differentiated incorporation of safety margins into the individual bases is presented below although there are other procedures that also achieve the desired objective.

#### 8.1.1.2 Possible procedure

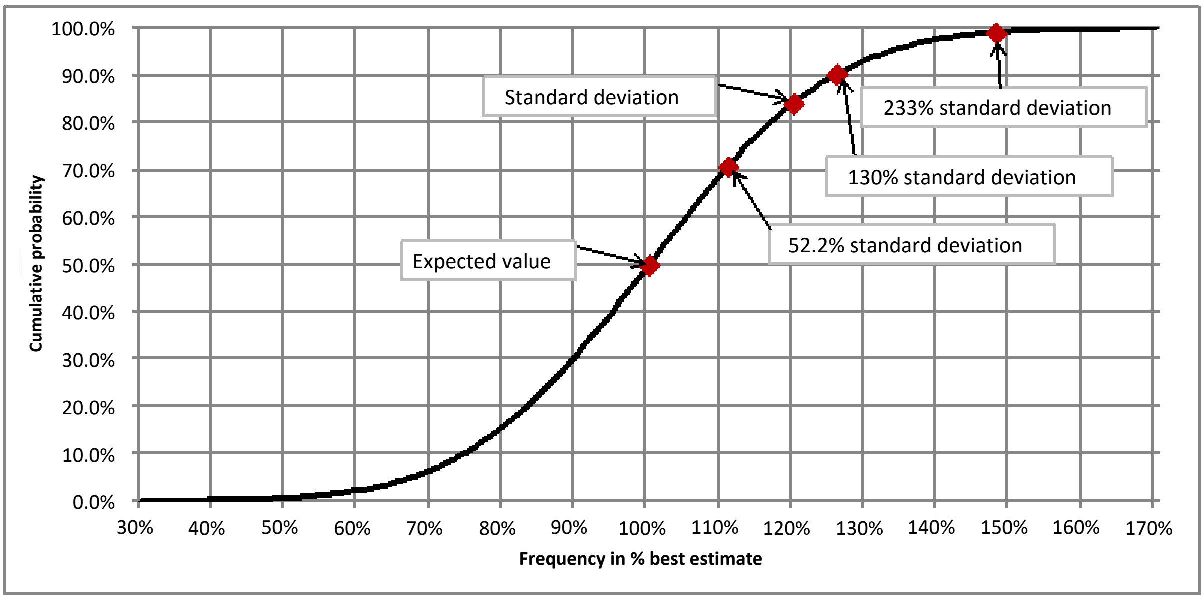
This possible procedure is as follows:

In a first step, it is determined how much safety should be built into the individual categories of the second-order bases whereby such a target system could look like this:

- Safety is built into the biometric bases in such a way that they are sufficient with 90% probability.
    - If only one biometric base (mortality of endowment insurance) is decisive for a sub-portfolio (eg death risk insurance in individual life insurance), a 90% level of safety is built into this base.
    - If two bases (probability of death and decrease in mortality) are approximately equally decisive for a sub-portfolio (eg individual pension insurance), safety at a level of 82% is built into each of the bases, which – if the two bases are independent – also results in a total level of around 90% (the safety level of 90% is achieved on the basis of a normal distribution at 130% of the standard deviation). If the two bases are independent, 130% / root (2) = 92% of the standard deviation (equivalent to a safety level of around 82%) must be incorporated into each base to achieve 130% of the standard deviation combined.
    - If other bases exist (eg basic demographics for current old-age pensions in group insurance), safety is no longer built into these other bases, on the assumption that the margins in the other bases are sufficient.
- Safety is built into the cost bases in such a way that they – based on historical volatilities – are sufficient with a 70% probability. The reason why less safety is built in here than with the biometric bases is that, on the one hand, this safety is added to the safety with the biometric bases and that costs do not usually fluctuate "randomly" or have fluctuated in the past but change as a result of specific management decisions or have changed in the past.

- Safety at a level of 70% is also included in the lapse assumptions whereby the direction in which the safety is to be built in must be checked beforehand for each sub-portfolio, ie as to whether more or fewer than expected lapses are worse for the company.
- Depending on the actuary's assessment of the extent to which the safety margin sufficiently covers the risk of the additional parameter, especially in the biometric bases, either no safety margin or a margin to the safety level of 70% is built into the other bases.

Assuming that the individual parameters are normally distributed, the following graphic shows (example with standard deviation of 20%) which safety margin must be built in so that a given probability level is not exceeded (eg the frequencies with a probability of 90% are not higher than 126% (100% plus 130% of the standard deviation of 20%) of the expected frequency of 100%).




For the different levels, the following safety margins are required as a percentage of the standard deviation:

| **Safety level** | **Safety margin** |
|---|---|
| 70% | 52.5% of the standard deviation |
| 82% | 92% of the standard deviation |
| 90% | 130% of the standard deviation |
| 99% | 233% of the standard deviation |

In a second step, it is necessary to determine how strongly the individual parameters can fluctuate or what their standard deviation is whereby, on the one hand, the parameter risk, which includes in particular the risk of change and error, and on the other hand, the random risk, also contribute to this.

For parameter risk, for example, the coefficients of variation in the underwriting risk of the Swiss Solvency Test, as specified by FINMA, or internal investigations can be used. If the underwriting risk of the Swiss Solvency Test shows that the random risk is insignificant (which is the case if the standard deviation of random and parametric risk is practically identical to the standard deviation, which results solely from the parameter risk), this can be disregarded, otherwise the coefficients of variation must be suitably increased.

If, for example, a company uses the coefficient of variation in accordance with the Swiss Solvency Test, the random risk is negligible for this company, and if it wants to achieve the safety level described above using the above procedure, the following safety margins are to be built in:

Individual insurance (illustrative)

| **Parameters** | **SST coefficient of variation** | **Safety level** | **Margin in % of SST coefficient of variation** | **Safety margin or discount** |
|---|---:|---:|---:|---:|
| Mortality for endowment insurance | 5% | 90% | 130% | 6.5% |
| Mortality for pension insurance | 5% | 82% | 92% | 4.6% |
| Reduced mortality for pension insurance | 10% | 82% | 92% | 9.2% |
| Disability | 10% | 82% | 92% | 9.2% |
| Probability of withdrawal of disabled persons (to review applicable insurances) | 10% | 82% | 92% | 9.2% |
| Average degree of disability | | | | None |
| Probability of withdrawal of disabled persons (to review ongoing benefits) | 10% | 90% | 130% | 13% |
| Costs | 10% | 70% | 52.5% | 5.25% |
| Lapse | 25% | 70% | 52.5% | 13.125% |
| Reinsurance costs | | | | None |

Group insurance (illustrative)

| **Parameters** | **SST coefficient of variation** | **Safety level** | **Margin in % of SST coefficient of variation** | **Safety margin or discount** |
|---|---:|---:|---:|---:|
| Mortality for endowment insurance | 5% | 90% | 130% | 6.5% |
| Mortality for pension insurance | 5% | 82% | 92% | 4.6% |
| Reduced mortality for pension insurance | 10% | 82% | 92% | 9.2% |
| Demographic data | | | | None |
| Disability | 20% | 82% | 92% | 18.4% |
| Probability of withdrawal of disabled persons (to review applicable insurances) | 10% | 82% | 92% | 9.2% |
| Average degree of disability | | | | None |
| Probability of withdrawal of disabled persons (to review ongoing benefits) | 10% | 90% | 130% | 13% |
| Costs | 10% | 70% | 52.5% | 5.25% |
| Lapse | 25% | 70% | 52.5% | 13.125% |
| Reinsurance costs | | | | None |
| Exercise of pension option on retirement | 10% | 82% | 92% | 9.2% |

Whether parameters used but not determined internally, such as the coefficients of variation of the SST, do justice to the company's individual situation, whether, in particular, more conservative parameters are to be used, which meet the long-term view of sufficient reserves and how high the desired safety levels per risk category and within the categories per parameter are, must be determined by each company according to its individual situation because, on the one hand, this depends on other safety cushions (eg in the return assumptions or in equalisation reserves), and, on the other hand, the actuary should also determine the order and amount of the individual risks according to his individual assessment. In this sense, the tables listed above are examples only.

It is also up to the actuary to choose other methods, however, the safety margin to be built in should in any case take into account the risk of fluctuation (consisting of random risk, error and change risk) of the corresponding parameter, and the level of the risk of fluctuation should be determined on the basis of a base that is as objective as possible and a justified actuarial assessment.

### 8.1.2 Safety margins in yield assumptions

#### 8.1.2.1 Introduction

The yield vector used to check the technical reserves of a portfolio is derived from the corresponding best-estimate yield vector (derived in accordance with Chapter 7) by adding a safety margin. The amount of the margin depends mainly on the volatility of the best-estimate yield vector, the estimation risks and the desired level of safety.

It should be borne in mind that the safety margin is used to ensure the long-term viability of the benefits and that the average remaining maturities are usually expected to be over ten years. The more long-term the view, the smaller the random risk usually becomes, but the risk of estimation or error or the risk that the environment will change significantly increases. For example, the standard deviation of the EUR/CHF exchange rate was about 15 centimes for a long time, so a few years ago (based on a normal distribution) the probability that the EUR exchange rate would fall from CHF 1.60 to CHF 1.00 was around 0.003%. As we know, this scenario has nevertheless occurred. Similarly, a few years ago, the probability that the yield on 10-year federal bonds would fall below 50 basis points would probably have been very low.
This also means that although it is theoretically possible – on the basis of historical or implicit volatilities – to calculate a long-term probability of default, this still has relatively little relevance for whether the yield after safety margins is achieved with sufficient certainty. Moreover, these volatilities are often only available at the level of market values and are, thus, poorly suited to reflecting, for example, the fluctuation in the expected cash flow of the properties (without a change in the value of the property itself).

Volatilities of the investments or the individual asset classes may, therefore, only be an indication of whether a large or small safety margin should be built into the yield assumption of an asset class. In addition, it is equally crucial that the actuary (pragmatically) considers which adverse developments may occur (eg no interest rate rise or interest rate rise not to the extent expected) that have a significant impact on the expected return. The determination of the safety margins on the yield assumptions should, therefore, be based on a mixture of "scenario considerations" and historical experiences (volatility).

An example of such an approach is the return scenario for minimum reserve requirements described in Chapter 10.2.

#### 8.1.2.2 Safety margins in the individual asset classes

<u>Shares (incl. investment funds)</u>

Shares have historically had a high yield, but their yield is also subject to high fluctuations. For example, the average annual performance of the Swiss Performance Index from 1926 to 2012 is 7.6% but with an annual volatility of 21.6%. The safety margin should, therefore, be relatively high.

<u>Alternative assets</u>

Alternative assets should be treated in the same way as shares but with a safety margin that must be adjusted to the volatility of the respective alternative assets.
If, for example, a discount proportional to the volatility is applied, this results in the following for the respective alternative assets:

$$Discount\ for\ alternative\ assets = Discountfor\ shares \cdot \frac{\sigma_{Alternative\ assets}}{\sigma_{Shares}}$$

*Example:*

*The following figure illustrates the application of the model for the following parameters.*

| **Parameters** | **Value** |
|---|---|
| Risk-free interest (simplified assumption) | 0.00% |
| Best-estimate yield shares | 4.00% |
| Share volatility | 21.6% |
| Share discount | 25% |
| Conservative share yield | 3.00% |
| Alternative asset volatility | 16.2% |
| Best-estimate yield of alternative assets | 3.00% |
| Alternative asset discount | 18.75% |
| Conservative yield for alternative assets | 2.44% |

<u>Properties</u>

The expected return on the properties is based on the payment flow (rental income, expenses for maintenance, management and insurance costs etc) in accordance with Chapter 7.2.3. Since these payment flows are usually relatively stable, a very high safety margin is not necessary. If, on the other hand, the realisation of any valuation reserves (in accordance with Chapter 7.2.3) is taken into account in the yield estimate, a much higher safety margin must be applied to this part of the expected property yield. The safety margin must also be considered in a more differentiated way if the settlement of the portfolio and/or the future change in the investment strategy entails substantial new investments in properties.

<u>Bonds</u>

In the case of bonds, a distinction must be made between the existing portfolio and future new investments or reinvestments.

In the existing portfolio, the future yields are predetermined by coupons and amortised cost write-ups/write-downs if the debtor remains solvent. The only risk, therefore, is that the debtor no longer meets its obligations. This should be taken into account by means of safety margins, which depend on the quality of the debtor (rating of the debtor).
If there is a substantial portion of bonds that are not fixed-interest, their safety margins should be considered in a differentiated manner.

For future new investments/reinvestments, on the other hand, the desired level of security with regard to debtor quality should already be taken into account in the choice of yield curve (risk-free plus spread or swap plus/minus spread). However, considerable uncertainty exists as to whether interest rates will actually develop as expected according to forward rates. The safety margin should, therefore, be built in in such a way that, for example, an expected rise in interest rates does not occur or only occurs in part and/or future yields do not rise above a certain level.

<u>Convertible bonds</u>

Convertible bonds are split between a bond component and a share component.
The bond component is treated in accordance with the notes on bonds.
The share component is treated in accordance with the notes on shares (incl. investment funds).

<u>Mortgages</u>

The situation with mortgages is very similar to that with bonds. In the portfolio, the only risk with fixed mortgages is the insolvency of the mortgage debtor. However, since there are very strict regulations for insurance companies when granting mortgages, this risk should be low and usually does not require too high a safety margin. This must be considered in a more differentiated manner if substantial defaults have been observed in the past and/or the proportion of subordinated mortgages (2nd) mortgages) represents a substantial proportion. The discount should also be considered in a more differentiated manner if there is (still) a substantial proportion of variable-rate mortgages.

For future new investments/reinvestments, the same approach should be taken as for bonds, in that the main risk of an overestimated future interest rate level is taken into account in such a way that an expected interest rate increase does not occur or only occurs in part, and/or future yields do not rise above a certain level.

Money market

Money market investments are to be treated in the same way as bonds.

Foreign currencies

Irrespective of the asset class, a safety margin shall be applied to investments in foreign currencies if the exchange rate risk is not fully hedged.

## 8.2 Risk margin for the scenario-based approach

The risk margin can be determined on the basis of sensitivities or stress scenarios.

- Sensitivities: For a sufficiently granular sub-portfolio, scenarios are defined as sensitivities per parameter for all relevant calculation bases. Appropriate safety margins are determined for the parameters under consideration, similar to the considerations for the method with safety margins, which describe the deviations from the best estimate for scenario-based adverse deflections in the medium-term and distant future. The additional reserve requirement for the results of the sensitivity measurements is determined using an appropriate aggregation method.
- Stress scenarios: Based on historical developments or worst-case assumptions about future developments, all parameters and calculation bases affected by these developments are adjusted consistently. The changes in the reserve are determined for the totality of the changes, including possible cross-connections between individual parameters, using a suitable aggregation method.

The determination of the possible adverse deflections of the estimation parameters for determining the risk margin should be derived from available empirical values (historical scenarios and volatility) and – where appropriate – other suitable sources of information and adapted appropriately to present and future circumstances.

# 9 Fluctuation reserves

In accordance with the Insurance Supervision Ordinance (ISO), Section 55, technical reserves are composed of:

a) Reserves calculated according to the tariff bases of the current insurance contracts or according to more conservative bases;
b) Reserves that are necessary for the formation of adequate reserves;
c) Reserves formed in accordance with actuarial methods set out in the business plan in order to increase the ability to meet the obligations arising from the insurance contracts.
d)

The reserves in accordance with points (a) and (b), thus, cover the "expected value" of future obligations and include a "safety margin" so that the obligations can be fulfilled not only in the expected value but with reasonable certainty.

Since the "expected value" is always calculated with current bases and assumptions, changes in the bases (deteriorations) are systematically reserved from the time of the product launch until the balance sheet date. This means that the reserves necessary to cover the "base fluctuations of the past" are included in the expected value.

In addition, the "safety margin" covers fluctuations and uncertainties in the medium term to a sufficient extent.

However, the "safety margin" cannot cover all future, as yet unknown scenarios or long-term trend changes at the current balance sheet date. For these scenarios or major trend changes over time, additional reserves may be required. For this reason, under point c) of Section 55 ISO there are further reserves, in particular *fluctuation reserves for equalisation over time on the assets side as well as on the liabilities side*, which go beyond the sufficient reserves and which, as the name suggests, may be additionally accumulated over time. If a change in trend manifests itself and for this reason the sufficient reserves have to be strengthened, the already existing funds can be transferred to the sufficient reserves to a certain extent. This makes it possible for an insurance company to achieve a result with as little fluctuation as possible.

In principle, it makes sense to define certain target values for the technical reserves mentioned in ISO Section 55 (c) for the stipulations regarding the fluctuation reserves in the business plan and to set a range in the business plan of the insurance company within which the actual reserves are to fluctuate. A range ensures that the reserves are sufficient, but at the same time there is no over-reserving.

For proof of sufficient reserves, the technical reserves according to Section 55 (c) ISO are not to be used. The proof is provided with the technical reserves under points a) and b).

# 10 Minimum requirements test for the reserves of simple products

## 10.1 Introduction

The test described below includes minimum requirements in the sense that the reserves are insufficient if the conditions are not met. The fulfilment of the requirements is, thus, a necessary criterion for the sufficiency of the reserves, which, however, need not be sufficient in every case. Irrespective of the minimum requirements test, tests must, therefore, be carried out in accordance with all the criteria of this Directive so that the specific characteristics of the portfolios are adequately taken into account.

The minimum requirements test applies to simple products as described in Chapter 4.1. The requirements are chosen in such a way that they identify possible problem areas in a simple and transparent manner and that the fulfilment of the test should in most cases lead to sufficient reserves.

The starting point for the minimum requirements is the best-estimate reserves calculated according to the individual contractual approach. The best-estimate assumptions include all parameters that are applicable in a consistent manner for the respective portfolios (cf. also Chapter 5).

The best-estimate reserves calculated in this way are then calculated

- Aggregated at most to the level of the defined sub-portfolios
- Aggregation to finer levels is permitted but not mandatory
- Aggregated reserves for each sub-portfolio must not be negative
- Cross-subsidisation within the aggregation levels is, thus, permitted

The sub-portfolios must be defined in the same way as described in Chapter 5.4.

The test for minimum requirements:

The current existing reserves of each (sub-) portfolio are to be compared with the best-estimate reserves. In addition, a minimum margin is to be calculated for each (sub-) portfolio whereby this margin results from the maximum of a scenario for return and longevity, a scenario for biometrics and costs, and a scenario for customer behaviour.

In other words, for the minimum requirement to be met, the following must apply to each sub-portfolio:

- Existing reserves ≥ maximum (reserves calculated using the yield and longevity scenario; reserves calculated using the biometrics and cost scenario; reserves calculated using the customer behaviour scenario)

The reserve for the risk of inflation in accordance with Section 36 of the FSOPP ("inflation fund" or "inflation reserve") is not included in the scenarios but is tested separately (see 10.5).

At least once a year on the balance sheet date, it must be checked whether the current existing reserves of each sub-portfolio pass the test described above.

The three scenarios are defined below whereby parameters may change due to the situation (especially the capital market situation). The changing parameters are designated P10.x.y in the following (according to the separate document "Parameters for the minimum requirements test as at 31/12/YYYY" and were reviewed in 2022. The parameters valid at the end of YYYY are listed in the separate document "Parameters for the minimum requirements test as at 31/12/YYYY". The Swiss Association of Actuaries will review annually whether these parameters should be adjusted – eg due to significantly changed circumstances – and will either communicate a confirmation of the existing parameters or any adjustments to the separate document "Parameters for the minimum requirements test as at 31/12/YYYY".
The Directive, or the separate document "Parameters for the minimum requirements test as at 31/12/YYYY", defines the parameters that can be changed only for the end of the respective current year. If the minimum requirements test is to be carried out in a forecast for a point in time beyond the current year, these parameters can be adjusted in a meaningful way.

## 10.2 Yield and longevity scenario

In this scenario, the best estimators are used for assumptions about biometrics (except for mortality pension insurance and decreases in mortality pension insurance), costs, lapses etc, but the best estimator for **yield** is modified as follows:

Basically, the same procedure is used as described in Chapter 7, ie the same assumptions are used with regard to investment distribution, instruments (incl. their maturities) in which reinvestment is made etc. However, the expected returns per asset class will be modified, and these adjustments are described below.

Shares (incl. investment funds)

Instead of the expected return, 75% (illustrative, see P10.2.1 in the separate document "Parameters for the minimum requirements test as at 31/12/YYYY" for the current parameter to use) of the best estimator (carrying value return after hedging costs) determined in accordance with Chapter 7.2.3 but no more than 3.5% of the market values (illustrative, parameter P10.2.2) (converted in proportion to carrying values) is used. If a constant annual yield is not assumed in the best estimator, the limit of 3.5% (parameter P10.2.2) applies to each of the individual years.

Alternative assets

Instead of the expected return, (1-v*25%) (illustrative, parameter P10.2.3) of the best estimator (carrying value return after hedging costs) determined in accordance with Chapter 7.2.3 but no more than v*3.5% (illustrative, parameter P10.2.4) of the market values (converted in proportion to carrying values) is used. If a constant annual return is not assumed in the best estimator, the limit of v*3.5% (illustrative, parameter P10.2.4) applies to each of the individual years where v is determined as follows:

$$v = \frac{\sigma_{Alternative\ assets}}{\sigma_{Shares}}$$

The resulting return based on the market values should not be higher than the assumed return on shares.

The separate derivation of a best-estimate yield vector in the case of alternative investments is not mandatory provided that the alternative investment asset class does not represent a significant proportion of the tied assets. In this case, alternative investments can be allocated to other existing asset classes, eg shares.

Properties

Instead of the expected return, 90% (illustrative, parameter P10.2.5) of the best estimator determined in accordance with Chapter 7.2.3 is used without the realisation of valuation reserves (expected cash flow but without realisation of valuation reserves, divided by the carrying amounts of the properties). In addition, the resulting cash flow (90% of the best estimator) must not exceed 3.0% (illustrative, parameter P10.2.6) of the market values, otherwise it must be further reduced accordingly. (Example: market value=100, carrying value=80, expected cash flow=4, 90% of which = 3.6 → carrying value yield to be used: 3.0 / 80 = 3.75% or min (3.6; 3.0% * 100) / 80). If a constant annual return is not expected, the limit of 3.0% (illustrative, parameter P10.2.6) applies to each of the individual years. In addition, the market values of the properties must not include any increase in value.

Bonds

A distinction is made here between the portfolio and new investments. For the bond portfolio in CHF, the amortised cost income (coupons +/- amortised cost write-ups/write-downs) is the basis whereby the following (absolute) discount is applied depending on the rating category:

Parameter table T1 (illustrative)

| Rating | Yield discount |
|---|---|
| AAA | 0.00% |
| AA | 0.10% |
| A | 0.15% |
| BBB | 0.45% |
| BB | 2.50% |
| B | 10.00% |

Bonds and similar investments without a rating are to be appropriately assigned to a category. The discount does not necessarily have to be applied at the level of the individual bond; it can also be determined globally on the basis of the distribution of the carrying values to the individual rating classes.

For the portfolio of bonds in foreign currency, the procedure is analogous to bonds in CHF whereby an absolute discount is also applied for the exchange rate risk or the hedge costs. This discount is calculated up to the projection year 15 by the difference between the one-year forwards in foreign currency and CHF, plus a base effect dependent on foreign currency. From the projection year 15 onwards, the discount is assumed to be constant since from this point on the UFR in CHF would distort the image.

Example: Hedging $\text{costs}_{EUR}(t) = f_{EUR}(t,t+1) – f_{CHF}(t,t+1) + \text{base}_{EUR}$

Where f(t,t+1) refers to the one-year forward rate at the valuation date t. The base is based on a historical average value increased by a safety margin and is redefined annually by the SAA.

Parameter table T2 (illustrative)

| Foreign currency | Base |
|---|---|
| EUR | 0.20% |
| USD | 0.40% |

The hedging costs for EUR and USD are published monthly by the SAA. Other currencies may be disregarded (provided their volume is insignificant).

For the reinvestment of bonds (incl. reinvestment of maturing bonds in foreign currency), the following assumption is made:

The base interest rate curve corresponds to the mean of the CHF swap curves of the last six months before the balance sheet date (thus, for the balance sheet date 31/12 the mean of the swap curves from the end of June to the end of November is decisive) without a discount. The relevant swap curves are published monthly by the SAA. The continuous interpolation and extrapolation of the monthly swap curves is carried out in accordance with the FINMA procedures for determining the risk-free interest rate curves in the SST calculation (ie Smith-Wilson procedure incl. ultimate forward rate, convergence, last liquid point). The SAA validates and, if necessary, adjusts the basic assumptions for the extrapolation of the relevant swap curves. The purpose of taking the weighted average over a six-month period is to capture market singularities, especially shortly before closing, affecting all future reinvestments and hedging costs.
The parameters used are as follows, Table T3 (illustrative)

| Foreign currency | Last liquid point | Ultimate forward rate | Alpha |
|---|---|---|---|
| **CHF** | 15 years | 1.50% | 0.1 |
| **EUR** | 30 years | 2.50% | 0.1 |
| **USD** | 50 years | 2.50% | 0.1 |

On the basis of this base interest rate curve, forward rates for future years are used to determine the return on reinvestment, with the following restrictions (cumulatively) applied:

- The expected returns are determined according to the n-year forward rate of the six-month average of the base swap curve with the following increase limit (compared to the first n-year forward rate $\mathrm{Fwds}(1,n)$):

$$\text{Maximum increase} = \frac{1}{3}\left(\max_{1\le i\le N} \mathrm{Fwds}(i,n) - \mathrm{Fwds}(1,n)\right)$$

$$\text{Maximum return on investment} = \mathrm{Fwds}(1,n) + \text{Maximum increase}$$

$$\text{Return on investment (i)} = \min\left(\mathrm{Fwds}(i,n)\,,\text{maximum return on investment}\right)$$

Where n is the company-dependent reinvestment period, N=30 and Fwds(i,n) is the n-year forward rate in year i. The forward rates are calculated using the base interest rate curve.

An example illustrates this:

On 31/12/2023, the returns on the swap curves or base interest rate curves of the last six months prior to 31/12/2023 were as follows:

| DATE | TYPE | 1Y | 2Y | 3Y | 4Y | 5Y | 6Y | 7Y | 8Y | 9Y | 10Y |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 30/11/2023 | ZccRate | 1.55% | 1.30% | 1.23% | 1.20% | 1.20% | 1.21% | 1.24% | 1.27% | 1.29% | 1.32% |
| 31/10/2023 | ZccRate | 1.61% | 1.42% | 1.37% | 1.38% | 1.41% | 1.45% | 1.50% | 1.54% | 1.58% | 1.62% |
| 29/09/2023 | ZccRate | 1.77% | 1.71% | 1.68% | 1.68% | 1.68% | 1.71% | 1.73% | 1.76% | 1.79% | 1.81% |
| 31/08/2023 | ZccRate | 1.82% | 1.77% | 1.74% | 1.71% | 1.69% | 1.69% | 1.69% | 1.70% | 1.70% | 1.71% |
| 31/07/2023 | ZccRate | 1.88% | 1.88% | 1.85% | 1.82% | 1.80% | 1.79% | 1.79% | 1.79% | 1.79% | 1.80% |
| 30/06/2023 | ZccRate | 1.95% | 1.96% | 1.92% | 1.87% | 1.82% | 1.80% | 1.78% | 1.78% | 1.78% | 1.78% |
| **Base interest rate curve** | | **1.77%** | **1.67%** | **1.63%** | **1.61%** | **1.60%** | **1.61%** | **1.62%** | **1.64%** | **1.66%** | **1.67%** |

| DATE | TYPE | 11Y | 12Y | 13Y | 14Y | 15Y | 16Y | 17Y | 18Y | 19Y | 20Y |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 30/11/2023 | ZccRate | 1.33% | 1.35% | 1.37% | 1.38% | 1.40% | 1.41% | 1.42% | 1.43% | 1.43% | 1.44% |
| 31/10/2023 | ZccRate | 1.66% | 1.68% | 1.71% | 1.72% | 1.74% | 1.75% | 1.75% | 1.75% | 1.76% | 1.76% |
| 29/09/2023 | ZccRate | 1.82% | 1.84% | 1.85% | 1.86% | 1.87% | 1.88% | 1.88% | 1.88% | 1.88% | 1.87% |
| 31/08/2023 | ZccRate | 1.72% | 1.73% | 1.74% | 1.75% | 1.76% | 1.76% | 1.76% | 1.76% | 1.76% | 1.76% |
| 31/07/2023 | ZccRate | 1.80% | 1.81% | 1.82% | 1.83% | 1.83% | 1.84% | 1.83% | 1.83% | 1.83% | 1.83% |
| 30/06/2023 | ZccRate | 1.78% | 1.78% | 1.79% | 1.79% | 1.79% | 1.79% | 1.79% | 1.79% | 1.79% | 1.78% |
| **Base interest rate curve** | | **1.69%** | **1.70%** | **1.71%** | **1.72%** | **1.73%** | **1.74%** | **1.74%** | **1.74%** | **1.74%** | **1.74%** |

| DATE | TYPE | 21Y | 22Y | 23Y | 24Y | 25Y | 26Y | 27Y | 28Y | 29Y | 30Y |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 30/11/2023 | ZccRate | 1.44% | 1.45% | 1.45% | 1.45% | 1.46% | 1.46% | 1.46% | 1.47% | 1.47% | 1.47% |
| 31/10/2023 | ZccRate | 1.76% | 1.75% | 1.75% | 1.75% | 1.74% | 1.74% | 1.74% | 1.73% | 1.73% | 1.72% |
| 29/09/2023 | ZccRate | 1.87% | 1.86% | 1.86% | 1.85% | 1.85% | 1.84% | 1.83% | 1.82% | 1.82% | 1.81% |
| 31/08/2023 | ZccRate | 1.76% | 1.75% | 1.75% | 1.74% | 1.74% | 1.74% | 1.73% | 1.73% | 1.72% | 1.72% |
| 31/07/2023 | ZccRate | 1.82% | 1.82% | 1.81% | 1.80% | 1.80% | 1.79% | 1.79% | 1.78% | 1.77% | 1.77% |
| 30/06/2023 | ZccRate | 1.78% | 1.77% | 1.77% | 1.76% | 1.76% | 1.75% | 1.74% | 1.74% | 1.73% | 1.73% |
| **Base interest rate curve** | | **1.74%** | **1.73%** | **1.73%** | **1.73%** | **1.72%** | **1.72%** | **1.72%** | **1.71%** | **1.71%** | **1.70%** |

Based on the forward rates, the expected return in x years for eg a ten-year investment is then calculated as:

$$\mathrm{Return}(x, 10) = \left(\frac{\left(1 + \mathrm{return}(\mathrm{base}, x + 10)\right)^{x+10}}{\left(1 + \mathrm{return}(\mathrm{base}, x)\right)^{x}}\right)^{1/10} - 1$$

In our example, this yields the following best estimators where for this yield scenario all values above 1.72% = 1.67% + 1/3 *(1.82% - 1.67%) are replaced by 1.72%.

| x | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 10-y forward in x years | 1.67% | 1.68% | 1.71% | 1.74% | 1.77% | 1.80% | 1.81% | 1.82% | 1.82% | 1.82% |
| Maximum return on investment | 1.72% | 1.72% | 1.72% | 1.72% | 1.72% | 1.72% | 1.72% | 1.72% | 1.72% | 1.72% |
| **Return on reinvestment** | **1.67%** | **1.68%** | **1.71%** | **1.72%** | **1.72%** | **1.72%** | **1.72%** | **1.72%** | **1.72%** | **1.72%** |

| x | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|
| 10-y forward in x years | 1.81% | 1.79% | 1.77% | 1.75% | 1.73% | 1.71% | 1.69% | 1.67% | 1.66% | 1.64% |
| Maximum return on investment | 1.72% | 1.72% | 1.72% | 1.72% | 1.72% | 1.72% | 1.72% | 1.72% | 1.72% | 1.72% |
| **Return on reinvestment** | **1.72%** | **1.72%** | **1.72%** | **1.72%** | **1.72%** | **1.72%** | **1.69%** | **1.67%** | **1.66%** | **1.64%** |

| x | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|
| 10-y forward in x years | 1.63% | 1.62% | 1.61% | 1.60% | 1.59% | 1.58% | 1.57% | 1.56% | 1.56% | 1.55% |
| Maximum return on investment | 1.72% | 1.72% | 1.72% | 1.72% | 1.72% | 1.72% | 1.72% | 1.72% | 1.72% | 1.72% |
| **Return on reinvestment** | **1.63%** | **1.62%** | **1.61%** | **1.60%** | **1.59%** | **1.58%** | **1.57%** | **1.56%** | **1.56%** | **1.55%** |

Convertible bonds

Convertible bonds are split between a bond component and a share component.
The bond component is treated in accordance with the notes on bonds.
The share component is treated in accordance with the notes on shares (incl. investment funds).

Mortgages

A distinction is also made here between the portfolio and the reinvestment. For the portfolio, the income of the existing portfolio is the basis, from which 7% (illustrative) is deducted (this results in the return as 93% (illustrative, parameter P10.2.8) of the expected interest payments divided by the carrying values of the mortgages).
For the reinvestment, the same interest rate curve is used as for the bonds (after limitation of the interest rate increase or absolute limitation) whereby the yield of the bonds is increased by 80 basis points (illustrative, parameter P10.2.9) for the reinvestment yield of the mortgages. The duration of the new fixed mortgages to be concluded must be chosen in the same way as the best estimator.

Money market

There are two options for money market yields:

1. The method is the same as for bond reinvestments but with a reinvestment period of =1
2. Cash yields are set at a constant level with a sufficient company-dependent discount

Hedging instruments

Hedges of shares and similar investments are implicitly already taken into account in the scenario assumptions. Not yet taken into account are any swaptions, which can, therefore, be additionally taken into account in the return scenario – without a discount.

In addition, half of the margin of the biometrics and costs scenario is incorporated into the best estimators for **mortality for pension insurance and decrease in mortality for pension insurance**:

| Parameter table T4 (illustrative) | Individual insurance: Safety margin or discount | Group insurance: Safety margin or discount |
|---|---:|---:|
| Mortality for pension insurance | 2.92% | 2.92% |
| Reduced mortality for pension insurance | 5.85% | 5.85% |

This return and longevity scenario does not apply to the following portfolios:

- Retirement credits in occupational pension plans (the assumption is made here that the total interest rate – mandatory and extra-mandatory – can be largely adjusted to the yield level), but the scenario must be applied to the expected conversion rate losses according to Chapter 6.6
- Unit-linked insurance without a guarantee (the assumption is made here that the changed investment income is entirely at the expense and risk of the policyholder)

In the minimum requirements test, the balance sheet reserves are, thus, assumed without a guarantee for the retirement credit in occupational pension plans and for the savings balance of the unit-linked insurance.

## 10.3 Biometrics and costs scenario

In this scenario, the best estimator is used for the return and lapse assumptions while safety margins are built into all other bases. They are built in as described in Chapter 8.1.1.2 whereby a safety level of approximately 95% is selected for biometrics and costs respectively and is based on the parameters for the coefficients of variation below – which have been slightly adjusted compared to the SST standard.
This means that a safety margin of 165% (if only one basis is decisive for the sub-portfolio) or of 117% (165% / root(2)) if two biometric bases are decisive) is to be built in. If more than two biometric bases are decisive, no margin is built in from the third base onwards. An exception concerns the parameter pension option exercise upon retirement in group insurance, which, on the one hand – although it concerns "customer behaviour" – is deflected in this scenario and in which, on the other hand, a safety margin is built in although it is the third basis in the calculation of the future losses from pension conversion.

This results in the following safety margins to be built into the individual bases for the other bases scenario:

Individual insurance

| **Parameter table T5a (illustrative)** | **Coefficient of variation** | **Margin in % coefficient of variation** | **Safety margin or discount** |
|---|---:|---:|---:|
| Mortality for endowment insurance | 5% | 165% | 8.25% |
| Mortality for pension insurance | 5% | 117% | 5.85% |
| Reduced mortality for pension insurance | 10% | 117% | 11.70% |
| Disability | 10% | 117% | 11.70% |
| Probability of withdrawal of disabled persons (to review applicable insurances) | 10% | 117% | 11.70% |
| Average degree of disability | | | None |
| Probability of withdrawal of disabled persons (to review ongoing benefits) | 10% | 165% | 16.50% |
| Costs | 5% | 165% | 8.25% |
| Lapse | 15% | | None |
| Reinsurance costs | | | None |

Group insurance

| **Parameter table T5b (illustrative)** | **Coefficient of variation** | **Margin in % coefficient of variation** | **Safety margin or discount** |
|---|---:|---:|---:|
| Mortality for endowment insurance | 5% | 165% | 8.25% |
| Mortality for pension insurance | 5% | 117% | 5.85% |
| Reduced mortality for pension insurance | 10% | 117% | 11.70% |
| Demographic data | | | None |
| Disability | 15% | 117% | 17.55% |
| Probability of withdrawal of disabled persons (to review applicable insurances) | 10% | 117% | 11.70% |
| Average degree of disability | | | None |
| Probability of withdrawal of disabled persons (to review ongoing benefits) | 10% | 165% | 16.50% |
| Costs | 5% | 165% | 8.25% |
| Lapse | 25% | | None |
| Reinsurance costs | | | None |
| Exercise of pension option on retirement | 10% | 117% | 11.70% |

If the premiums of a product can be adjusted for the existing portfolio (eg for the one-year premiums in group insurance or possibly for disability premiums in individual insurance), only 50% of the above safety margin must be included for the review of the reserves of these qualifying insurance policies.

## 10.4 Customer behaviour scenario

In this scenario, the best estimates are used for yield, biometrics and costs while the lapse probabilities are changed.
The aim is also to achieve a level of safety of 95% on the basis of a coefficient of variation of 15% in individual insurance and of 25% in group insurance, resulting in a margin of 24.75% (illustrative) in individual insurance and of 41.25% (illustrative) in group insurance, and these margins must be built in. For each sub-portfolio, the reserves are to be calculated once with 24.75% and 41.25% higher lapses and once with 24.75% and 41.25% lower lapses, and the higher of the two results is to be used as the scenario result. In summary:

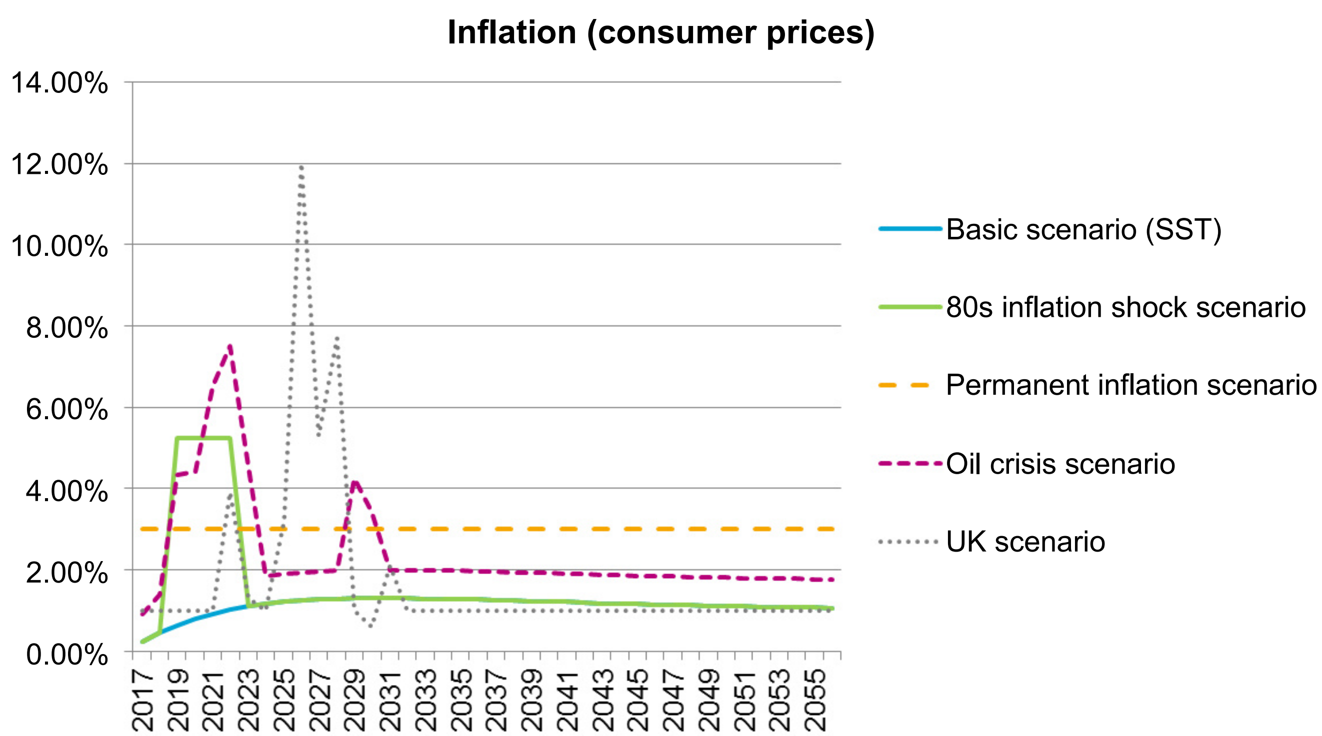
| **Parameter table T6** | **Individual insurance: Safety margin or discount** | **Group insurance: Safety margin or discount** |
|---|---:|---:|
| Lapse | 24.75% | 41.25% |

## 10.5 Inflation reserve in the occupational pension plan

The reserve for the risk of inflation in accordance with Section 36 of the FSOPP ("inflation fund" or "inflation reserve") is tested separately. It must have at least the following amount:

Actuarial reserve of current pensions not subject to inflation x 36%

The average factor 36% is illustrative (parameter P10.2.11). All current pensions subject to inflation are taken into account, regardless of whether an adjustment to inflation has already taken place.
The factor is based on an evaluation of five scenarios (see chart) in the portfolios as at 31/12/2016 of insurers active in occupational pension plans. The cash flows caused by inflation were discounted at 1%. The most expensive scenarios for all insurers were the "oil crisis scenario" (average factor 36%) and the "permanent inflation scenario" (average factor 34%).



# 11 Disclosure

Transparency is not a primary criterion for sufficient reserves, but without the possibility of verification it is difficult to assess the adequacy of the reserves. Transparency is an important tool here. In particular, the following should be disclosed to management

- The derivation of the parameters for the respective approaches,
- The changes made to methods and parameters compared to the previous period, and
- The most important sensitivities