

Swiss Association of Actuaries guidelines on the assignment of adequate technical life reserves pursuant to FINMA circular 2008/43 “Life insurance reserves”

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1 Introduction

The communication regarding the change of the Federal Law on Insurance Supervision (VAG), which entered into force on 01.01.2006, already specified that technical reserves help maintain the solvency of insurance companies. According to Article 1, paragraph 2, the VAG aims to protect insured persons against abuse and the risk of insolvency of insurance companies. Article 16, paragraph 1 specifies that the insurance company is obliged to establish adequate actuarial reserves for all of its business activities. According to Article 21 of the Supervision Ordinance (AVO), financial security is assessed based on solvency and the actuarial reserves. The actuary is responsible for determining adequate actuarial reserves. The proof of adequate actuarial reserves and adequate risk capital complement each other. The necessary safety margin for adequate actuarial reserves must ensure the fulfilment of the obligations from the insurance contracts, without taking the risk capital into account.

This guideline is intended to support the actuary in this central task of determining adequate reserves. It is **binding for actuaries that are responsible for establishing adequate reserves for the Swiss life insurance business pursuant to the definition of FINMA circular 2008/43**, whereby deviations from this guideline may be permitted in justified cases. The guideline supplements and defines the specifications of the FINMA circular and was to be initially applied for the review and establishment of actuarial reserves as at 31.12.2013 and for all of the following financial years. It was partly revised in 2016, and the revised guideline is to be applied as at 31.12.2016 and for all of the following financial years.

The guideline relates only to so-called "simple" products.

2 Principles of FINMA circular 2008/43

According to FINMA circular 08/43 margin note 5, actuarial reserves are deemed adequate once the permanent fulfilment of the obligations from the insurance contracts is ensured. The basic principle for establishing adequate actuarial reserves specifies:

The assumptions and methods used to establish the reserves must be defined so that the permanent fulfilment of the obligations from the insurance contracts is ensured. The reserves must be at least calculated so that it is possible to cover any arising benefit obligations with an appropriate investment portfolio in the amount of the reserves with a sufficient degree of security.

The following principles must be observed:

- In all cases, the individual contractual actuarial reserve must at least be equivalent to the amount if it were determined based on the assumptions and methods applicable at the start of the contract.
- A review of whether the actuarial reserves are adequate must take place at least once a year on the reporting date.
- Each sub-portfolio of the actuarial reserves must be adequate.
- The reserves must be established without taking as yet unpaid acquisition costs into account.
- The uncertainties in the assumptions and methods for determining the actuarial reserves are to be considered by the inclusion of safety margins.
- In order to establish adequate actuarial reserves, it is necessary to consider the possibility of an extremely unfavorable change in the behavior of policyholders or insured persons. A particularly unfavorable development must be considered at the start of the contract.
- Simple classic products can be modelled in simple terms, with their actuarial reserves determined as the value of future payment streams using a conservative technical interest rate and conservative biometric principles.
- If insurance products contain complex financial obligations, these generally need to be considered using stochastic models.
- In the case of a run-off of an insurance company or major sub-portfolio, any increasing cost factors and the decreasing risk diversification must be taken into account.

3 Principles for adequate reserves

Obligations from life insurance contracts normally have long contract terms that often extend for decades. The valuation of adequate actuarial reserves must take these circumstances into consideration. The uncertainties that may occur in such a long future period must be considered by the assumptions and methods used to determine adequate actuarial reserves. Estimates for the development of capital market parameters, biometric parameters, the behavior of policyholders or future expenses must be made for the future duration of an insurance contract, and their adverse deflections must be included in the calculation.

The basis for determining adequate actuarial reserves is an unbiased estimate of all parameters that affect the development of the obligations from the insurance contracts (capital market, biometrics, costs, customer behavior and management rules). This estimate must be as realistic as possible and consider all of the information available at the time of valuation. In addition, the uncertainties regarding the future development of these parameters must be taken into account with a sufficient degree of security. Adequate actuarial reserves are comprised of a Best Estimate for the development of liabilities from the insurance contracts and an appropriate risk margin, allowing the obligations from the insurance contracts to be permanently fulfilled.

The following principles must be considered in order to determine the **Best Estimate**:

- A consistent link to an effectively available investment portfolio and its management for the term of the transaction must be established for the allocation of the investments to the sub-portfolios to be separately evaluated according to FINMA circular 2008/43.
- The methodology for evaluating the reserves must be consistent with the balance sheet valuation principles for evaluating investments.
- The unbiased estimate of the parameters for determining the Best Estimate (capital market parameter, parameter for the biometric principles, cost parameter and parameter for customer and management behavior) must consider the entire term of the obligations and must not contain any implicit margins.

The **risk margin** amount is crucial in determining adequate reserves. The following criteria and principles are decisive for determining the risk margin:

- The risk margin must cover adverse deflections in the above-mentioned estimated parameters for the Best Estimate with sufficient certainty.
- The possible adverse deflections must be determined based on the available empirical values (historical scenarios and volatilities) and, where relevant, other suitable sources of information and must be appropriately adapted to current and future conditions.

The risk margin is a safety margin for the inherent uncertainties in the assumptions and methods for establishing adequate actuarial reserves in accordance with margin note 6 of FINMA circular 2008/43. The sum of the Best Estimate and the risk margin per sub-portfolio establishes adequate technical reserves in the sense of margin note 10 of FINMA circular 2008/43 and Article 54, paragraph 1 of the AVO. Additional equalization reserves may also need to be established in order to ensure financial security pursuant to Article 21 of the AVO.

4 Differentiating between simple and complex products

4.1 Simple products

Simple products include the classic life insurance products for which the guaranteed benefits are determined as a set amount and therefore a deterministic variable. Only the payment date is a stochastic variable dependent on the condition of the insured person.

The savings premium is invested in a collective investment and the insurer determines the investment strategy. Depending on business development, the insurer may distribute surpluses in addition to the guaranteed benefits.

Simple products defined as such include pure risk insurances, classic mixed insurances and traditional life annuities.

Deterministic methods can be applied to determine the guaranteed benefits of these products by weighting and discounting the future expected payment streams against corresponding probabilities.

Another group of simple products is unit-linked insurances without financial guarantees. The savings capital is invested for the individual contract and the benefits precisely correspond to the value of the underlying assets. These products can also be evaluated based on deterministic methods.

4.2 Complex products

Complex products include all insurance products with financial guarantees that are dependent on the performance of the underlying assets or indices. The savings capital is entirely or partially invested in the scope of the individual contract.

Typically, complex products include various options for the policyholder, such as the selection of the investment strategy (either a free selection or from defined options), change of investment options, guarantee increase options (e.g. in the event of good investment performance) or a capital or annuity selection option. In some cases, the products may also include insurer options such as the option to adapt benefits or the investment strategy in certain situations.

Complex products include so-called "variable annuities" or unit-linked insurances with an endowment guarantee.

Stochastic models generally need to be applied when evaluating complex products in order to take appropriate account of the value of the guarantees and options. Simulation models generally need to be implemented. Closed approximation formulae may be used if they exist. An important aspect when evaluating these products is the modelling of the behavior of policyholders and potentially also the insurer.

In many cases, a complex product can be conceptually represented as the sum of a unit-linked insurance product without any guarantee (i.e. a simple product) and the options and guarantees.

The valuation of complex products is not dealt with in detail in this guideline.

5 Basic information on provisioning and on reviewing the technical reserves

5.1 General approach

The review of the technical reserves required according to FINMA circular 08/43 involves the comparison of the existing reserves with the adequate reserves determined using an appropriate process. This section describes three fundamentally equivalent processes that, suitably calibrated, can be used to derive adequate reserves for this comparison. If the required reserve is higher than that currently available, this requires an increase in the reserve by an amount that equals the deficit.

The same process must be used for both the review of the reserves as well as for evaluating the deficit and the actual increase in the reserves.

In general, the calculation of the necessary reserves for a sub-portfolio can be described as follows:

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

where

t	Time in years
Benefits _t	Cash flow for benefits in year t, in which these include insurance benefits, benefits in the event of surrender and reinsurance costs
Costs _t	Ongoing management and administration costs in year t
Premium _t	Premium income in year t
v	Discounting factor for the cash flow in year t
k	Timing factor to take account of the cash flow accruals during the course of the year (e.g. k=0.5, if the cash flows accrue on average in the middle of the year)

In contrast, the (net) balance sheet reserves for the sub-portfolio are generally composed of the following:

$$Balance\ sheet\ reserve^{SP} = Policy\ reserve^{SP} + unearned\ premium\ reserve^{SP} - deferred\ acquisition\ costs^{SP}$$

The necessary increase in reserves is then calculated as:

$$Increase\ in\ reserves^{SP} = \max(Reserve_{necessary}^{SP} - Balance\ sheet\ reserve^{SP}; 0)$$

All three of the processes below for evaluating and reviewing the reserves are based on the same Best Estimate assumptions for the relevant parameters and calculation bases, but apply different approaches for determining an adequate safety margin (a detailed description of two of the three processes is provided in the following chapters):

- **Safety loadings:**
Adequate safety margins on top of the Best Estimate are defined for every estimated parameter by way of safety loadings for each basis of calculation and tariff/product and the reserves for the sub-portfolio to be evaluated are accordingly pooled through addition.
- **Scenario approach:**
Based on Best Estimate reserves of (sub-)portfolios, scenario-based stress tests on the relevant estimated parameters determine how high the stress resistance of the reserves for these (sub-)portfolios must be to be assessed as adequate.
- **Stochastic simulation:**
Appropriate distributions are calibrated for all considered parameters and calculation bases. The distribution of the provisioning requirement is determined empirically based on the joint distribution of all parameters and calculation bases with appropriate dependencies between the parameters. The adequate reserve can then be determined as an appropriate quantile (potentially still dependent on the term of the guarantees).

The key difference between the safety loading approach and the scenario approach is that the safety loading approach initially relates to the bases of calculation for each tariff/product and individual contract and is then pooled to (sub-)portfolios by way of addition from this very granular view – the focus of the considerations is on the individual tariff or the individual product. In contrast, the scenario approach starts from the question of how changes to individual or several parameters simultaneously would influence the (sub-)portfolio and then converts these scenarios into loadings on the bases of calculation and parameters of the individual tariffs/products.

Either the safety loading approach or the scenario approach may be preferable depending on the problem and application: for example, an advantage of the safety loading approach is that it is based on the same basis and comparable assumptions of the tariff/product bases of calculation. This allows changes to the assumptions (Best Estimate and safety margin) to be directly transferred to new tariffs and products. However, there is the issue of correlation between the various safety margins and there is also the possibility of overestimating the individual safety margins. In contrast, the scenario approach has the advantage of providing a more comprehensive estimate of the reserve risk on (sub-)portfolios and is particularly well suited for bases of calculation that are not well defined due to cross-balance-sheet reference values on sub-portfolios, such as the yield of investments.

The stochastic simulation is more suitable for evaluating capital market risks and the associated necessary reserves for variable annuities. However, this is not dealt with in any greater detail in this guideline, and has only been listed for the sake of completeness.

As illustrated above, it can be useful to select the most appropriate approach in each case for various parameters and bases of calculation. For example, in the case of variable annuities (complex products), the reserve components, driven by the parameters for biometrics and costs, can be determined extremely well based on safety loadings. The impact of customer behavior on the reserves can be determined using various comprehensive scenarios (in order to also take account of the dependencies between cancellations, the capital market and claims), while capital market changes and hedging are best evaluated using the stochastic simulation approach.

The process for calculating the Swiss Solvency Test (SST) can be viewed as the basis for the scenario approach (calculations using the standard model and valuation of individual scenarios such as the pandemic scenario) and the stochastic simulation (calculations using an internal model with Economic Scenario Generator and path-dependent management rules). In particular, it may even be useful to also reuse individual parameters and calibrations of the distributions to determine adequate reserves. However, the SST itself is not suited for direct use as a numerical benchmark for determining adequate reserves for the following reasons, and the two points below should also be considered when using individual parameters and distributions of the SST:

- Reserves should be evaluated based on real world capital market assumptions. The statutory balance sheet is also the basis for every valuation. In comparison, risk-neutral assumptions are made for investments and economic valuation methods are applied under SST.
- The projections of the reserves must be made across several years and a particular focus should be on the distant future and not just the following year as is the case for the risk measurement under the SST.

As mentioned in Chapter 4, the stochastic simulation approach primarily relates to “complex products”, which are not dealt with below. The two other processes should be applied for classic products. Details on these two processes are provided in later chapters.

Example: pure risk insurance

Tariff reserves are determined as the difference between the present value of the benefits and premiums based on the prospective calculation. The present values take account of both cost approaches as well as the probabilities of occurrence for death depending on age and term. The discount rate for establishing the present value is typically based on the current technical interest rate. Safety buffers are considered in all three bases of calculation (costs, probabilities of death and interest rate) during pricing.

5.2 Safety loadings

As described above, the objective of the methodology is to establish adequate provisioning bases using safety loadings, analogous to the process for deriving first-order tariff bases, which can be used to evaluate the key obligations with regard to contractual financing at a certain point in time. This allows for the consideration of more up-to-date measurements and findings for the bases of calculation, of payments already received (e.g. distribution remuneration) and of the knowledge of future premiums in their currency amount.

As regards the method, the calibration of the safety loadings can take place based on the parameters and distributions for the SST. As described there, the safety margin for biometric bases of calculation is divided into

- an equalization loading in order to allocate adequate reserves to compensate for the uncertainty with respect to the balancing of risks in the portfolio and
- a change and error loading in order to allocate adequate reserves to compensate for future trends and developments as well as estimation errors relating to the internal Best Estimate principles.

The issue of the correlation of the individual loadings is particularly important in order to prevent undesired accumulation effects as a result of overestimating the individual loadings. Considerations on the selection of safety loadings are provided in Chapter 8.1.

Example continued: pure risk insurance

A flat-rate loading of 15% is applied for fluctuation, changes and errors for probabilities of death. The reserve is re-determined with the Best Estimate for probabilities of death increased by a factor of 1.15 and is compared with the tariff reserve.

5.3 Scenario approach

The current Best Estimate assumptions for each basis of calculation also form the starting point in this case. As described above, two basic approaches are possible:

- Sensitivities: Scenarios are defined as sensitivities for each parameter for all relevant bases of calculation to ensure the sufficiently granular separation of the sub-portfolio. Adequate safety margins are determined for the parameters considered, analogous to the considerations for the method with safety loadings, which describe the deviations from the Best Estimate for scenario-based adverse deflections in the intermediate and distant future. The additional provisioning requirement for the results of the sensitivity measurements is determined based on an appropriate aggregation procedure.
- Stress scenarios: All of the parameters and bases of calculation affected by these developments are consistently adapted based on historic developments or worst case assumptions of future developments. The changes to the reserve are determined for the entirety of the changes incl. possible cross-connections between individual parameters using an appropriate accumulation procedure.

An adequate reserve can only be assumed with the suitable accumulation of the individual sensitivities and dependencies between the sensitivities. In contrast, very specific developments are directly considered with all dependencies for the stress scenarios. Individual stress scenarios can therefore allow conclusions to be drawn on whether the reserves for adverse developments are still sufficient. Considerations on the scenario approach are provided in Chapter 8.2.

Example continued: pure risk insurance

Sensitivity: A flat-rate increase in the cost rates of 10% is applied to the current Best Estimate assumption for all classic insurance products.

Stress scenario: Flat-rate cost inflation of 1% p.a. is applied to the current Best Estimate assumption for all classic insurance products. Consistent with this, it is assumed that the Best Estimate interest rate curve also compensates for this inflation. Probabilities of death are not adapted in this stress scenario.

5.4 Division into sub-portfolios

FINMA circular RS 08/43 requires a minimum split into sub-portfolios for the annual audit of the actuarial reserves (for individual as well as for group insurance business; Cf. appendix to the FINMA circular). The reserves must be adequate for each of the individual sub-portfolios. Additionally, paragraph 26 imposes that *“Portfolios of significant size within these sub-portfolios must be regarded as additional separate sub-portfolios if their actuarial reserves are smaller than the adequate amount for a significant period of time”*.

Additional separate sub-portfolios must in any case be constituted if cross-subsidies favorable to the additional sub-portfolio cannot be sustained over time with a high level of confidence. The main criterion to consider here is the lapse risk for sub-portfolios with surrender options (for example, a different lapse experience for different levels of interest rate guarantee could endanger cross-subsidies between the sub-portfolios).

To constitute additional sub-portfolios, characteristics such as technical rate, mortality table and tariff generation should therefore be considered.

For sub-portfolios with no expected (individual) lapses (such as immediate old age or survivor annuities, or immediate invalidity benefits), no separate sub-portfolios have to be constituted.

In addition to that, additional sub-portfolios that are backed by assets or financial hedges distinct from those from the rest of the sub-portfolio must be viewed separately.

In deviation from these criteria, additional sub-portfolios don't have to be constituted if

- the reserves of the sub-portfolio in question are less than 0.2% of the corresponding tied assets or
- the reserves of the sub-portfolio in question are less than 1% of the corresponding tied assets and the reserves are equal to or higher than the best estimate reserves.

6 Provisioning principles for biometrics, costs, cancellations, etc.

6.1 Introduction

Reserve review principles for biometrics, costs, cancellations, etc. are applied when reviewing the actuarial reserves for a sub-portfolio. These include conservative estimates

- of biometric probabilities, such as
 - the probability of death of an active or disabled person,
 - the reactivation probability of a disabled person, or
 - the probability that a person is married at the time of their death;
- of biometric expectations of demographic random variables, such as
 - the expected age of a person's spouse, or
 - the expected number of children that a person has;
- of expectations on the development of costs;
- of cancellation probabilities;
- of expected reinsurance costs;
- and of expectations on other special parameters, especially in collective insurance.

In the safety loading process, the reserve review principles are based on corresponding Best Estimates, identified as **second-order principles**, and arise from these principles through the addition of safety loadings (where the loading can also be zero for individual principles).

The objective of sections 6.2 to 6.8 is to provide actuarial recommendations for the establishment of second-order principles. The inclusion of safety loadings is dealt with under section 8.1.1.

6.2 Second-order biometric principles

6.2.1 Statistical data base

The establishment of second-order principles is based on sub-portfolio observations, where possible, for which the actuarial reserves are to be determined.

If the scope or the quality of the resulting data base is insufficient in order to derive sufficiently reliable estimates, or if the sub-portfolio has no experience regarding the variable to be estimated, plausible statistics from similar portfolios may be consulted.

For example, this includes

- community statistics from the companies of the Swiss Insurance Association, or
- surveys by the Federal Statistical Office.

If statistics of similar portfolios are used, a check must be performed to confirm whether the resulting second-order principles are adequate for the relevant sub-portfolio. Relevant adjustments must be made if significant deviations arise (pursuant to section 6.2.3).

The observation period must be selected so that the events or developments that are expected to be permanently relevant and applicable for the variable to be estimated are able to flow into the collected data as well as possible. Past events and developments that may lead to a distortion of the estimate must not be included where possible. For example, in the case of a considerable and relevant adjustment of the framework conditions for the respective insurance, this means that the start of the observation period should not lie before the effective date of the change.

If the inclusion in the data base of known one-off effects or previous developments that are no longer present cannot be avoided when selecting the observation period, these influences must be appropriately compensated for when deriving the second-order principles (pursuant to section 6.2.2).

If the derivation of the second-order principles is entirely or partially based on an internal data base, the accuracy of the data must then be checked. This verification may, for example, consist of sufficiently extensive spot checks or be based on parameters to be verified, such as average, minimum or maximum values.

The data is counted so that this does not result in any distortion of the estimate. ^{1><1} For example, if personal data is accumulated in various IT systems (such as for portfolio management and for benefit processing), then a uniform and consistent counting method must be ensured¹.

Available, actuarially recognized regulations such as the instructions for preparing community statistics from the companies of the Swiss Insurance Association, may be consulted during counting, if these are applicable.

6.2.2 Balancing the raw statistics

The counting (measurement) of the data base generates raw statistics that contain observations of the variables to be estimated. For example, if probabilities of death are to be determined, then the corresponding raw statistics cover the incidents of death observed in the observation period.

The second-order principles result from the raw statistics

- by adjusting for known events and trends that have been included in the data base and that distort the estimate, and
- by compensating for any incidental fluctuations.

If one-off events or trends have been included in the data base and may distort the estimate, these must be compensated for accordingly. ^{1><1} In particular, the effects of late recordings² must be considered.

The compensation of any incidental fluctuations is performed using recognized mathematical methods, such as the Whittaker and Henderson method or with splines.

Extrapolations may be used if the second-order principles have to be expanded to areas without sufficient statistical experience (such as marginal age ranges in mortality tables).

6.2.3 Reviewing and adjusting the principles

If second-order principles are not exclusively based on the insurer's internal statistics, as the extent of the relevant data base was not sufficient in order to establish reliable estimates (cf. section 6.2.1), their adequacy for the relevant portfolios is reviewed prior to use.

The values expected in accordance with the principle to be reviewed are compared to the relevant observed values for this purpose. For example, a second-order review of probabilities of death can take place by comparing the expected number of deaths to the number of deaths actually observed. If the principles have been corrected for one-off effects (pursuant to section 6.2.1) for example, this must be taken into account during the review.

The second-order principles must be adjusted accordingly if significant deviations occur between the expected and observed values. The adjustment is performed using recognized mathematical methods (such as credibility methods), which consider the statistical relevance of the deviations.

Second-order principles that are used to determine actuarial reserves must be reviewed periodically. The principles and methods described above must be used for this purpose.

6.2.4 Special principles

When determining actuarial reserves for life annuities, probabilities of death that depend on the pensioner's gender and age as well as their generation (i.e. year of birth) must be considered. The basis for determining these generation-dependent reserve review principles are the relevant second-order probabilities of death, which contain assumptions on the future development of mortality rates. These assumptions are based on recognized mathematical models (such as the Nolfi half-life model or the Lee and Carter model). If additional characteristics such as smoker status or occupational group are used for the classification, these must also be considered in the reserve review principles.

¹ For example, this means that it must not be possible to mix policy and personal statistics.

² Late recordings are insurance-related incidents, such as the occurrence of a claim or the reactivation of a disabled person, which the insurance company is notified of with a delay and that are therefore only recorded in the IT systems with a delay. Late recording may result in an incomplete data base and an estimation error.

6.3 Second-order cost parameters

The second-order cost parameters must also be determined individually for each company. As this relates to the valuation of the existing portfolio not including future new business, no one-off acquisition costs have to be taken into account, rather only ongoing costs. These ongoing costs also include the depreciation of capitalized investments (e.g. EDP systems), while the depreciation of goodwill, which was established following the acquisition of a company, is not considered in this case. As a rule, the cost parameters are determined based on the actual costs for the previous financial year. If extraordinary one-off costs (e.g. restructuring costs, costs for the integration of an acquired company) accrued in this financial year, these may be excluded when determining the cost parameters, whereby the definition of "extraordinary costs" must be restrictive. Future planned cost savings may only be considered insofar as they have already been implemented and it is extremely probable that the planned savings will be achieved.

A "going concern" assumption in the existing business model should be assumed for the definition of ongoing costs, i.e. only the one-off costs arising in connection with new acquisitions (and contract increases), such as acquisition fees (incl. additional fees and social security benefits associated with the acquisition fees) and costs for underwriting and policy preparation, should be excluded in order to determine the ongoing costs from the total costs.

The following example should help to clarify this distribution:

<p>One-off costs on conclusion of the insurance</p> <ul style="list-style-type: none"> - acquisition fees - additional fees in connection with new acquisitions (for advisors, brokers, managers in sales, etc.) - costs for social security benefits on these fees - costs for preparing the policies (part of the customer service costs, general agency – back-office costs, call center costs, information costs, etc.) - costs for underwriting/medical check-ups
<p>Ongoing costs in the current business model (not incl. portfolio acquisition)</p> <ul style="list-style-type: none"> - costs in connection with sales management - costs of general agencies (not incl. the part for "acquisition support") - costs for market performance development and marketing - project costs - information costs that do not purely involve contract management (e.g. for new products, customer relationship management) - majority of the finance functions - majority of management - etc.
<p>Ongoing costs purely for contract execution</p> <ul style="list-style-type: none"> - costs for policy administration (personnel and information) - costs of the benefits - portfolio service fees - small part of the finance functions - small part of management - etc.

These total ongoing costs, which do not just include the costs required purely for executing the contract, must then be distributed to the individual products using an appropriate model and used to determine the second-order cost parameters per product (e.g. unit costs, costs as a % of the premium, costs as a % of the sum insured, etc.).

As part of the “going concern” assumption, it can be assumed that these ongoing costs reduce synchronously with the reduction of the portfolio, as the future new business continues to take on a larger portion of the fixed costs. There is likewise always the possibility that the ongoing costs of the existing business model that have no direct relationship to the pure execution of the contract are adapted to a possibly shrinking volume.

However, this assumption is not applicable if a company is already in run-off mode, i.e. a more precise investigation is required to confirm which part of the costs is variable, and therefore also decreases as the portfolio decreases, and which part of the costs is fixed regardless of the size of the portfolio, and so will receive an increasingly higher weighting in relation to the existing portfolio.

The inflation-related increase must be taken into account in the development of the cost parameters over time. At least the costs that serve purely to execute the contract (with the exception of portfolio fees) must be increased by expected inflation on an annual basis. For the remaining ongoing costs, it may be assumed that these increase at most in proportion to the overall business volume (incl. future new business), while the parameters remain constant for this part of the costs.

6.4 Second-order cancellation probabilities

Cancellation is regarded as the termination of a contract as well as the release from premium payment in the individual insurance business. In collective insurance, cancellations include contract terminations, but not the end of employment, as it is assumed that the portfolio of insured persons remains constant within a contract.

In general, the same principles apply for determining the second-order principles for cancellations as are described in the “second-order biometric principles” chapter.

In particular, the principles must be based on internal observation while even more detailed subdivisions take place if the cancellation behavior is obviously different (e.g. different probabilities of cancellation for single-premium and annual-premium insurances).

6.5 Expected reinsurance costs

The reinsurance balance normally represents an expected loss for the insurance company, which is why these costs must be considered as part of a review of the technical reserves if they are significant.

6.6 Special second-order parameters for collective life

6.6.1 Introduction

Collective insurance has various parameters that will change in the future, as they depend on statutory adjustments (such as the compulsory conversion rate), are determined externally based on capital market parameters (such as the minimum yield on LOB retirement savings) or can be freely determined by the company (such as parameters in the supplementary system, etc.). In particular, a number of these parameters have to be determined as part of a review or establishment of a reserve for future conversion rate losses and are defined in this chapter.

Besides the principles mentioned below, the same principles essentially apply for determining the necessary parameters as for the second-order biometric principles (see Chapter 6.2).

6.6.2 Interest on old-age savings

Uniform or separate assumptions may be made for the interest paid in the projection of old-age savings for the compulsory and supplementary old-age savings. At least the compulsory assumptions must be used when uniform assumptions are applied.

When determining the parameter in the supplementary system, either an internal calculation method, which is consistent with the determination of long-term expected yields, can be used to determine the technical actuarial interest rate, or the (70/7/7) method.

A direct or indirect method can be selected for the supplementary parameter. For the direct method, the parameter is determined based on the expected yields and business considerations, while it must remain consistent with the other parameters (compulsory interest, compulsory and supplementary conversion rate, technical actuarial interest rate).

For the indirect method, a surcharge or discount is applied to the compulsory interest rate based on business considerations. Consistency must also be ensured when using this method.

6.6.3 Conversion rates

Three different conversion rates or bases of calculation are applied with regard to the interest rate and mortality rate at the projection date.

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

When converting the old-age savings at the retirement date, the losses are equal to the difference between the actuarial conversion rate and the statutory or tariff-based conversion rate.

The actuarial conversion rate must be determined with the same reserve review principles used to review the remaining reserves (Best Estimate plus safety loadings).

The expected interest rate and the expected development of the mortality rate may be considered when determining the future statutory and tariff-based conversion rates. If a reduction is assumed for the future conversion rates, then the statutory, contractual and operational framework conditions must be taken into account.

The conversion rates are only applied to the old-age savings which are expected to exist at retirement. An assumption on the withdrawal of pensions and lump sums must be made, for which the same principles as for the biometric principles apply (see Chapter 6.2).

6.6.4 Discounting and loss probabilities relating to conversion rate losses

The same interest rate must be used for discounting future conversion rate losses as is used to review the reserves.

The probability of the effective 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 required probabilities of death are determined in accordance with the biometric principles described in Chapter 6.2.

6.6.5 Duration of consideration of conversion rate losses

The following two approaches can be used with regard to the duration of consideration of the expected conversion rate losses:

One possibility is to consider the expected retirement losses of all insured persons included by the portfolio at the calculation date. When discounting the expected retirement losses, this may include (increased) probabilities of cancellation that take account of the insurer's opportunities to actively terminate contracts.

Another approach consists of only considering the retirement losses that are expected within a limited period from the review date. The duration of this period may be based on the average remaining term of the contract of the sub-portfolio or may be based directly on the remaining term of the individual contracts.

6.6.6 Reserve for high price risk

For the risk of high price according to art. 36 of the Federal Law on Occupational Retirement (BVG/LPP) a separate reserve ("High price fund" oder " High price reserve") is allocated. The underlying inflation hypothesis for the calculation of this reserve should be based on historical scenarios and effective returns.

6.7 Insurer options

In particular, the insurer has various options in collective insurance, such as the options to increase premiums or to terminate contracts. Exercising these options allows various risks (such as future conversion rate losses in collective insurance) to be reduced.

The consideration of these insurer options when reviewing the reserves is permitted to the extent that there is a realistic probability that they can be exercised "in an emergency".

If these insurer adaptation options (whether for premiums or benefits) are considered when reviewing the reserves, a review must also be performed to determine whether any resulting extraordinary customer termination options have a negative impact.

6.8 Policyholder options

Many life insurance contracts provide various options in favor of policyholders or insured persons. In collective insurance these include

- the option of selecting between a lump-sum withdrawal or a pension,
- the choice of early, planned or deferred retirement,
- the option to cancel the contract (cancellation), especially without an interest rate risk reduction,
- purchases and early withdrawals, or
- an increase in the sums insured.

In individual insurance these include

- the option of premature surrender or a release from premium payment (cancellation), or
- subsequent insurance guarantees.

If exercising an option results in or could result in a significantly higher risk for the life insurer, the options must be included in the reserve calculation.

These options are often characterized by the fact that exercising these options and their value is dependent on other parameters, such as the interest rate level for example.

Examples of interest-sensitive options for simple classic insurances:

- If the customer in collective insurance has the option of redeeming the reserves for ongoing pensions in the event of a contract cancellation or of them remaining with the insurer, the customer is more likely to redeem these in the event of high interest rates, while they are more likely to be left with the insurer in the event of low interest rates.
- In collective insurance, the customer is relatively free to select when their contract is to be terminated. A lack of interest rate risk deductions may result in losses arising in the event that the option is exercised and interest rates increase, as customers have to be paid a "nominal value", while the market value of the assets to be liquidated may be less than this nominal value. In contrast, rising interest rates may lead to lower reserve requirements at other points (e.g. for ongoing pensions), which would require a review of which is the predominant effect.

For a review of the technical reserves of simple classic insurances without special options, it is generally not necessary to model the dependency of cancellations on other parameters, such as the interest rate level for example.

If special options are included in a simple classic product, or if this relates to a complex product, scenarios must be used to review how a correlation (between the interest rate and cancellations, for example) impacts the reserve requirement. If the dependency has a significant impact, then it must either be modelled appropriately as part of the review of the technical reserves or a separate reserve must be established for this risk.

The risk of cancellation must also be considered when offsetting gains and losses between the various portfolios. For example, according to the FINMA circular, in collective insurance no gains on asset portfolios may be offset against losses on pension portfolios, as the assets may disappear in the event of cancellation while the pensions remain with the insurance company.

7 Best Estimate of future yields on investments

7.1 Introduction

When reviewing the actuarial reserves for a portfolio, a yield vector must be used to discount the expected future obligations, which includes conservative estimates of the future expected yields for the corresponding investment of the tied assets. It is based on a corresponding Best Estimate yield vector (second order) and is derived by offsetting the safety markdowns.

Chapter 7.2 initially provides actuarial recommendations for creating a Best Estimate yield vector. Chapter 8.1.2 then deals with determining the safety markdowns.

7.2 Deriving the Best Estimate yield vector

In order to determine the Best Estimate yield vector, the expected future development of the yields on the investments that are allocated to the statutory reserves to be reviewed must be estimated. The starting point is the investments of the tied assets in the life insurer's statutory balance sheet. It must be ensured that the investments in a statutory balance sheet, i.e. including the investments that are allocated to the tied assets, are evaluated based on book values.

The collective life business and the individual life business must be considered separately based on the Transparency Ordinance dated 01.04.2004 and in accordance with the AVO, Article 77. Accordingly, a Best Estimate yield vector must be created at least separated according to collective and individual life insurance based on the relevant separate tied assets.

7.2.1 Determining the relevant reserves and investments

Actuarial reserves are considered to be reserves that are established in accordance with Article 54 of the AVO and Business Plan Form D and that are to be covered by the target amount of the tied assets in accordance with the AVO, Article 56, paragraph 1, point a. In general, the individual investments are not allocated to any specific technical reserves.

If there are significant reserves that are matched by specific, precisely defined investments, these reserves and the corresponding investments must be considered separately. For example, this may affect products (such as so-called index-linked insurances or "tranche products") with specific allocated investments.

The total book value of the remaining investments of tied assets will generally exceed the total remaining actuarial reserves which development is considered in the projection. The second step involves scaling the total book value of the remaining investments of tied assets so that it corresponds to the total remaining actuarial reserves (cf. section 5 (basic principle) of FINMA circular 2008/43). This ensures that any surplus coverage of the target amount does not lead to an increase in yield.

The investment allocation of the remaining investments at the reporting date defines the investments relevant for the review of adequate reserves. The Best Estimate yield vector is derived based on this investment allocation. This yield vector must be determined so that its application to the statutorily evaluated assets generates the Best Estimate cash flows. Confirmation of whether the considered portfolio is closed (i.e. is in run-off mode) or not must be provided. If this does not relate to a closed portfolio, the "going concern" principle is taken as a basis.

In order to estimate the future yields, the investment portfolio must be projected and the balance of the investment cash flow and the actuarial cash flows from premiums, benefits and costs must be reinvested, in order to cover the reserves with the book value of the assets. As a simplification, the projected individual reserves by contract may be used instead of the total adequate reserves. So long as the assets are not allocated to specific (additional) sub-portfolios, the projection can be performed at the level of the considered tied assets and the corresponding insurance contracts, and do not have to be performed for each sub-portfolio. The company's internal capital investment strategy must be taken into account. The asset allocation as well as the new investments can be projected according to a going-concern approach, in line with the current or planned asset strategy.

For a growing volume of assets, as well as during the transition between the current and planned strategic asset allocation, new or re-investments in real assets (such as stocks and property) may be necessary in order to maintain the pre-defined asset allocation. Similarly to fixed-interest securities, the projected returns for these

new or re-investments must take into account the current market conditions, and not be based on the book value return of the existing asset portfolio.

In line with the going-concern approach, the maturity for reinvesting fixed-interest securities can be determined according to the current or planned investment strategy, with the exceptions of separate sub-portfolios having specific allocated assets, and of tied assets for portfolios in runoff. In these exceptional cases, potential reinvestments have to be performed with a maturity no longer than the residual maturity of the corresponding insurance contracts.

In order to derive the Best Estimate yield vector for the investment portfolio, the yield vectors of the individual investment categories (cf. section 7.2.3) must first be estimated and then appropriately combined to form a Best Estimate yield vector weighted according to investment categories (cf. section 7.2.4).

7.2.2 Notes on the approach

The valuation principle relating to the guaranteed liabilities of the traditional business must be viewed in the context of statutory accounting. The liabilities side of a statutory balance sheet must always be considered in connection with the assets side. Any differing treatment (such as the valuation of the assets side at book value and the valuation of the liabilities side at market value) must be avoided for reasons of consistency.

Various principles are derived from this aspect.

The expected yield of the actual investment portfolio, which (in accordance with section 7.2.1) is used to cover the relevant liabilities, must be considered when determining the Best Estimate yield vector weighted according to investment categories. A separate Best Estimate yield vector can be determined for sub-portfolios whose obligations are replicated by corresponding assets.

The relevant valuation method applicable according to statutory accounting must be used when evaluating an investment category. For example, the application of an amortized cost principle for liabilities enables stable and calculable yields to be presented in the statutory accounting even in the event of fluctuating market interest rates. The stabilization of the yields at a predictable level is necessary due to the traditional life insurance business model, according to which annual guarantees must be provided at a constant level for the term of the contracts and statutory gains or losses are asymmetrically allocated to customers and shareholders.

Expected yields (Best Estimate) must be assumed for real estate and shares. The valuation reserves that are generated based on the lowest value principle may be included in the estimates in these investment categories if required.

7.2.3 Yields of the individual investment categories

Our following considerations are restricted to the main investment categories of fixed-interest investments, shares and investment properties. The other investment categories must be dealt with analogously.

It is possible that the identified investment categories may be refined 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 combined into a Best Estimate yield vector for the investment category. The combination is weighted in accordance with the allocation of the sub-categories within the relevant investment category.

Fixed-interest investments

The fixed-interest investment category primarily includes bonds, such as

- Swiss government bonds and bonds (such as cantonal bonds) with a similarly low risk of default,
- foreign government bonds,
- corporate bonds or high-yield bonds,

as well as similar investments such as

- mortgages or
- policy loans.

The expected yield vector for fixed-interest investments is based on the relevant expected payment flow divided by the book value of the corresponding current investment portfolio. The payment flow is composed of the expected interest income and amortization expenses.

The risk of default must be taken into account when determining the expected payment flow for fixed-interest investments. The currency risk must also be appropriately considered for fixed-interest investments in foreign currencies. Any hedging expenses must also be taken into account.

Maturing fixed-interest investments are reinvested in the same or another asset class in line with the current or strategic asset allocation. The reinvestment interest rate may be aligned to the forward rates of low-risk investments and a spread. An additional surcharge may be added in justified cases (such as due to higher expected yields in the Eurozone) if the current or strategic asset allocation includes investments in foreign currencies. On the other hand, an appropriate discount must be considered for currency risk and hedging costs.

Shares

Besides shares, this investment category also includes investment funds.

The expected yields are generally determined based on the expected book value yields including the hidden reserves.

A possible approach for determining the Best Estimate yield vector for a share consists of using the expected yield curve for low-risk investments (such as Swiss government bonds) as the base value to be increased by appropriate surcharges (spreads).

The disadvantage of this approach is the high interest rate sensitivity of the resulting Best Estimate yield vector. Instead of the yields of low-risk assets, the ultimate forward rate could also be selected to obtain a yield curve less sensitive to interest rates. It is also advisable to base the spread on a long-term average.

Another option is to determine a fixed yield for this investment category using the method described above.

In general, hedging costs must be taken into account when determining the Best Estimate yield vector.

Investment properties

This investment category primarily includes properties for own use and real estate that is either commercially or privately used by third parties.

In principle, the expected yields of investment properties should be aligned to book value yields.

These yields can be based on the cash-flows defined within the DCF (Discounted Cash-Flows) approach used for determining the market value of properties. These cash-flows generally correspond to the current rental income, minus the costs associated to the operation, maintenance, renovation and improvement of the properties. The determination of the book value returns can make allowance for the fact that the costs of renovations (designed to increase the value of the property and activated from an accounting point of view) compensate for the amortization linked to the aging of the property (which has to be taken into account from a statutory accounting perspective). The expected cash-flows can be directly taken from the DCF-valuation of the properties. In case other sources are used to determine these expected cash-flows, they have at least to be checked for reasonableness against those from the DCF-valuation.

The expected yield vector for investment properties is then based on the relevant expected payment flow divided by the book value of the corresponding current investment portfolio.. As a simplification, the average of these yields can be used as constant expected return.

Foreseeable extraordinary measures that will have an impact on the payment flow or the book value in the foreseeable future must be taken into account in a suitable form.

Any valuation reserves can be included in the yield estimate if their realization is realistic with regard to the strategic asset allocation and any additional investment is also considered for the yield estimate.

Alternative investments

This asset category generally comprises private equity, hedge funds, and other asset classes which cannot be classified in other categories. This asset class can be treated similarly to shares, although with the use of a specific risk premium and prudent safety margin, in order to reflect their own volatility and risks.

A possible approach to determine the Best Estimate return vector for alternative investments uses the reference yield curve for risk-free assets in the same currency (for example Swiss government bonds for CHF) as the basis return, augmented with an appropriate risk-based add-on (risk premium). This risk premium can be determined as the product of the factor s (Sharpe ratio) multiplied with the volatility of the alternative investments considered:

$$\text{Expected return alternative investments} = \text{Expected risk free rate} + s \cdot \sigma_{\text{Alternative investments}}$$

The calibration of the Sharpe ratio s can be performed using the return and volatility assumptions for equity in the Best Estimate scenario, as solution of the following equation:

$$\text{Expected return equity} = \text{Expected risk free rate} + s \cdot \sigma_{\text{Equity}}$$

As a consequence, the Sharpe ratio is calculated as the difference between the expected return for equity and the expected risk free rate at valuation date, divided by the equity volatility at valuation date:

$$s = \frac{\text{Expected return equity} - \text{Expected risk free rate}}{\sigma_{\text{Equity}}}$$

In case a constant return assumption is used for equity, and the risk free rate is equal or very close to zero, then the following simplification can also be made (slightly underestimating the return in case the risk-free rate is positive):

$$\text{Expected return alternative investments} = \text{Expected return equity} \cdot \frac{\sigma_{\text{Alternative investments}}}{\sigma_{\text{Equity}}}$$

If alternative investments do not constitute a significant proportion of the tied assets, then the derivation of a separate Best Estimate return vector for this asset class is not mandatory. In this case, alternative investments can be included within another existing asset category, for example shares.

Convertible bonds

The determination of a Best Estimate return vector for convertible bonds is based on their split into a bond-component and an equity-component.

In case convertible bonds constitute a significant proportion of the tied assets, they should be split into separate assets based on their main risk characteristics. For example, their “Equity-Delta” (sensitivity of the convertible bond to price movements of the underlying share) can be used as an approximation.

Example:

Convertible bond with:

- Book value = Nominal value = CHF 100
- Market value CHF 110
- Maturity 5 years
- Coupon 1%
- Equity-Delta 0.6

This convertible bond can be split into two theoretical assets:

- Share with:
 - Book value = CHF 60 (= 100 x 0.6)
 - Market value = CHF 66 (= 110 x 0.6)
- Bond with:
 - Book value = CHF 40 (= 100 x (1 - 0.6))
 - Nominal value = CHF 40 (= 100 x (1 - 0.6))
 - Approximation for the market value = CHF 44 (= 100 x (1 - 0.6))
 - Maturity 5 years
 - Coupon = 1% of the new bond nominal value (to avoid double-counting of coupon payments)
 - Rating and other characteristics similar to the original convertible bond.

In case convertible bonds do not constitute a significant proportion of the tied assets, their split can be performed in a simpler way, so that the aggregated volatility (after taking into account correlation effects between shares and bonds) corresponds to the volatility of the convertible bond. As long as enough data is available to do so, the volatility of convertible bonds should be specific to the insurance company. Otherwise, this volatility can be determined using a market index. The volatility and correlation assumptions for shares and bonds can for example make use of the latest available parameterization for the SST.

The part mapped onto bonds should be projected separately similarly to fixed-interest securities, whereas the part mapped onto equity should be projected separately similarly to shares.

Hedging instruments.

In general, income from hedging instruments (such as swaptions) can be taken into account when determining the Best Estimate yield vectors or when analyzing scenarios.

The hedging costs of fixed-interest investments, shares and other investments should already have been taken into account in the separately determined yield curves of the respective investment categories.

7.2.4 Accumulation of the investment category yields

A resultant Best Estimate yield vector for the entire underlying investment portfolio can be generated from the individually determined Best Estimate yield vectors (yield curves) of the relevant investment categories based on the asset allocation weighted according to book values.

This yield vector must be reduced by the asset management costs, if this has not already taken place, which may be aligned to the expected future costs assuming a going concern.

Valuation rates to review the reserves can be determined using the Best Estimate yield vector less the expected asset management costs. The fact that not all reserves require interest may also be taken into account when determining these valuation rates.

For simplification purposes, Best Estimate yield vectors (as well as the resulting valuation rates for reviewing the reserves) for each sub-portfolio may be converted into a constant implicit interest rate, but this may not result in any significant deviation from the application of the yield vector. For example, this may be performed by searching for a constant implicit interest rate where the sum of the discounted cash flow provides the same amount as discounting based on the interest rate vector (cash value of the cash flow with constant interest rate = cash value of the cash flow with yield vector).

8 Safety margins

8.1 Safety loadings in the individual principles

Safety loadings, for which a number of different options exist, must be included when reviewing the actuarial reserves. This may either take place globally at the level of the individual reserves or individually at the level of the individual parameters, probabilities or assumptions. Security can also be provided by establishing equalization reserves.

This chapter provides recommendations and possible methods in the event that the security is included at the level of the individual parameters.

8.1.1 Inclusion of safety loadings in the principles for biometrics, costs, cancellations, etc.

8.1.1.1 General

The safety loadings to be included in the second-order principles are intended to equalize adverse developments, whether these are a result of random fluctuations or changes to the environment.

The size of the margin to be included in the individual principles depends on the size of the fluctuations that are expected for these parameters in the future, i.e. a larger safety margin must be included in a principle for which strong fluctuations are expected than in a principle for which barely any fluctuations are expected.

The fact that a different number of principles apply depending on the insurance cover must also be considered. For example, only the biometric principle of mortality is required for death risk insurance in the individual insurance business, while the biometric principles of the probability of disability, the average level of disability, the probability of reactivation and mortality are required for disability insurance. As not all of these principles are normally completely (positively) correlated, less security has to be included for individual principles as the number of principles to be applied increases in order to achieve the same level of security.

A possible approach for the differentiated inclusion of safety loadings in the individual principles is provided below. It must be noted that other approaches that achieve the desired objective also exist.

8.1.1.2 Possible approach

This possible approach is as follows:

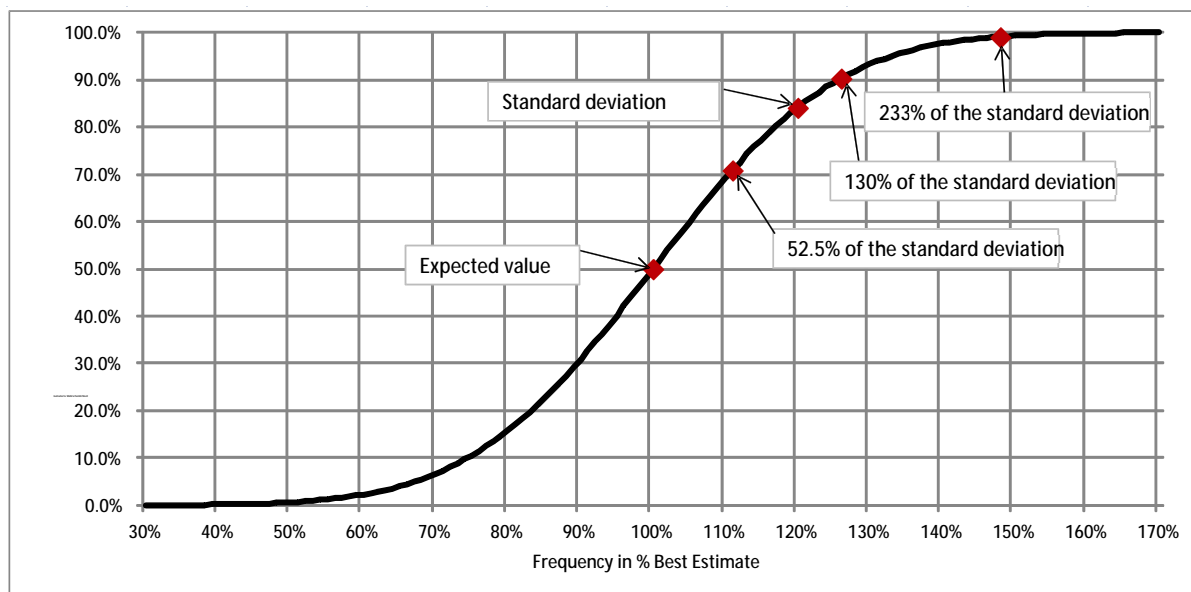
The first step determines the amount of security to be included in the individual categories of the second-order principles. A target system could look similar to the following:

- Security is included in the biometric principles with a 90% probability that this is sufficient.
 - If only one biometric principle (mortality, endowment insurance) is influential for a sub-portfolio (e.g. death risk insurances in the individual life insurance business), a 90% level of security is included in this principle.
 - If two principles (probability of death and reduction in mortality) are roughly equally determinant for a sub-portfolio, a security level of 82% is included in each of the principles, whereby, if the two principles are independent, this likewise results in a security level of 90% (the 90% security level is achieved for 130% of the standard deviation based on a standard distribution). If the two principles are independent, $130\% / \text{square root}(2) = 92\%$ of the standard deviation must be included in each principle (corresponds to a security level of about 82%) in order to reach 130% of the standard deviation when combined.
 - If other principles exist (e.g. demographic data for ongoing retirement pensions in collective insurance), no security is included in these additional principles, based on the assumption that the margin in the other principles is sufficient.
- Security is built into the cost principles so that, based on historic volatilities, these are likely to be sufficient with a 70% probability. The justification for less security being required here than for the biometric principles is that this security is an addition to the security for the biometric principles and that costs generally do not

“randomly” fluctuate or have not fluctuated in the past, rather they change or have changed in the past based on specific management decisions.

- A security level of 70% is also included in the cancellation assumptions, with the direction of the security for each sub-portfolio having to be checked in advance, i.e. whether more or fewer than expected cancellations are worse for the company.
- Either no safety margin or a margin with a security level of 70% is included for the remaining principles, depending on the actuary’s assessment of the extent to which the safety margin, particularly in the biometric principles, adequately covers/does not cover the risk of the additional parameters.

If it is assumed that the individual parameters are normally distributed, the following graph displays (example with a standard deviation of 20%) the safety loading required so that a prescribed level of probability is not exceeded (e.g. the frequencies with a probability of 90% are not greater than 126% (100% plus 130% of the standard deviation of 20%) of the expected frequency of 100%).



The following safety loadings as a % of the standard deviation apply for the various levels:

Security level	Safety loading
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

The second step is to determine the potential severity of the fluctuations of the individual parameters or their standard deviation, which are affected by both the parameter risk (which particularly includes the risk of change and error) and the risk of random fluctuations.

The parameter risk may either be based on the coefficients of variation for the actuarial risk of the Swiss Solvency Test defined by FINMA or internal investigations. The risk of random fluctuations may be ignored if the actuarial risk of the Swiss Solvency Test shows that the risk of random fluctuations is insignificant (which is the case if the standard deviation from the risk of random fluctuations and the parameter risk are practically identical to the standard deviation resulting purely from the parameter risk), otherwise the coefficients of variation must be increased accordingly.

If a company uses the FINMA standard of the coefficients of variation according to the Swiss Solvency Test, if the risk of random fluctuations is negligible for this company and if it would like to achieve the security level described above using the method described above, this results in the following safety loadings to be included:

Individual insurance

Parameter	SST coefficient of variation	Security level	Loading in % of the SST coefficient of variation	Safety loading or markdown
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 expiring insurances)	10%	82%	92%	9.2%
Average level of disability				None
Probability of withdrawal of disabled persons (to review ongoing benefits)	10%	90%	130%	13%
Costs	10%	70%	52.5%	5.25%
Cancellation	25%	70%	52.5%	13.125%
Reinsurance costs				None

Collective insurance

Parameter	SST coefficient of variation	Security level	Loading in % of the SST coefficient of variation	Safety loading or markdown
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 expiring insurances)	10%	82%	92%	9.2%
Average level of disability				None
Probability of withdrawal of disabled persons (to review ongoing benefits)	10%	90%	130%	13%
Costs	10%	70%	52.5%	5.25%
Cancellation	25%	70%	52.5%	13.125%
Reinsurance costs				None
Exercise of pension option on retirement	10%	82%	92%	9.2%

The intended security level per risk category and per parameter within the categories must be specified by each company in line with its individual situation, as, on the one hand, this depends on other safety buffers (e.g. in the yield assumptions or in the equalization reserves) and, on the other hand, the actuary should determine the order and extent of the individual risks according to their individual estimates.

The actuary may select other methods, but the safety margin to be included must always consider the risk of fluctuation (consisting of the risk of random fluctuation, error and change) of the relevant parameter, and the extent of the risk of fluctuation should be determined based on the most objective basis possible as well as a justified actuarial estimate.

8.1.2 Safety markdowns in the yield assumptions

8.1.2.1 Introduction

The yield vector that is used to review the actuarial reserves of a portfolio is derived from the corresponding Best Estimate yield vector (derived in accordance with Chapter 7) by including a safety markdown. The amount of the markdown primarily depends on the volatility of the Best Estimate yield vector, the estimation risks and the intended level of security.

It must be remembered that the safety markdown serves to ensure that the benefits can be financed in the long term and that their average terms to maturity should be over ten years. In general, the longer the term of consideration, the smaller the risk of random fluctuations, but the higher the estimation risk or risk of error or the risk that the environment will undergo a significant change. For example, for a long time the standard deviation of the EUR/CHF exchange rate amounted to about 15 centimes, while a couple of years ago (based on a normal distribution) the probability that the euro exchange rate of CHF 1.60 would fall to CHF 1.00 was only 0.003%. As we know, the scenario occurred despite this. The probability that the yields on 10-year government bonds would fall below 50 basis points was likewise probably very low a few years ago.

This also means that while a long-term probability of default can theoretically (based on historic or implicit volatilities) be calculated, this still has relatively little relevance for whether the yields will be achieved with sufficient security after a safety markdown has been applied. Furthermore, these volatilities are often only available at the level of market values and are poorly suited for replicating the expected payment flows of real estate (without a change in value of the real estate itself), for example.

Volatilities of investments or individual investment categories can therefore only be used as an indication of whether a high or low safety markdown should be included in the yield assumptions of an investment category. In addition, it is just as important that the actuary (pragmatically) considers which adverse developments could occur (e.g. no increase in interest rates or an increase in interest rates that is not to the expected extent) that have a significant impact on the expected yields. The determination of the safety markdowns on the yield assumptions should therefore be based on a combination of "scenario considerations" and past experiences (volatilities).

An example of this type of approach is the yield scenario for the minimum reserve requirements described in Chapter 10.2.

8.1.2.2 Safety markdowns in the individual investment categories

Shares (incl. investment funds)

Shares have historically high yields, but are also subject to high fluctuations. For example, the average annual performance of the Swiss Performance Index from 1926-2012 is 7.6%, but with an annual volatility of 21.6%. The safety markdown should therefore be relatively large.

Alternative investments

Alternative investments should be treated similarly to shares, although with a specific safety markdown adjusted based on their own volatility. Assuming for example a safety markdown proportional to the volatility, then the markdown for alternative investments is as follows:

$$\text{Markdown alternative investments} = \text{Markdown shares} \cdot \frac{\sigma_{\text{alternative investments}}}{\sigma_{\text{Shares}}}$$

Example:

The following table illustrates the application of the model for the following parameters:

Parameter	Value
Risk-free rate (simplified assumption)	0.00%
Best Estimate equity return	4.00%
Equity volatility	21.6%
Safety markdown equity	25%
Prudent equity return	3.00%
Alternative investments volatility	16.2%
Best Estimate return alternative investments	3.00%
Safety markdown alternative investments	18.75%
Prudent alternative investments return	2.44%

Investment properties

The expected yields for investment properties are based on the payment flow (rental income, maintenance, management and insurance costs, etc.) in accordance with Chapter 7.2.3. As these payment flows are generally relatively stable, this does not require a large safety markdown. However, if the yields estimate considers the realization of any valuation reserves (in accordance with Chapter 7.2.3), a much larger safety markdown must be applied for this part of the expected real estate yield. The safety markdown must also be considered differently if the development of the portfolio and/or the future change of investment strategy require substantial new investments in investment properties.

Bonds

Bonds must be divided into the existing portfolio and future new or re-investments.

In the existing portfolio, the coupons and amortized cost write-ups/-downs specify the future yields as long as the debtor remains solvent. The only risk involves the inability of the debtor to continue to meet their obligations. This should be taken into account using safety markdowns that depend on the quality of the debtor (debtor rating).

If there are a substantial portion of bonds that do not pay a fixed amount of interest, their safety markdown must be considered separately.

However, for future new investments/re-investments, the desired security level with regard to the quality of the debtor should already be taken into account when selecting the interest rate curve (risk-free plus spread or swap plus/minus spread). The great uncertainty lies in whether the interest rates effectively develop as expected by the forward rates. The safety markdown should therefore be included so that, for example, an expected rise in interest rates does not occur or only in part and/or the future yields do not exceed a certain level (or fall to this level in a phase with higher interest rates).

Convertible bonds

Convertible bonds are split between a bond-component and an equity-component. The bond component is treated similarly to bonds as described above. The equity component is treated similarly to shares (and investment funds) as described above.

Mortgages

Mortgages are dealt with in a similar fashion to bonds; the portfolio's sole risk for fixed mortgages is the insolvency of the mortgage borrower. However, as extremely strict regulations are in place regarding the granting of mortgages for insurance companies, this risk should be very low and should generally not require an overly high safety markdown. This must be considered differently if substantial defaults were observed in the past and/or there is a substantial portion of subordinate mortgages (second mortgages). A different markdown must also be considered if a substantial portion of variable mortgages (still) exists.

The future new investments/re-investments should be approached analogously to bonds, where the main risk of an overestimated future interest rate level is considered so that an expected rise in interest rates does not occur, or only in part, and/or the future yields do not exceed a specific level.

Money market

Money market investments are treated the same way as bonds.

Foreign currencies

A safety markdown must be applied for investments in foreign currencies, regardless of the investment category, in case the exchange rate risk has not been sufficiently hedged.

8.2 Risk margin for the scenario-based approach

In accordance with Chapter 3, the possible adverse deflections of the estimated parameters for the determination of the risk margin must be established based on the available empirical values (historical scenarios and volatilities) and, where relevant, other suitable sources of information and appropriately adapted to the current and future conditions.

As described in Chapter 5.3, the risk margin can be determined based on sensitivities or stress scenarios, whereby, in many cases, an accumulation of sensitivities to the adverse deflections of individual estimated parameters, which have a key influence on the development of the reserves, may be a sufficient basis for determining the risk margin. In particular, the inclusion of capital market, corporate or product-specific scenarios must be considered if this is required due to the complexity of the product or investment portfolio or as a result of special situations such as in the event of the run-off of a portfolio.

8.2.1 Sensitivities

In a sensitivity scenario, an individual parameter is deflected based on the Best Estimate without considering the interactions with other parameters.

- All parameters that have a significant influence on the reserves must be taken into account.
- The consideration of justifiably subordinate parameters can be avoided.
- The focus is on long-term changes and not on short-term shocks.

Parameterization

The basis for determining the deflections of the individual parameters should either be the safety loadings in accordance with Chapter 8.1 or the historically verified volatilities of the parameters.

The sensitivities should cover all important parameters.

1. Yield assumptions
2. Biometric and cost parameters
3. Parameters that depend on customer behavior
4. Management rules and external influences

The parameters to be used are derived from the Best Estimate parameters. The parameterization generally takes place independent of the underlying sub-portfolios.

1. Yield assumptions:

These are based on the Best Estimate interest rates and the Best Estimate interest rate curve on which the sub-portfolio to be assessed is based. A relative margin a is deducted from the Best Estimate interest rate (i.e. $\text{interest rate}_{\text{Stress}} = \text{interest rate}_{\text{Best Estimate}} \times (1-a)$). For example, the relative margin could be defined as follows:

- The most severe relative downward deviation of two successive decade averages in the past 30 years.

Other parameters (e.g. customer behavior, rates of disability) are deflected so that they match the interest rate shock.

2. Biometrics and costs:

Scenarios are defined consistent with the derivation of the safety loadings, once again based on Best Estimate assumptions.

3. Customer behavior

Scenarios are defined consistent with the derivation of the safety loadings, once again based on Best Estimate assumptions.

4. Scenario change to the management rules parameters

A change to the corporate strategy or a deviation from the modelled strategy affects costs, new business, investment performance, etc. (E.g.: change of strategic asset allocation depending on the risk situation.)

Aggregation

For example, one of the two following methods can be used for the aggregation:

If S_1, \dots, S_n are the results of the reserve calculation of the affected sub-portfolio in the relevant scenarios and S_0 is the Best Estimate reserve, then $\Delta S_i := S_i - S_0$. The adequate reserve S should at least fulfil the following conditions (one or more):

Method 1: every scenario is achieved: $S \geq \max(S_1, \dots, S_n)$.

Method 2: The adequate reserve can be determined from the calibration factors using the following equation:

$$S = S_0 + \sum_i a_i \Delta S_i$$

The a_i factors do not determine a probability of occurrence, but rather a relative weighting of the relevant scenarios in relation to each other. The a_i factor for each scenario should therefore be selected so that the sum of all weightings equals 1 and so that all factors are not negative.

8.2.2 Stress scenarios

A stress scenario involves a scenario that deflects several parameters simultaneously in order to provide a consistent image, for example of an historic fact.

Example: A fall in the capital market yields has a direct impact on the scenario's capital market parameters. However, this also changes customer behavior, which may also affect the cost parameter.

The following scenarios can be considered for adverse developments in the capital market:

- Deflation (low interest rate scenario)
- Inflation (high interest rate scenario)
- Real estate crash
- Share crash
- Currency scenarios (e.g. breakdown of the euro)

Aggregation

To determine the risk margin, the individual reserve deflections must then be aggregated using the following formula (for example) with a suitable dependency matrix (r_{ij}) ³:

$$RM = \sqrt{\sum \rho_{ij} \Delta S_i \Delta S_j}$$

or using one of the methods described under 8.2.1.

³ This dependency matrix should not be used to make any implicit assumptions on the distribution of margins.

9 Equalization reserves

In accordance with Article 55 of the Supervision Ordinance (AVO), actuarial reserves comprise:

- a) Reserves calculated according to the tariff conditions (or more prudent conditions) of the insurance contracts in-force;
- b) Reserves necessary for the constitution of adequate reserves; and
- c) Reserves constituted according to actuarial methods in line with the business plan in order to increase the coverage of the liabilities arising from the insurance contracts.

The reserves mentioned under points a) and b) above cover the “expected value” of future liabilities and include a safety margin, so that the liabilities are not covered only in the expected case but also with an appropriate additional level of confidence.

As the “expected value” is always calculated using the current principles and assumptions, systematic changes to the principles (deteriorations) are additionally reserved at the time the product is launched up to the balance sheet date. I.e. necessary reserves to cover the “past principle fluctuations” are included in the expected value.

Furthermore, the “safety loading” adequately covers the medium-term fluctuations and uncertainties.

However, the “safety loading” cannot cover all future, unknown scenarios and long-term trend changes at the current balance sheet date. An increase in reserves might be required for these scenarios or larger trend changes over time. For this reason, additional reserves are mentioned in AVO Article 55 c), in particular *equalization reserves to balance fluctuations on the assets and liabilities sides over time*, which go beyond the adequate reserves and, as the name implies, can be additionally increased over time. If a trend change occurs and this requires an increase in the adequate reserves, a certain amount of existing assets can be transferred to the adequate reserves. This provides for the maximum possible stability of the earnings development for an insurance company.

In principle, it is useful for the equalization reserves set out in the business plan to define certain target values for the actuarial reserves mentioned in AVO Article 55 c) and to specify a range in the insurance company’s business plan within which the current reserves may fluctuate. This range ensures that the reserves are adequate, but also that there is no reserve surplus. It also provides the insurance company with scope and flexibility to plan its business activities according to the relevant circumstances.

10 Minimum requirements test for reserves for simple products

10.1 Introduction

The test presented in the following includes minimum requirements in the sense that the reserves are not adequate if the conditions are not met. The fulfilment of the requirements is a necessary criterion for the adequacy of the reserves, but it does not have to be sufficient in every case. Tests must be performed according to all criteria in this guideline, regardless of the minimum requirements test, to ensure that the specific characteristics of the portfolios are suitably considered.

The minimum requirements test applies for simple products in accordance with Chapter 4.1. The requirements are selected so that they clearly and transparently identify possible problem areas and so that the fulfilment of the tests generally leads to adequate reserves.

The starting point for the minimum requirements is the Best Estimate reserves calculated using the individual contract approach. The Best Estimate assumptions consistently include the applicable parameters for the relevant portfolios (cf. also Chapter 5).

The Best Estimate reserves calculated in this manner are then

- pooled, at most at the level of the defined sub-portfolios
- pooling at more refined levels is permitted but not mandatory
- pooled reserves for each sub-portfolio may not be negative
- cross-subsidization within the aggregations levels is permitted

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

The minimum requirements test:

The existing reserves for each (sub-)portfolio must be compared with the Best Estimate reserves. Furthermore, a minimum loading must be calculated for each (sub-)portfolio, whereby this loading is provided by the maximum of a scenario for yields and longevity, a scenario for biometrics and costs and a scenario for customer behavior.

This means that the following must apply for every sub-portfolio for the minimum requirement to be fulfilled:

- Existing reserves ³ maximum (reserves calculated using the scenario for yield and longevity; reserves calculated using the scenario for biometrics and costs; reserves calculated using the scenario for customer behavior)

The reserve for high price risk according to art. 36 of the Federal Law on Occupational Retirement (BVG/LPP) ("High price fund" oder " High price reserve") is not taken into account within the scenarios and will be tested separately (see 10.5).

A review to check whether the existing reserves of each sub-portfolio pass the test described above must be performed at least once a year on the reporting date.

The three scenarios are defined in the following, whereby the parameters have been calibrated based on the situation (especially the capital market situation) at the end of 2012. The parameters applicable at the end of 2013 are listed separately in the appendix and the Swiss Association of Actuaries will review whether these parameters need to be adapted (e.g. due to significantly changed circumstances) at least once a year and either submit a confirmation of the existing parameters or any adjustments to the appendix.

10.2 Yield and longevity scenario

This scenario uses the best estimates for assumptions on biometrics (except mortality for pension insurance and reduced mortality for pension insurance), costs, cancellations, etc., while the best estimate for the **yield** is modified as follows:

In principle, the approach is the same as is described under Chapter 7, i.e. the same assumptions are used regarding asset allocation, instruments (incl. their terms to maturity) for reinvestment, etc. However, the expected yields per investment category are modified and the adjustments have been described below.

Shares (incl. investment funds)

Instead of the expected yields, 75% of the best estimate determined in accordance with Chapter 7.2.3 (book value yields after deducting hedging costs) is used, however a maximum of 4% of the market value (in relation to book values converted). The limit of 4% applies for each of the individual years if the best estimate does not assume a constant annual yield.

Alternative investments

Instead of the expected return, a return equal to $(1-v*25\%)$ of the best estimate determined in accordance with Chapter 7.2.3. (book value return after hedging costs) is used, up to a maximum of $v*4\%$ of the market value (calculated as a proportion of the book value). In case where the best estimate is not constant over the years, the limit of $v*4\%$ applies to all projection years. v is determined as follows:

$$v = \frac{\sigma_{\text{Alternative investments}}}{\sigma_{\text{Shares}}}$$

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

If alternative investments do not constitute a significant proportion of the tied assets, then the derivation of a separate Best Estimate return vector for this asset class is not mandatory. In this case, alternative investments can be included within another existing asset category, for example shares.

Investment properties

Instead of the expected yields, 90% of the best estimate determined in accordance with Chapter 7.2.3 without realizing the valuation reserves is used (expected payment flow without realizing valuation reserves, divided by the book values of the investment properties). Furthermore, the resulting payment flow (90% of the best estimate) may not exceed 3.5% of the market value, otherwise this will need to be reduced accordingly. (Example: market value=100, book value=80, expected payment flow=4, 90% of this = 3.6 → book value yield to be used: $3.5 / 80 = 4.375\%$ or $\min(3.6 ; 3.5\% * 100) / 80$). The limit of 3.5% applies for each of the individual years if a constant annual yield cannot be assumed. In addition, no value increases may be added to the market values of the real estate.

Bonds

A distinction is made between the portfolio and new investments. The amortized cost income (coupons +/- amortized cost surcharges/deductions) is the basis for the portfolio of bonds in CHF, while the following (absolute) discount is applied depending on the rating category:

Rating	Discount on yields
AAA	0.00%
AA	0.10%
A	0.15%
BBB	0.45%
BB	2.50%
B	10.00%

Bonds and similar investments without ratings must be allocated to an appropriate category. The discount does not necessarily have to take place at the level of the individual bonds, but can be determined as an overall discount by allocating the book values to the individual rating classes.

Bonds in foreign currencies are treated similarly to bonds in CHF, with an additional markdown for exchange risk resp. hedge costs. This markdown is determined until projection year 15 as the difference between 1-year forward rates in CHF and in foreign currency, plus a basis effect depending on the foreign currency considered. From projection year 15, the markdown is assumed to be constant, since this is the point where the use of the UFR in CHF would introduce a distortion.

Example: Hedge costs_{EUR}(t) = f_{EUR}(t,t+1) – f_{CHF}(t,t+1) + Basis_{EUR}

where f(t,t+1) is the 1-year forward rate at valuation date t. The basis effect is based on an average historical value, increased by a safety margin and will be yearly adjusted by the ASA .

Foreign currency	Basis
EUR	0.20%
USD	0.40%

The SAA will publish monthly hedge costs for EUR and USD. Other currencies can be considered negligible (so long as their volume is not significant).

The following assumption is made for the reinvestment of the bonds (incl. reinvestment of maturing bonds in foreign currencies):

The reference interest rate curve corresponds to the average of CHF swap curves for the last 6 months before the valuation date (therefore at closing date 31.12. the average of swap curves from end of June until end of November is relevant), without markdown. The relevant swap curves will be published every month by the SAA. The interpolation and extrapolation of the monthly swap curves is performed similarly to the FINMA approach for determining the risk-free yield curve for SST calculations (i.e. Smith-Wilson method including Ultimate Forward Rate, convergence, Last Liquid Point and Bloomberg-Ticker IO57). The SAV validates the basic assumptions for the extrapolation of the swap curves, and updates them if necessary. Thanks to the use of a weighted average over a half-year, market singularities (in particular shortly before the end of the financial year) can be smoothed out, thus avoiding an undue impact on all future reinvestments and hedge costs. The reinvestment yields are determined using the forward rates based on this reference interest rate curve with the following restrictions (cumulative):

- Compared to the yield on the reporting date, the future reinvestment yield increases by a maximum of 1/3 of the difference between 2.50% and the current 10-year swap rate:
 $\frac{1}{3} \max(2,5\% - 10\text{-year reference swap rate}, 0,0\%)$.
- The future reinvestment yield never rises over 2.50%.

If the current yield is over 2.50%, this still means that a reinvestment yield of over 2.50% cannot be assumed.

An example to provide clarification:

The yields on the swap curves resp. the reference interest rate curve of the last six months before 30.04.2016 are as follows on 30.04.2016:

DATE	TYPE	1Y	2Y	3Y	4Y	5Y	6Y	7Y	8Y	9Y	10Y
31.03.2016	ZccRate	-0.56%	-0.75%	-0.72%	-0.66%	-0.58%	-0.48%	-0.39%	-0.30%	-0.22%	-0.15%
29.02.2016	ZccRate	-0.70%	-0.95%	-0.91%	-0.82%	-0.72%	-0.60%	-0.49%	-0.39%	-0.30%	-0.23%
31.01.2016	ZccRate	-0.62%	-0.79%	-0.74%	-0.64%	-0.53%	-0.41%	-0.29%	-0.19%	-0.10%	-0.01%
31.12.2015	ZccRate	-0.60%	-0.65%	-0.57%	-0.45%	-0.31%	-0.17%	-0.04%	0.07%	0.18%	0.26%
30.11.2015	ZccRate	-0.71%	-0.94%	-0.88%	-0.76%	-0.62%	-0.46%	-0.32%	-0.19%	-0.10%	0.02%
31.10.2015	ZccRate	-0.61%	-0.81%	-0.76%	-0.66%	-0.53%	-0.38%	-0.24%	-0.11%	0.00%	0.10%
Reference interest curve		-0.63%	-0.82%	-0.76%	-0.67%	-0.55%	-0.42%	-0.30%	-0.19%	-0.09%	0.00%

DATE	TYPE	11Y	12Y	13Y	14Y	15Y	16Y	17Y	18Y	19Y	20Y
31.03.2016	ZccRate	-0.10%	-0.05%	0.00%	0.05%	0.11%	0.17%	0.24%	0.31%	0.39%	0.46%
29.02.2016	ZccRate	-0.18%	-0.13%	-0.08%	-0.02%	0.04%	0.11%	0.18%	0.25%	0.32%	0.40%
31.01.2016	ZccRate	0.06%	0.11%	0.17%	0.22%	0.28%	0.34%	0.40%	0.47%	0.54%	0.61%
31.12.2015	ZccRate	0.32%	0.39%	0.45%	0.51%	0.57%	0.64%	0.71%	0.77%	0.84%	0.90%
30.11.2015	ZccRate	0.11%	0.19%	0.25%	0.30%	0.36%	0.42%	0.49%	0.56%	0.62%	0.69%
31.10.2015	ZccRate	0.18%	0.25%	0.31%	0.37%	0.44%	0.50%	0.57%	0.64%	0.71%	0.77%
Reference interest curve		0.07%	0.13%	0.18%	0.24%	0.30%	0.36%	0.43%	0.50%	0.57%	0.64%

Based on the forward rates, in x years the expected yield for an example investment of ten years is as follows:

$$Yield(x, 10) = \left(\frac{(1 + yield(basis, x + 10))^{x+10}}{(1 + yield(basis, x))^x} \right)^{1/10} - 1$$

In our example, this results in the following best estimate returns, whereby in this scenario all value over 0.83% = 1/3 * (2.50% - 0.00%), (10-year reference rate of 0.00% plus a maximum increase of 0.83%) are replaced with 0.83%.

X	1	2	3	4	5	6	7	8	9	10
10y forward in x years	0.14%	0.31%	0.47%	0.60%	0.72%	0.84%	0.94%	1.05%	1.17%	1.29%
Maximum increase	0.83%	0.83%	0.83%	0.83%	0.83%	0.83%	0.83%	0.83%	0.83%	0.83%
Reinvestment return	0.14%	0.31%	0.47%	0.60%	0.72%	0.83%	0.83%	0.83%	0.83%	0.83%

X	11	12	13	14	15	16	17	18	19	20
10y forward in x years	1.41%	1.55%	1.69%	1.83%	1.95%	2.06%	2.16%	2.25%	2.33%	2.40%
Maximum increase	0.83%	0.83%	0.83%	0.83%	0.83%	0.83%	0.83%	0.83%	0.83%	0.83%
Reinvestment return	0.83%	0.83%	0.83%	0.83%	0.83%	0.83%	0.83%	0.83%	0.83%	0.83%

Convertible bonds

Convertible bonds are split between a bond-component and an equity-component. The bond component is treated similarly to bonds as described above. The equity component is treated similarly to shares (and investment funds) as described above.

Mortgages

A distinction between the portfolio and reinvestments is also made in this case. The income for the existing portfolio is the basis for the portfolio, whereby 7% is deducted from this (this means that the yield is equal to 93% of the expected interest payments divided by the book values of the mortgages). Reinvestments are based on the same interest rate curve as for bonds (after a restriction of the interest rate rise or an absolute restriction), whereby the bond yields are increased by 80 basis points for the mortgage reinvestment yields. The selection of the duration of the new fixed mortgages to be concluded must be identical to the best estimate.

Money market

This again uses the same approach as for bonds, with no discount on the portfolio and the upper limit for the future reinvestment yields set at 1.50% instead of 2.50%.

Hedging instruments

Hedging shares and similar investments are already implicitly considered in the scenario assumptions. Any swaps have not yet been considered and may be added to the yield scenario (without a discount).

Furthermore, half of the margin of the biometrics and costs scenario is included in the best estimates for **mortality for pension insurances and reduced mortality for pension insurances**:

Parameter	Individual insurance: safety loading or markdown	Collective insurance: safety loading or markdown
Mortality for pension insurance	2.92%	2.92%
Reduced mortality for pension insurance	5.85%	5.85%

This yield and longevity scenario is not applicable for the following portfolios:

- Old-age savings in the occupational benefits insurance (this is based on the assumption that the overall interest yield (mandatory insurance and the supplementary system) can largely be adapted to the yield level), however the scenario must be applied to the expected conversion rate losses according to Chapter 6.6
-
- Unit-linked insurances without guarantees (this is based on the assumption that the changed investment earnings are entirely for the account of and at the risk of the policyholder)

In the minimum requirements test, the balance sheet reserves for old-age savings and inflation funds as well as savings in unit-linked insurances without guarantees are transferred to occupational benefits insurance.

10.3 Biometrics and costs scenario

This scenario uses the best estimate for the yield and cancellation assumptions, whereas safety margins are included in all remaining principles. Inclusion takes place as described in Chapter 8.1.1.2, whereby a security level of about 95% is selected for biometrics and costs and this is based on the parameters below for the coefficients of variation (which have been slightly adapted with regard to the standard SST).

A safety margin of 165% (if only one principle is decisive for the sub-portfolio) or 117% ($165\% / \sqrt{2}$) (if two biometric principles are decisive) should be used. If more than two biometric principles are decisive, no margin is added from the third principle. An exception applies for the “exercise pension option on retirement” parameter in the collective insurance, which is deflected in this scenario (although it relates to “customer behavior”) and in which a safety margin is included even though it is the third principle when calculating future losses from pension conversions.

This results in the following safety margins to be included in the individual principles for the residual principles scenario:

Individual insurance

Parameter	Coefficient of variation	Loading in % of the coefficient of variation	Safety loading or markdown
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 expired insurances)	10%	117%	11.70%
Average level of disability			None
Probability of withdrawal of disabled persons (to review ongoing benefits)	10%	165%	16.50%
Costs	5%	165%	8.25%
Cancellation	15%		None
Reinsurance costs			None

Collective insurance

Parameter	Coefficient of variation	Loading in % of the coefficient of variation	Safety loading or markdown
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 expired insurances)	10%	117%	11.70%
Average level of disability			None
Probability of withdrawal of disabled persons (to review ongoing benefits)	10%	165%	16.50%
Costs	5%	165%	8.25%
Cancellation	25%		None
Reinsurance costs			None
Exercise of pension option on retirement	10%	117%	11.70%

If the premiums can be adapted for an existing product portfolio (e.g. for the "one-year" premiums in the collective insurance or for disability premiums in individual insurance), only 50% of the above safety margin must be included when reviewing the reserves for these contingent insurances.

10.4 Customer behavior scenario

This scenario uses the best estimates for yields, biometrics and costs, while the cancellation probabilities are changed.

A security level of 95%, based on a coefficient of variation of 15% in the individual insurance and 25% in the collective insurance, is sought, which results in a margin to be included of 24.75% in the individual insurance and of 41.25% in the collective insurance. Reserves for each sub-portfolio with 24.75% or 41.25% higher and 24.75% or 41.25% lower cancellations must be calculated and the higher of the two results must be used as the scenario result.

10.5 Reserve for high price risk for occupational pensions

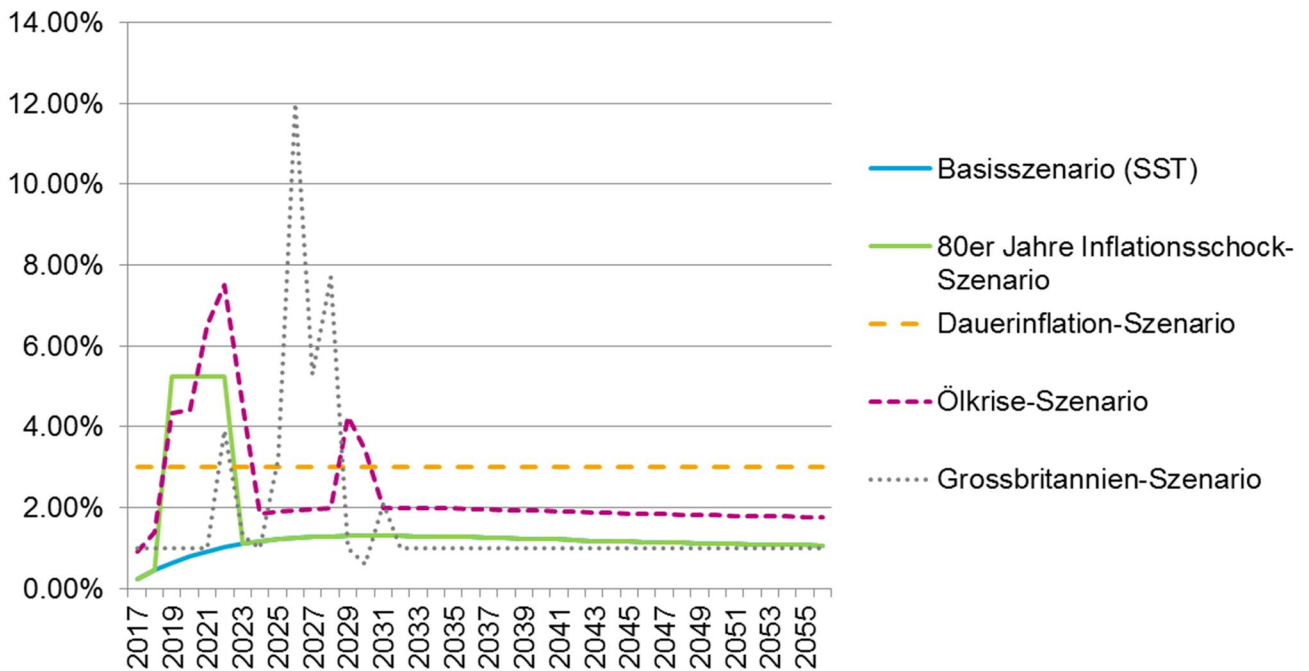
The reserve for high price risk according to art. 36 of the Federal Law on Occupational Retirement (BVG/LPP) ("High price fund" oder " High price reserve") should be tested separately. The level must be at least as follows:

$$\text{Mathematical reserve of current annuities subject to high price risk} \times 36\%$$

All current annuities subject to high price risk must be taken into account and it does not depend on the fact that a high price adjustment has already be done or not.

The factor of 36% is based on the valuation of five scenarios (see graph below) as at 31.12.2016 in the portfolios of insurers active within the field of occupational retirement. The cash flows resulting from the high price risk were discounted with 1%. The most expensive scenarios for all insurers were the scenario "petrol crisis" (average factor of 36%) and the scenario "long-lasting inflation" (average factor of 34%).

Teuerung (Konsumentenpreise)



11 Disclosure

Transparency is not a primary criterion for adequate reserves. But the adequacy of reserves is virtually impossible to assess without the possibility of verification. Transparency is an important tool in this respect. In particular,

- the derivation of the parameters in the respective approaches,
- the changes made to the methods and parameters compared to the previous period and
- the key sensitivities

must be disclosed to management.

Appendix: parameters for the minimum requirements test

The following parameters must be used for the minimum requirements test for the reserves for simple products as at **31.12.2018**:

Yield and longevity scenario

Investment category	Assumed yield																				
Shares (incl. investment funds)	75% of the best estimate, however a maximum of 4% of the market value																				
Alternative investments	(100% – v · 25%) of the best estimate, up to a maximum of v · 4% of the market value, with: $v = \frac{\sigma_{Alternative\ investments}}{\sigma_{Shares}}$ The resulting return based on the market values should not be higher than the assumed return on shares.																				
Investment properties	90% of the best estimate, however a maximum of 3.5% of the market value																				
Bond portfolio	Amortized cost income less the following (absolute) discount depending on the rating category: <table border="1"> <thead> <tr> <th>Rating</th> <th>Discount on yields</th> </tr> </thead> <tbody> <tr> <td>AAA</td> <td>0.00%</td> </tr> <tr> <td>AA</td> <td>0.10%</td> </tr> <tr> <td>A</td> <td>0.15%</td> </tr> <tr> <td>BBB</td> <td>0.45%</td> </tr> <tr> <td>BB</td> <td>2.50%</td> </tr> <tr> <td>B</td> <td>10.00%</td> </tr> </tbody> </table> Basis markdown for exchange risk: <table border="1"> <thead> <tr> <th>Currency</th> <th>Basis</th> </tr> </thead> <tbody> <tr> <td>EUR</td> <td>0.20%</td> </tr> <tr> <td>USD</td> <td>0.40%</td> </tr> </tbody> </table>	Rating	Discount on yields	AAA	0.00%	AA	0.10%	A	0.15%	BBB	0.45%	BB	2.50%	B	10.00%	Currency	Basis	EUR	0.20%	USD	0.40%
Rating	Discount on yields																				
AAA	0.00%																				
AA	0.10%																				
A	0.15%																				
BBB	0.45%																				
BB	2.50%																				
B	10.00%																				
Currency	Basis																				
EUR	0.20%																				
USD	0.40%																				
Parameter for the basis interest rate curve	<table border="1"> <thead> <tr> <th>FX</th> <th>Last Liquid Point</th> <th>Ultimate Forward Rate</th> <th>alpha</th> </tr> </thead> <tbody> <tr> <td>CHF</td> <td>15 Jahre</td> <td>2.25%</td> <td>0.1</td> </tr> <tr> <td>EURO</td> <td>35 Jahre</td> <td>3.65%</td> <td>0.1</td> </tr> <tr> <td>USD</td> <td>50 Jahre</td> <td>3.65%</td> <td>0.1</td> </tr> </tbody> </table>	FX	Last Liquid Point	Ultimate Forward Rate	alpha	CHF	15 Jahre	2.25%	0.1	EURO	35 Jahre	3.65%	0.1	USD	50 Jahre	3.65%	0.1				
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Bond reinvestments	Expected returns are estimated according to the forward reference interest rate curve, with the following maximum increase: $\frac{1}{3} \max(2.5\% - 10\text{ year reference swap rate}, 0.0\%)$ Furthermore, the future reinvestment yield never rises over 2.50% .																				
Convertible bonds	Convertible bonds are split between a bond-component and an equity-component. The bond component is treated similarly to bonds. The equity component is treated similarly to shares (and investment funds).																				
Mortgage portfolio	93% of the portfolio's interest income																				
Mortgage reinvestments	Bond reinvestment yields increased by 80 basis points																				
Money market	Like bond reinvestment yield, however the future reinvestment yield never exceeds 1.50% .																				

Parameter	Individual insurance: safety loading or markdown	Collective insurance: safety loading or markdown
Mortality for pension insurance	2.92%	2.92%
Reduced mortality for pension insurance	5.85%	5.85%

Biometrics and costs scenario

Parameter	Individual insurance: safety loading or markdown	Collective insurance: safety loading or markdown
Mortality for endowment insurance	8.25%	8.25%
Mortality for pension insurance	5.85%	5.85%
Reduced mortality for pension insurance	11.70%	11.70%
Demographic data	Not available	None
Disability	11.70%	17.55%
Probability of withdrawal of disabled persons (to review expired insurances)	11.70%	11.70%
Average level of disability	None	None
Probability of withdrawal of disabled persons (to review ongoing benefits)	16.50%	16.50%
Costs	8.25%	8.25%
Cancellation	None	None
Reinsurance costs	None	None
Exercise of pension option on retirement	Not available	11.70%

Customer behavior scenario

Parameter	Individual insurance: safety loading or markdown	Collective insurance: safety loading or markdown
Cancellation	24.75%	41.25%

Reserve for high price risk for occupational pensions

Parameter	Group life insurance
Minimum level of the reserve for high price risk in % of the mathematical reserve for current annuities subject to high price	36.00%