Milliman Research Report

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How equivalent are the quantitative aspects of Swiss Solvency Test and Solvency II for life insurers?

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1. Executive summary

Solvency II and the Swiss Solvency Test are conceptually similar principle-based, risk-based solvency regimes based on market-consistent valuation of assets and liabilities. However, while the regulatory objectives are consistent, there are a number of areas where the two regimes approach this in very different ways.

The main similarities and differences between the quantitative aspects of the standard models of the two regimes are summarised in Figure 1.

Figure 1: Solvency II and Swiss Solvency Test

Item	Solvency II treatment	SST treatment
Asset valuation	Generally market value. Reinsurance provisions shown as assets. Deferred tax assets calculated.	Generally market value. Under the SST the reinsurance part of the reserves must be shown explicitly on the liability side of the balance sheet.
Liability valuation, BEL	Projection of all future liability cash flows based on best-estimate operating assumptions and market-consistent economic assumptions. Restrictions on contract boundaries. Future discretionary benefits valued. Discount rates based on credit-adjusted swap rates with a last liquid point of 20 years (for EUR) and an ultimate forward rate of 4.2%. A package of countercyclical measures and dampeners are proposed deviating from pure market consistency.	Projection of all future liability cash flows based on best-estimate operating assumptions and market-consistent economic assumptions. Future discretionary benefits not valued as a liability. Temporary choice of discount rates. Often the more beneficial of the following will be used: ▪ Those derived from AAA-rated government bonds ▪ Those based on credit-adjusted swap rates with a last liquid point of 30 years and an ultimate forward rate of 3.9% for EUR.
Liability valuation, risk margin	Based on a cost of capital methodology for non-hedgeable risks. Interest rate risk not taken into account. Risk margin treated as liability on the balance sheet.	Based on a cost of capital methodology for non-hedgeable risks. All market risk past the last liquid point (LLP) considered non-hedgeable and thus affects the risk margin. Risk margin treated as increase in required capital.
Risk modules	Life Underwriting Market Counterparty Default Operational Intangibles	Life Underwriting Market Credit Extreme Scenarios
Risk measure	Value at Risk, 99.5% confidence.	Tail Value at Risk, 99% confidence.

Figure 1: Solvency II and Swiss Solvency Test (continued)

Structure of the capital model for life and market risks	Based on evaluation of the effect of pre-specified shocks to risk factors on the net assets.	Based on fitting a delta-gamma model, calibrating parameters through various risk factor sensitivities.
Aggregation	Two-level aggregation using correlation matrices to aggregate sub-modules within a risk module and between risk modules.	Based on multivariate normal distribution and correlation matrix between risk drivers.
Life underwriting risk capital	Stress to key risk factors such as lapses, expenses, mortality.	Takes account of parameter and stochastic risk for key risk factors such as lapses, expenses, and mortality.
Market risk capital	Stress to key risk factors such as interest rates, equity, and spreads.	Uses a large number of risk factors, including volatility factors and detailed yield curve buckets for each currency.
Credit risk	Does not consider bond portfolio (although considered in the spread market module). Focus is cash and reinsurance positions. Based on common shock model.	Considers default and migration risk for all relevant positions. Basic methodology based on Basel III framework.
Operational risk	Simple formula based on premiums and reserves.	Not quantified.
Extreme scenarios	Not considered, though they form part of the Pillar II framework.	Combined market and life risk capital adjusted for the impact of extreme scenarios to allow for tail dependency and heaviness of tail risk.
Other elements of the capital model	Loss absorbency of deferred taxes and technical provisions allowed for.	Tax not considered. Discount rate used in calculating the stresses to the liabilities is based on AAA-rated government bonds, regardless of choice of discounting methodology for the liabilities.

2. Legal framework, purpose, and general methodology

2.1 Introduction

In October 2011, the European Insurance and Operational Pensions Authority (EIOPA) issued its final report on the equivalence of the Swiss supervisory system to Solvency II. Under Solvency II, equivalence has three strands affecting European Economic Area (EEA) insurers with reinsurance outside the EEA, EEA insurers with subsidiaries outside the EEA, and non-EEA companies with EEA subsidiaries. The Swiss supervisory system was found to fully meet the criteria for equivalence under Article 227 for the calculation of group solvency where an EEA parent company has a subsidiary in Switzerland. Equivalence was also advised under Articles 172 and 260, albeit with certain caveats.

Essentially the quantitative requirements of the Swiss Solvency Test (SST) for life insurers were deemed equivalent to those of Solvency II. This Milliman Research Report addresses the key quantitative (Pillar 1, in Solvency II terms) issues under both regimes and seeks to qualitatively compare them.

This paper builds on 'Comparison of the standard formulae for life insurers under the Swiss Solvency Test and Solvency II' by Kinrade and Wülling, and refreshes the content in the light of numerous changes to the Swiss Solvency Test and Solvency II since 2010 and 2011.

The SST and Solvency II are both recently developed principle-based regulatory capital regimes, designed to replace the Solvency I capital regime which has formally been in place since the 2002 Life Directive.

This report focuses on aspects related to life insurance. We do not discuss nonlife or health insurance capital requirements in detail. Additionally, in this paper we focus entirely on the key Pillar 1 aspects of the SST and Solvency II.

Unless otherwise stated, the material presented in Sections 4 to 10 refers to the standard models of the various regimes, which are the main focus of this paper. Specific internal models may well vary in a number of aspects, including those alluded to in Section 11.3.

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2.2 Solvency II background

The Solvency II project aims to introduce a consistent and harmonised risk-based supervisory framework for all insurers and reinsurers operating in EEA countries. This is currently expected to be in force by 1 January 2016 at the earliest.

Solvency II is set out in three pillars:

- Pillar 1: The qualitative and quantitative requirements for the calculation of technical provisions and solvency capital requirement (SCR) using either the prescribed standard formula or an internal model developed by the (re)insurance company.
- Pillar 2: The requirements for the governance and risk management of insurers, as well as for the effective supervision of insurers.
- Pillar 3: The disclosure and transparency requirements.

When finalised, the Solvency II requirements will be set out in a four-level process, termed the 'Lamfalussy Process.' The Solvency II Directive (also referred to as Level 1) sets out the principles for Solvency II. Once Level 1 has been adopted by the European Council and European Parliament, the European Commission, with advice from EIOPA, will set out the more detailed requirements that (re)insurers must meet in the Level 2 implementing measures. To help ensure that the requirements are adopted in a consistent and harmonised way across the EEA, EIOPA will provide nonbinding guidance through Level 3. The fourth and final level will only become apparent after Solvency II is implemented, at which point the European Commission is tasked with ensuring member states are complying with the legislation.

Since the Solvency II Directive was first adopted in April 2009, further amendments have been proposed through the Omnibus II Directive. Discussion relating in particular to the measures required to address issues for products with long-term guarantees have delayed finalisation of the Omnibus II Directive. A long-term guarantee assessment (LTGA) was performed in early 2013 with the aim of finalising these measures. EIOPA's report from this proposed the use of a number of measures, including:

- A matching adjustment applied to the discount rate used to value specific liabilities to help remove so-called artificial volatility from balance sheets that is due to the impact of spread movements on assets invested with a hold-to-maturity strategy
- A volatility adjustment, applied to the discount rate used to value all other liabilities which do not fall under the scope of the matching adjustment, to prevent pro-cyclical behaviour caused by companies needing to sell assets during distressed market conditions
- Extrapolation to extend the risk-free interest rate term structure beyond that observable from market data
- The use of transitional measures to phase in the full impact of Solvency II on business written before the new regime is brought into effect

Current expectations are that the Omnibus II Directive will be finalised by the end of 2013 (with a Plenary vote in the European Parliament scheduled for 3 February 2014). Under this timeline, the Level 2 text would be expected to be finalised during the second half of 2014, with publication at the beginning of 2015 in time for member states to implement the new regime into national regulations on 31 January 2015 with full implementation for firms on 1 January 2016.

2.3 Swiss Solvency Test background

The SST is a risk-based market-consistent principle-based solvency regime, and has been in force since 1 January 2011 in Switzerland. Before this the SST was calculated and reported on by Swiss insurers for an interim period from January 2008 onwards.

The SST is defined by the Swiss insurance regulator, FINMA. The legislative grounding for the SST is found in the Insurance Supervision Act, 'Verordnung über die Beaufsichtigung von privaten Versicherungsunternehmen,' which entered into force on 1 January 2006. The technical specifications for the SST originate from a 2006 SST technical document, as subsequently amended by FINMA Circulars 2008/44 and 2013/02. In addition to these documents, details and other amendments to the SST are found in a number of annual Guidance Notes ('Wegleitungen').

Since the publication of Milliman's last paper on this topic, the major changes in SST reporting are as follows:

- Implementation of the Delta-Gamma model, superseding the Delta-Normal approach. This necessitates consideration of the second-order terms and cross-terms between market and insurance risk factors in the calculation of the required capital.
- An update of the credit risk module under the standard model, moving from a Basel II to a Basel III basis.
- The provisions of Circular 2013/02 'Temporary Relief under the SST,' which applies to SST calculations in the years 2013 to 2015 inclusive. This Circular makes two main adjustments:
  - The use of a risk discount rate (RDR), as opposed to a risk-free discount rate, for use in discounting best-estimate liabilities. Whether or not to use the RDR is at the discretion of companies, but an RDR will generally be used where a resulting uplift in the available capital is likely to occur. No change to the risk-free discount rate for the required capital is permitted.
  - Easing of the intervention ladder. The intervention ladder defines key floors on the SST ratio, below which FINMA will intervene in the management of the company.

2.4 Solvency II Pillar 1 methodology

Available capital (AC), known as own funds (OF), is calculated as the difference between the market value of assets (MVA) and the market value of liabilities (MVL). The MVL is the sum of the best-estimate liability (BEL) and the risk margin (RM).

The BEL is the present value of all liability cash flows calculated using (generally) market-consistent economic assumptions and best-estimate operating assumptions.

The risk margin is derived using a cost of capital approach and is based on a projection of future risk capital requirements for non-hedgeable risks.

The solvency capital requirement (SCR) is the required capital and is calculated as the Value at Risk (VaR), calibrated to a 99.5% confidence level, for the change in MVA less the BEL, MVA – BEL. The VaR is determined by a two-level aggregation approach, aggregating the risk capital for a number of risk factors. The individual risk capital is determined by stressing a given risk factor by a predetermined amount, corresponding to a 1-in-200-year event, and observing the change in MVA – BEL.

This modular approach categorises risk factors into market risks, underwriting risks, default risk, operational risk, and intangible asset risk. Additionally there is specific allowance for the loss-absorbing capacity of both deferred taxes and technical provisions.

2.5 Swiss Solvency Test overview

The goal of the SST is to obtain a picture of:

- The amount of risk borne by an insurance undertaking
- Its financial capacity to bear these risks

The amount of risk assumed is measured by the target capital (ZK from the German *Zielkapital*), and the capacity to bear risks is measured by the risk-bearing capital (RTK from the German *Risikotragendes Kapital*).

Risk-bearing capital is taken as the difference between the MVA and BEL. This is conceptually similar to the Solvency II own funds.

The target capital is defined as a capital requirement, determined using a Tail Value at Risk (TVaR) approach calibrated to a 99% confidence level, plus the market value margin (MVM). This is conceptually similar to the Solvency II SCR.

The MVM is somewhat equivalent to the risk margin under Solvency II and is derived using a cost of capital approach based on a projection of future risk capital requirements.

The remaining part of the ZK, the capital requirement, is calculated by combining risk distributions for several risk types and determining the TVaR from the resulting distribution.

The capital requirement for market and life underwriting risk is calculated by assuming that the change in RTK is a multivariate normal distribution in the underlying risk factors, such as interest rates, equities, mortality, and lapses. This capital is assessed by assuming a so-called Delta-Gamma model of the change in RTK, where the change in RTK is approximated by a multivariate quadratic form. Correlation between risk factors is allowed for via a correlation matrix.

This combined insurance and market capital requirement is then adjusted to allow for the impact of predefined extreme scenarios, comprising historic market events, self-defined company-specific events, and market-wide events.

Additionally, risk capital for credit risks, determined using a simplified Basel III model, is added to calculate the total ZK. This approach intentionally neglects diversification effects between market and credit risks.

2.6 Solvency measure

The solvency of an insurance undertaking is measured as:

- Solvency II: Ratio of Own Funds/SCR.
- SST: Ratio of target capital to risk-bearing capital (RTK/ZK). Note that this ratio is somewhat equivalent to the ratio of (Own Funds + Risk Margin) / (SCR + Risk Margin) in Solvency II.

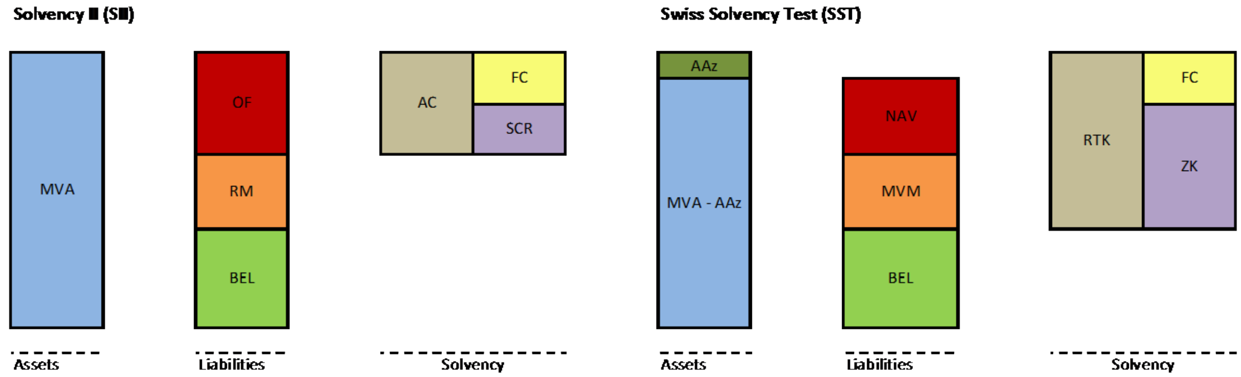
It is worth noting that if a company is solvent (i.e., Own Funds / SCR > 100%) then the SST ratio of Own Funds + Risk Margin / SCR + Risk Margin would always be less than the Solvency II ratio of SCR / Own Funds.

3. Available capital

3.1 Overview

Figure 2 illustrates an overall structure of the balance sheet under both regimes. The relative sizes of the various components are not shown to scale.

Figure 2



Available capital under Solvency II, known as own funds (OF), is the market value of assets (MVA) less the market value of liabilities (MVL), where the MVL is the sum of the best-estimate liabilities (BEL) and the risk margin (RM). Thus:

$OF = MVA – BEL – RM$

Under the SST, the risk-bearing capital (RTK) is the MVA less some asset and liability adjustments (AAz, EK, and ZKK, as described in the next sections) less the BEL. Thus:

$RTK = MVA – AAz – BEL + EK + ZKK$

As such, the net assets of an insurance entity under both regimes are broadly the MVA less the BEL, with an additional adjustment for risk via the risk margin in the case of Solvency II.

3.2 Asset valuation

Assets are generally taken at market value under both frameworks.

Under Solvency II, 'assets should be valued at the amount for which they could be exchanged between knowledgeable willing parties in an arm's length transaction.' Additionally, Solvency II adopts international accounting standards (i.e., IFRS) for the valuation of all assets and liabilities, other than technical provisions (i.e., the MVL for insurance liabilities). However, where IFRS valuation standards conflict with the principles of market-consistent valuation, Solvency II sets out a hierarchy of valuation methods that should take precedence over IFRS.

Similarly the SST states that all assets should be valued 'in accordance with economic principles and in a market-consistent manner, unless specified otherwise' in regulation. The SST does not make direct reference to IFRS but also defines a hierarchy of valuation methods, broadly in line with Solvency II, as well as giving guidance on the valuation of certain asset types, such as real estate and participations in subsidiaries. Put simply, this requires mark-to-market valuation where possible, followed by mark-to-model. Where the latter is used there is a set of criteria the valuation methodology must satisfy.

For Solvency II, reinsurance assets (i.e., the difference between net and gross of reinsurance BEL, adjusted for default risk) are shown as separate assets on the economic balance sheet. Under the SST, the effect of reinsurance is considered as a liability and not credit-risk-adjusted in the base valuation.

On the Solvency II balance sheet, goodwill is not valued and other intangible assets may only receive a value if they can be sold separately and have a quoted market price. Under the SST, intangible assets are considered part of the MVA but later removed in calculating the RTK as part of the specified asset deductions (AAz).

Under both regimes, holdings in own shares do not form part of the balance sheet.

Under Solvency II, the economic value of deferred tax assets is included. For life insurers under the SST, the deferred taxes are not taken into account because the entire SST calculation is gross of tax. Note, however, that historical receivables and payables relating to tax form part of the SST market value balance sheet, much like other debtor and creditor positions.

In addition, under the SST, there are several adjustments to the difference between MVA and BEL to arrive at RTK. These are asset deductions, supplementary capital, and additional core capital. The first of these three adjustments is asset-side, and the latter two liability-side. The asset adjustments are as follows:

- Asset deductions (AAz):
  - Own shares and self-issued debt
  - Intangible assets
  - Tax on real estate gains and real estate transfer tax associated with the valuation of land and buildings
  - Anticipated dividends and repayments of capital
  - The value of inadmissible internal loans (within a group)

It should be noted that under Solvency II these adjustments are also made, albeit considered within the MVA valuation rather than identified separately. In particular, the following items are removed from the own funds (in forming the reconciliation reserve):

- The amount of own shares held by the insurance or reinsurance undertaking
- The foreseeable dividends and distributions

3.3 Liability valuation

Under both frameworks, the value of the insurance technical provisions (before risk adjustment) is defined as the probability-weighed expected value (under risk-neutral probability measures, and including the value of options and guarantees) of the future liability payments, allowing for the time value of money (i.e., discounting). Thus, the BEL is the average of the outcomes of all possible scenarios, weighted by the probability of occurrence and allowing for the associated uncertainty.

The determination of BEL can be broken down into the following issues:

- Methodology underlying the cash flow projection:
  - Generally, a projection of all relevant cash flows using a suitable time horizon and assumptions is required by both regimes.
  - Where considered necessary, this projection should be done stochastically in order to appropriately value all policyholder options and guarantees, although under Solvency II other options are possible, including a series of deterministic projections with attributed probabilities or deterministic valuation based on expected cash flows (where this delivers a market-consistent valuation). Specifically, in the SST, it is stated that it is not necessary to assume rational behaviour of policyholders, instead historical take-up probabilities may be used.
  - Uncertainty in timing, frequency, severity, and amount of claims, as well as in amount of expenses, policyholder behaviour, path dependency, and dependencies between causes of uncertainty, need to be allowed for. The projections should reflect expected realistic demographic, legal, medical, technological, social, and economic developments.
  - The projection should be performed at a suitably granular level and for each relevant currency separately, so as to allow for discounting of liabilities in the relevant currency. Solvency II specifies that the level of granularity for the calculations should be at the level of homogeneous risk groups, and at a minimum by lines of business.
  - Cash flow values should be adjusted to allow for the default of associated counterparties under Solvency II. This requirement is not explicit in the SST.

- The SST legislation defines the following principles in the calculation of the BEL: completeness (i.e., all policyholder options, reinsurance profit sharing, and policyholder bonuses are valued), best estimate (i.e., no margins implicit in the assumptions), up-to-date (information used is the latest), and transparency (of model, parameters, and with deviations from best practice disclosed).
- No allowance for own credit risk in the value of liabilities is allowed under either regime.

▪ Types of cash flows to be projected:

- All future premiums, expenses, and benefits relating to the in-force insurance contracts should be projected (subject to contract boundary restrictions—see below).
- This includes all expenses incurred in servicing these contracts (overhead, administrative, investment, claims, and acquisition), policyholder tax payments, and guaranteed bonuses paid to policyholders.
- These items are the same under both regimes. However, there is a significant difference when it comes to the valuation of future discretionary benefits, i.e., those not contractually guaranteed. Under Solvency II, future discretionary benefits must be valued if they are expected to be paid, regardless of any contractual guarantee. The value must be separately calculated and the relevant assumptions, particularly around any management actions, need to be objective, realistic, and verifiable. Under the SST, the value of future discretionary benefits is explicitly excluded.

▪ Time horizon of the premium projection—contract boundaries:

- Generally cash flows should be projected for their full lifetime under both regimes. However, Solvency II specifically sets out the concept of a contract boundary, which is missing from the SST.
- The contract boundary determines which future premiums, benefits, and associated expense cash flows should be considered part of the contract, and hence included in any projections. This is determined with reference to the unilateral right of the insurer to reject future premiums, to terminate the contact, or to amend the premiums or the benefits payable under the contract in such a way that the premiums fully reflect the risks. Thus, for a unit-linked contract where the insurer can unilaterally change the expense charge after one year to fully reflect the risks associated with the contract, the contract boundary would only be one year and future premiums (along with associated benefits and expenses) would not be projected past this point. Where any restriction is in place on the ability of the insurer to change to the expense charge it cannot be assured that such a change would be sufficient to 'fully reflect the risk' and, as such, all future premiums would belong to this contract.
- Under the SST, the Pillar 2 pensions business (BVG) is generally only projected for 10 years.

▪ Assumptions underlying the cash flow projections:

- For both regimes, economic assumptions (yield curves, exchange rates, inflation, volatilities, etc.) should be market-consistent.
- Demographic, operating, and other assumptions should not contain prudence and must be best estimate (i.e., estimated from historical internal or external data, adjusted to allow for expected future experience).
- Modelling of policyholder behaviour should be realistic and based on current and credible information. Assumptions about take-up rates should be based on an historical analysis and should be made dependent on key model variables (financial or economic) where relevant.
- Where relevant, management actions should be taken into account. These actions should be realistic and consistent with current practice.

▪ Discounting of cash flows:

- Until 2013, the SST discount rates were based on AAA-rated government bond rates, as issued by FINMA.
- As part of the package of measures set out in FINMA Circular 2013/2, designed to provide temporary relief to insurers, a risk discount rate (RDR) may now be used for discounting as opposed to the risk-free rates. This RDR is also provided by FINMA. Companies have discretion whether or not to use the RDR, but the RDR will, in most cases, be used and result in an uplift to the available capital. It should be noted, however, that in calculation of the ZK (including the risk margin), no change to the risk-free discount rate is permitted.
- The risk discount rates are calculated by FINMA based on swap rates adjusted for a credit risk premium of 10 basis points (bps) up to a fixed last liquid point. Beyond the last liquid point (LLP), the interest rates are

extrapolated using the Smith-Wilson method toward an ultimate forward rate (UFR). The LLP is currently 30 years for EUR, USD, and GBP, 20 years for JPY, and 15 for CHF. The UFR is 3.9% for EUR, USD, and GBP, and 2.9% for CHF and JPY. The convergence rate to the UFR used for all currencies is 0.1.

  - Under Solvency II, cash flows are to be discounted using a risk-free discount rate to be published by EIOPA on a frequent basis (at least monthly for the major currencies). The discount rates to be used will be based on swap rates less an adjustment for credit risk (this adjustment will be reviewed on a regular basis and was set at 35 bps as at 31 December 2011).
  - The (risk-free) SST discount rates must be extrapolated beyond the LLP. Current proposals set this LLP at 20 years for EUR. The extrapolated part of the discount rate should converge to the UFR of 4.2% within 40 years from the LLP.

In addition to the insurance BEL, the market value of deferred tax liabilities, arising from future profits, is included under Solvency II. Under the SST they are not valued.

As mentioned in Section 3.2 above, under the SST there are several adjustments to the difference between MVA and BEL to arrive at RTK. The liability adjustments are as follows:

- Supplementary capital (EK)
  - Upper-tier supplementary capital consisting of undated loans, bonds, and other debt with own fund characteristics.
  - Lower-tier supplementary capital consisting of loans, bonds, and other debt with own fund characteristics and a fixed maturity (subordinated debt).
- Additional core capital (ZKK)
  - Loans, bonds, and other debt which must be converted into equity (convertible debt).

3.4 Risk adjustment

Under both regimes, the risk margin or market value margin is an addition to the liabilities to allow for appropriate valuation of non-hedgeable risks which are not included in the BEL.

Under both regimes, the risk allowance is estimated using a cost of capital approach. That is, a capital charge is applied to projected non-hedgeable risk capital in each future year of the runoff of existing liabilities and then discounted to form the RM or MVM.

Under both regimes, the cost of capital charge is 6% (specified as the spread over risk-free) and the elements of the required capital considered non-hedgeable are the same, namely:

- Underwriting risks (SCRlife, SCRhealth)
- Operational risk (not applicable for the SST)
- The non-hedgeable part of the market risk (see below for details)
- The non-hedgeable part of the credit/default risk which relates to reinsurance and insurance operations
- In the case of Solvency II, the loss absorbing capacity of technical provisions relating to the above risks.

The non-hedgeable part of the market risk is determined differently under each regime. Solvency II defines this part of the market risk as that arising from the asset liability management (ALM) mismatch between the actual liabilities and the assets chosen in order to minimise the market risk. That is, those investible assets in the market which best replicate the liabilities. This is essentially the same definition as that used by the SST, i.e., an optimal replicating portfolio (ORP). However, there is a large deviation in the calculation of and treatment of the residual interest rate risk. Under Solvency II, residual interest rate risk is specifically excluded from consideration in the risk margin. This is not the case for the SST MVM where, because of the methodology used to construct the yield curve, there is an assumption that government bonds are not liquid past a given duration, the last liquid point (LLP). FINMA's general view is that government bonds with maturities greater than the LLP cannot form part of the ORP and, therefore, the non-hedgeable market risk component of the MVM will reflect this additional market risk.

In theory, calculation of the risk margin requires a full SCR/ZK calculation in each future year, which is onerous and impractical in most cases. Thus, under Solvency II a hierarchy of simplifications are possible (ranging from full calculation to estimation based on the runoff pattern of the BEL) while, under the SST, approximation methods are to be justified to FINMA and fully documented. In practice, under both regimes, a commonly adopted approach is to project the opening capital using appropriate risk carriers or proxies. The choice of such risk carriers may differ by product and/or risk type depending on the simplicity of the approach.

3.5 Capital tiering

Under banking regulation there is often a tiering of the own capital of a bank, designed to differentiate between the different quality and characteristics of the capital. This tiering has been carried over to Solvency II for the classification of own funds. At a high level, own funds are split between basic own items (funds that are paid in and ready to be absorbed if required, including the excess of assets over technical provisions and subordinated liabilities) and ancillary own funds (items other than basic own funds that are not paid-in but can be called up to absorb losses if required). Ancillary own funds cannot be used to cover the minimum capital requirement (MCR), a less onerous version of the SCR under Solvency II, and there are limits to the extent they can be used to cover the SCR.

Within these broad categories the own funds are divided into three tiers:

- **Tier 1 (only basic own funds):** Instruments with all of the following properties:

  1. Subordination, rank after all other claims on wind-up.
  2. Absence of features causing or accelerating insolvency, e.g., the holder cannot demand payment or petition for insolvency.
  3. Immediately available to absorb losses, i.e., the holding is paid-in and free of conditions of contingencies.
  4. Absorb losses once SCR is breached and do not hinder recapitalisation.
  5. Undated, in that the instruments are not repayable except in wind-up.
  6. Repayment or redemption is at the option of the insurer and does not include any incentives to do so.
  7. Repayment, redemption, and distributions can be suspended if the SCR is breached or would be breached.
  8. Absence of encumbrances, i.e., the instruments are free from charges, guarantees, rights of setoff, etc.

  Items that meet all of the above criteria are classified as unrestricted Tier 1. Restricted Tier 1 items are classified as those where only criteria 1, 4, 5, and 7 above are met. Total restricted Tier 1 items cannot make up more than 20% of the total Tier 1 own funds.

- **Tier 2 (basic and ancillary own funds):** Defined as paid-up items that do not satisfy the criteria for Tier 1 classification (including restricted Tier 1 basic own funds in excess of the 20% limit).
- **Tier 3 (basic and ancillary own funds):** Any other own fund items.

Solvency II specifies certain limits for the various tiers of capital, as follows:

- Tier 1 capital must be at least 50% of the SCR and Tier 3 capital at most 15% of the SCR.
- Tier 1 capital and Tier 2 Basic own funds must cover 100% of the MCR. Additionally, Tier 1 capital alone must cover at least 80% of the MCR.

Under the SST, tiering receives less focus but RTK falls into the following three tiers:

- Core capital (KK): All RTK other than EK and ZKK.
- Additional core capital (ZKK): Convertible debt which must be converted to equity, as defined in Section 3.2 above.
- Supplementary capital (EK): Debt securities with own fund characteristics, as defined in Section 3.2.

The SST places the following limits on the EK:

- The EK is capped at 100% of the KK
- The lower-tier supplementary capital is capped at 50% of the KK.

3.6 Deviations from market consistency and countercyclical measures

While Solvency II is designed as a market-consistent regime, there are a number of measures that have been introduced into the regulations which deviate from a strict economic view of the balance sheet. The most significant of these measures are intended to recognise the long-term nature of many insurers' investments and to prevent insurers from acting in a pro-cyclical way, particularly during times of market stress when the requirement to perform mark-to-market asset valuations may drive insurers to sell assets into a falling market to reduce the risk of further falls or to lock into a specific solvency position.

Of particular concern is where insurers invest long-term in fixed income markets with the intention to hold these investments to maturity (or at least over a long time horizon). In these circumstances, the insurer is not exposed to frequent market fluctuations (caused by spread movements). However, the use of frequent market valuations of assets causes these fluctuations to be reflected on the balance sheet, an impact frequently labelled 'artificial volatility.'

Concerns have been raised that, without appropriate measures in place within Solvency II, the issues of artificial volatility and pro-cyclicality risks insurers shifting from longer-term to shorter-term assets, leading to a range of unintended adverse macroeconomic impacts. These impacts have been highlighted by industry groups as:

- Limiting the insurance industry's traditional role to invest and assist growth in the European economy
- Reducing the insurance industry's traditional role as a stabiliser in financial markets, and thereby reducing systemic risk and market volatility

In order to address these issues, two specific adjustments have been proposed within the Solvency II framework:

- A matching adjustment, applied to the discount rate used to value specific liabilities to help remove artificial volatility from balance sheets that is due to the impact of spread movements on assets invested with a hold-to-maturity strategy
- A volatility adjustment, applied to the discount rate used to value all other liabilities which do not fall under the scope of the matching adjustment, to prevent pro-cyclical behaviour caused by companies needing to sell assets during distressed market conditions

Depending on the nature of their liabilities and investment strategies, companies can apply one of these two adjustments which act to adjust the value of the liabilities in relation to spread-related movements in asset value through adjustments to the discount rates used to value insurance liabilities.

Under the SST, the temporary measures include the use of a risk discount rate (RDR). This can also be viewed as a deviation from market consistency, although it is worth noting that this RDR is based on swap rates (considered risk-free under Solvency II).

4. Required capital: Overview and aggregation

4.1 Solvency II required capital (SCR)

4.1.1 Overview

The solvency capital requirement (SCR) under the Solvency II regime is the sum of the base SCR (BSCR), the adjustments for the loss absorbency of deferred taxes and technical provisions (Adj), and the operational risk capital (SCRop). That is:

SCR = BSCR + Adj + SCRop

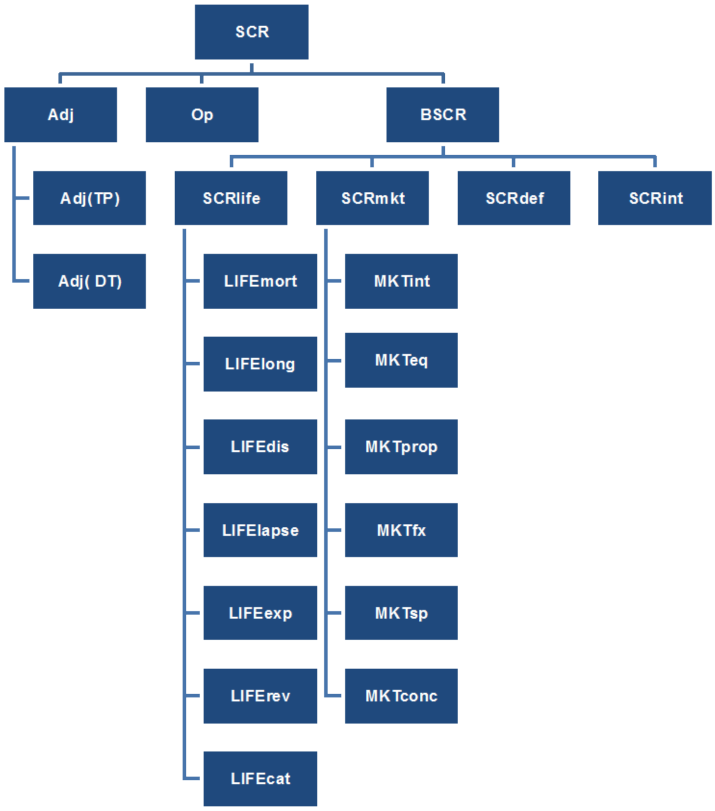
The BSCR in turn is determined by taking into account the solvency capital requirements generated by the following modules:

- Market risk
- Counterparty default risk
- Life underwriting risk
- Health underwriting risk (for health insurance products that are similar to life products; the treatment is broadly similar to the life underwriting module and thus we don't expand on it further in this paper)
- Intangible asset risk

Some of these modules require a more detailed calculation based on sub-modules. For example, the market risk module is split into sub-modules for equity risk, interest rate risk, etc. The methodology relating to each of the individual modules contributing to BSCR is described in the following sections.

The SCR structure for life insurers can be depicted as shown in Figure 3.

Figure 3



4.1.2 Standard estimation of risk capital: Scenario approach

The standard method for calculating risk capital under Solvency II, which is used for all market and life sub-modules, is a scenario approach. The risk capital for a given module is taken as the change in basic own funds (BOF) from the given scenario to the base balance sheet. That is:

$Sub\text{-}module\text{-}SCR_{risk\ type} = MAX\ \{0,\ mean\ BOF_{stressed} - mean\ BOF_{base}\}$

Where the BOF only takes account of the MVA less the BEL, i.e., the risk margin and net deferred assets are not stressed.

The stressed scenario is defined by regulation and in terms of a stress to the given risk factor (i.e., for mortality the assumed mortality rates are worsened by 15%), representing the 1-in-200-year event.

4.1.3 Aggregation

Aggregation of the sub-module requirements under the standard formula is done via the aggregation matrix shown in Figure 4 to calculate the BSCR, with the addition of the capital for the intangibles (SCRint).

Figure 4

	Market	Default	Life
Market	1	0.25	0.25
Default	0.25	1	0.25
Life	0.25	0.25	1

Operational risk and the adjustments for loss absorbency are taken into account by addition (i.e., full dependency with the BSCR is assumed).

4.2 SST target capital (ZK)

4.2.1 Overview

The target capital (ZK) under the SST regime is defined as the market value margin (MVM) plus a solvency capital requirement (ZK_{SCR}). This capital requirement is calculated as the sum of a credit capital requirement (ZK_{CRED}) and an aggregated insurance and market capital requirement after allowing for the impact of extreme scenarios ($ZK_{LIFE,MKT,SCEN}$).

The total insurance and market capital requirement is derived by aggregating separate insurance (ZK_{LIFE}) and market (ZK_{MKT}) requirements assuming zero correlation between market and insurance risk factors. This amount is then adjusted to allow for its change under the extreme scenarios (ZK_{SCEN}).

The target capital can therefore be presented as:

$$ZK = ZK_{SCR} + MVM = ZK_{LIFE,MKT,SCEN} + ZK_{CRED} + MVM$$

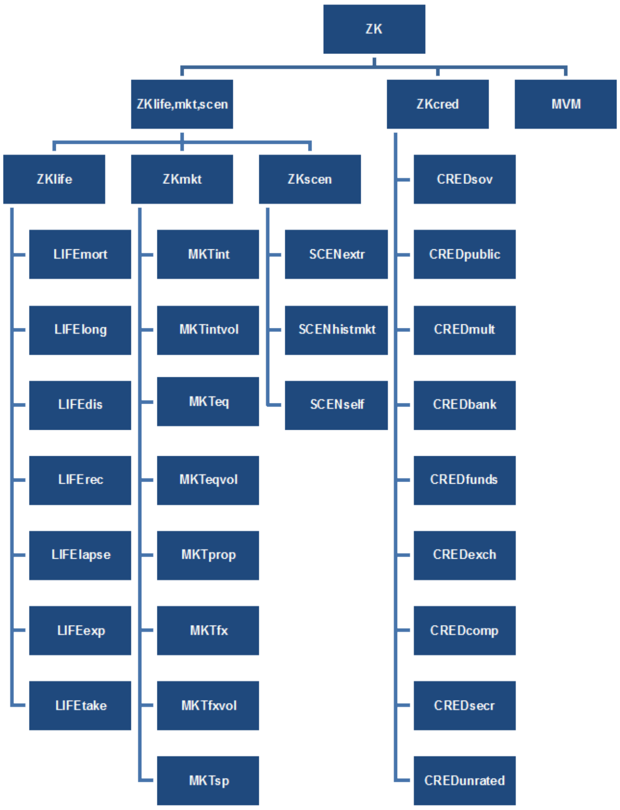
Therefore, comparing with the Solvency II SCR in the previous section, the ZK takes into account the following major risk types (plus the MVM allowance):

- Market risk
- Credit risk
- Life underwriting risk
- Scenario add-on risk capital

Some of these modules require a detailed calculation based on risk factors. For example, the ZK_{MKT} requires the use of more than 70 risk factors, including interest rate risks and volatilities, equity risks, and volatilities, in order to calculate the expected loss. The methodology relating to each of the individual modules contributing to ZK is described in other sections of this document.

The structure of the SST ZK can thus be depicted as shown in Figure 5.

Figure 5



4.2.2 Standard estimation of risk capital: Delta-gamma model

Under the SST, the standard model uses the so-called delta-gamma model to assess the capital for life and market risks.

This is a distribution-based model which assumes that the change in risk-bearing-capital (MVA less BEL) can be described as a multivariate normal distribution in life and market risk factors. There are currently 82 market risk factors and 14 life risk factors, which result in a distribution of degree 96.

The delta-gamma model for the change in RTK ($\delta\mathrm{RTK}$) is:

$$\delta RTK = \Delta\delta RF + \frac{1}{2}\delta RF\ \Gamma\ \delta RF^{T}$$

where $\delta\mathrm{RF}$ is a vector or the change in risk factors, Δ is a vector of the parameters (the delta vector), and Γ is a matrix of parameters (the gamma matrix).

This formula follows from the Taylor series and is thus a quadratic estimate.

Until the year-end 2011, the SST standard formula did not consider the second-order gamma term in the equation and the model was known as the delta-normal model.

To calculate required capital from this model, it is necessary to calculate the TVaR of $\delta\mathrm{NAV}$ with a 99% confidence level. This is a two-step process:

1. Determine the parameters of the 96-element delta vector, Δ, the 96-by-96 gamma matrix, Γ, and the sensitivities of the change in RTK to changes in risk factors.
2. Determine the TVaR of $\delta\mathrm{RTK}$.

4.2.2.1 Determining delta and gamma

In order to determine the delta vector, it is necessary to find the delta for each individual risk factor. This is done by performing two sensitivities of RTK to each risk factor. The risk factors are shocked by +/- 1% for all interest rate and spread risk factors and by +/- 10% for all others. We denote the change in RTK from each of these sensitivities as $\delta\mathrm{RTK}^{+}$ and $\delta\mathrm{RTK}^{-}$ respectively.

Delta is then calculated as the gradient of the line passing through these two points. That is:

$$\Delta_i = \frac{\delta\mathrm{RTK}^{+} - \delta\mathrm{RTK}^{-}}{2\delta\mathrm{RF}_i}$$

Similarly the estimate for the second-order coefficient can be determined from the results of these two sensitivities. These 96 coefficients make up the diagonal elements of the gamma matrix. Thus:

$$\Gamma_{ii} = \frac{\delta\mathrm{RTK}^{+} + \delta\mathrm{RTK}^{-}}{\delta\mathrm{RF}_i{}^{2}}$$

Therefore, if a given up-stress for a (non-interest-rate/non-spread) risk factor gives a change in RTK of 5 and the down-stress is -10, then Δ =75 and $\Gamma = 500$.

At this point the non-diagonal cross-elements of the gamma matrix remain to be determined. There are theoretically 96 x 95 / 2 = 4,560 of these to be determined. In practice, a given company may not be exposed to all of the 96 risk factors and in addition many cross-elements will not be material for certain types of business. It is thus common, within the framework of the standard model, not to evaluate all 4,560 elements but to justify why some are zero or immaterial.

For each gamma cross-term to be evaluated, four sensitivities need to be evaluated (i.e., by stressing each of the risk factors up/down simultaneously with the other). These can be represented as ++, --, +-, and -+. As an example, for the cross-term between EUR interest rates duration 1 and Swiss commercial property, the four sensitivities would be:

- EUR interest rates duration 1 +1%, Swiss commercial property +10%
- EUR interest rates duration 1 -1%, Swiss commercial property -10%
- EUR interest rates duration 1 +1%, Swiss commercial property -10%
- EUR interest rates duration 1 -1%, Swiss commercial property +10%

The estimate for the gamma cross-term, between risk factors *i* and *j*, is then determined as:

$$\Gamma_{ij} = \frac{\delta\mathrm{RTK}^{++} + \delta\mathrm{RTK}^{--} - \delta\mathrm{RTK}^{+-} - \delta\mathrm{RTK}^{-+}}{4\delta\mathrm{RF}_i\delta\mathrm{RF}_j}$$

4.2.2.2 Determining the TVaR of the change in RTK

In addition to providing economic inputs, such as yield curves, for the SST, FINMA also provides the historical volatilities of each of the 96 risk factors and the correlations between them.

Under the previous Delta-Normal model the TVaR could be determined analytically for each risk factor given the delta parameter. This follows from the assumption that the change in risk factors is normally distributed with zero mean and standard deviation *s* (the historical volatility provided by FINMA) and the model $\delta\mathrm{RTK} = \Delta\delta\mathrm{RF}$. Thus $\delta\mathrm{RTK}$ has a normal distribution with zero mean and standard deviation Δs. Furthermore, for a given confidence level α the distribution properties of the normal distribution gives:

$$TVaR = \frac{\Phi\left(\varphi^{-1}(\alpha)\right)}{\alpha}\Delta s$$

However, under the Delta-Gamma model the TVaR cannot be determined analytically and must therefore be determined numerically. There are several possibilities but generally Monte Carlo simulation is used. The process is thus:

1. Generate a large number of scenarios (i.e., realisations for each of the 96 risk factors). The number of scenarios should be at least 500,000. These scenarios can be generated by using a set of random numbers and the FINMA correlation matrix along with the historical volatilities of the risk factors.

2. Observe the change in RTK per scenario and take the mean of the worst 1% to evaluate the TVaR of δRTK.

4.2.3 Aggregation

Aggregation of the SST risk factors within and between the market and life risk factors is done using a correlation matrix.

To determine the stand-alone risk capital for any subset of market/life risks it is thus necessary to follow the process in Section 4.2.2.2 above but only to generate the scenario where the risk factors in question vary.

For the effect of the extreme scenarios on the aggregate market and life risk capital, see Section 9. Credit risk is assumed to be fully correlated with the combined market and life capital and is thus aggregated by addition.

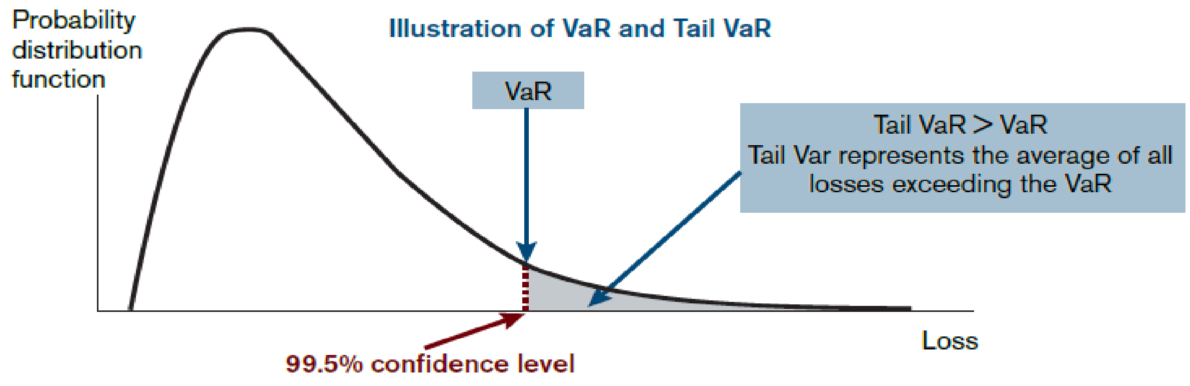
4.3 Methodological differences

At the overall level of the required capital, the differences in methodology between the two regimes can be classified as set out below.

4.3.1 Risk measure and confidence level

The diagram in Figure 6 illustrates the difference between the VaR and the TVaR risk measures.

Figure 6



Source: CEA working paper on the risk measures VaR and TailVaR, November 2006.

In general it is not possible to say, all else being equal, whether a 99.5% VaR or 99% TVaR results in higher capital requirements. This depends on the underlying distribution, but in the case of a normal distribution the VaR and the TVaR are given by $\Phi^{-1}(1-\alpha)$ and $\phi(\Phi^{-1}(1-\alpha))/(1-\alpha)$ respectively for a confidence level α. Thus, here the VaR would be $\Phi^{-1}(0.005) = 2.58$ and the TVaR would be slightly larger at $\phi(\Phi^{-1}(0.01))/0.01 = 2.67$.

Additionally, there are a number of theoretical reasons for using one measure or the other, with a wide range of literature setting out the arguments on this subject. For instance, the TVaR measure satisfies the sub-additive property of a coherent risk measure, whereas VaR does not. Furthermore, it can be argued that a shareholder has no interest in an insurer once it is insolvent and the degree of insolvency is not of interest (because the shareholder's liability is limited) whereas for a policyholder receiving 20% or 80% of a given claim clearly makes a difference. On this basis, TVaR, which takes account of the size of a given 'tail loss' would be seen as a better regulatory measure designed to protect policyholders.

4.3.2 Estimation of required capital for individual risks

In general, under the Solvency II standard model, the 99.5% VaR stresses to apply are predefined in the methodology, e.g., 15% mortality stress. This means the stress is not company-specific, although the result of the stress will be specific in financial terms. Given a stress level, the change in own funds is determined exactly.

Under the SST, the method is not so direct and the 99.0% TVaR stress is found implicitly by estimation of the distribution. Thus, both the level of the stress and the impact of the stress are company-specific. This means if one back-solved the required capital for a given risk as determined under the SST standard model and looked for a given shock which resulted in the same change in NAV as the capital required, the amount of the shock would vary from company to company.

4.3.3 Aggregation approach

Solvency II uses a two-step aggregation approach. Both steps use correlation matrices. The first step aggregates the required capital from the various sub-modules within a specific risk module to give a required capital for the individual risk modules. The required capital for the risk modules is then aggregated via a second correlation matrix. It can be shown that it is not possible to transform this two-step correlation into a single larger correlation matrix with all risk factors and, as such, implicitly there is no standard level of correlation between any two risk factors not in the same module, e.g., interest rates and lapses.

Under the SST, it is necessary to combine marginal risk distributions to form one multivariate distribution. This is generally done empirically by producing a large enough set of appropriately distributed and intercorrelated risk factors. These are generated under the assumption that each factor is normally distributed with a predefined standard deviation.

5. Required capital: Life insurance risk

Both the SST and Solvency II calculate a life insurance capital requirement by considering individual risk factors. These risk factors are generally the same under both regimes, although Solvency II considers an extra two explicit factors. The methodology follows the standard Solvency II and SST approaches respectively. In aggregating the capital amounts, Solvency II considers more risk factors to be correlated with one another.

The risk factors shown in Figure 7 are considered in Solvency II and the SST.

Figure 7

RISK FACTOR	INCLUDED IN SOLVENCY II	INCLUDED IN SST
MORTALITY	YES	YES
MORBIDITY	YES	YES
RECOVERY RATES	WITHIN MORBIDITY SUB MODULE	YES
LONGEVITY	YES	YES
EXPENSES	YES	YES
LAPSES	YES	YES
LIFE CATASTROPHE	YES	N/A
ANNUITY REVISION	YES	N/A
OPTION TAKE-UP	WITHIN LAPSE SUB MODULE	YES

Recovery rates and option take-up are explicit risk factors under the SST. However, in Solvency II they are tested within the morbidity and lapses sub-modules respectively. Additionally, dynamic lapses driven by economic scenarios should be captured within the market module under both regimes. Catastrophe (CAT) and annuity revision risks are not explicitly tested under the SST, although there are SST extreme scenarios that simulate catastrophic events.

5.1 Risk methodology

Under Solvency II, the standard scenario approach, as described in Section 4.1.2, is used for all life sub-modules apart from the lapse risk sub-module.

For lapses, three sub-modules stresses must be performed:

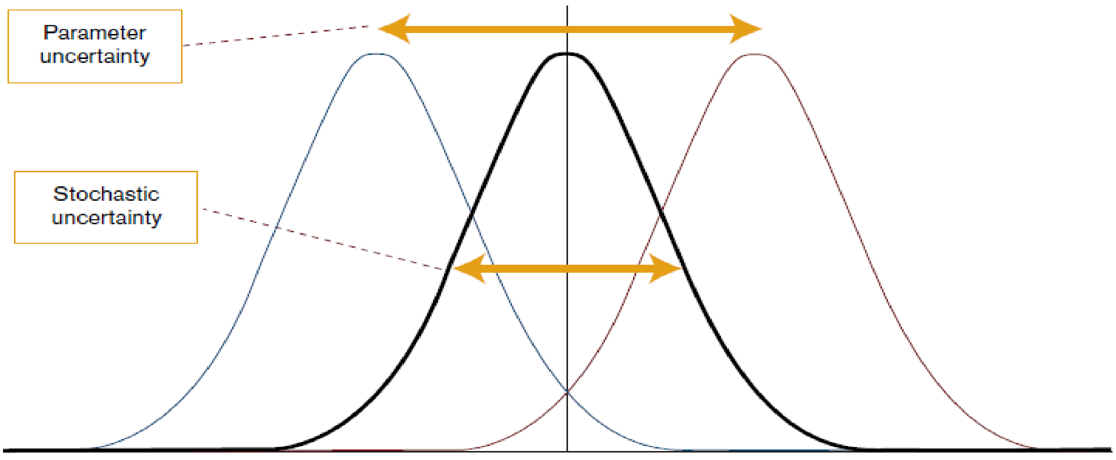
- Lapse down shock: Determined as the change in BOF following an instantaneous 50% decrease in all lapse options rates, applied only to those options (products) where lapsing/exercising the option would result in an increase in the BEL. Furthermore the post-shocked lapse rates are capped at 100%.
- Lapse up shock: Determined as the change in BOF following an instantaneous 50% increase in all lapse options rates, applied only to those options (products) where lapsing/exercising the option would result in a decrease in the BEL. Furthermore the post-shocked lapse rates are floored at a 20 percentage point reduction of the pre-shocked rates.
- Mass lapse shock: The change in BOF following the combination of a mass lapsing of 40% of the non-retail policies, 70% of the retail policies, and 40% of reinsurance contracts. These percentage mass lapses should be considered only from the portfolio of contracts that produce a surrender strain (i.e., the surrender does not produce a gain for the insurer).

The $\text{Life}_{\text{lapse}}$ capital requirement is then taken as the change in BOF from the above shock which corresponds to the maximum change in basic own funds including the loss-absorbing capacity on a net basis.

The SST standard model for life underwriting risk allows for two types of risk for each risk factor: parameter risk and stochastic risk.

Parameter risk arises from the uncertainty in a parameter estimate, whereas stochastic risk arises from the inherent variation in that risk factor. This is illustrated in the diagram in Figure 8, which is adapted from the SST technical document.

Figure 8



Group (BVG, Pensions Pillar 2 business in Switzerland, i.e., mandatory private or occupational pension schemes) and individual life insurance business are treated slightly differently, in that different correlation factors and assumed volatilities are used.

For parameter risk, the standard methodology (see Section 4.2.2 above) is used. The historical volatilities of the risk factors used are shown in Figure 9.

Figure 9

RISK FACTOR	STANDARD DEVIATION
MORTALITY	5%
LONGEVITY	10%
DISABILITY	10% (20% FOR BVG)
RECOVERY RATES	10%
EXPENSES	10%
LAPSES	25%
OPTION TAKE-UP	10%

Secondly, for the SST, the stochastic standard deviation must be calculated. The standard model uses the so-called collective risk model to estimate the stochastic risk for each risk factor. This estimate is based on the expected number of claims (relating to the risk type), the variance of the distribution of a single claim, and a distributional assumption. The stochastic risk TVaR is then calculated by transforming the standard deviation to the TVaR.

As an example, to calculate the stochastic risk for mortality the following process is normally used:

1. Approximate the total death claims distribution with a normal distribution (which requires only the standard deviation of the total claims). For the assumption of normality to be valid we require the distribution of the individual claims not to exhibit any extremes. For the distribution of the claims frequencies the normal approximation should be appropriate, being the sum of individual binomial distribution observations (does a policy claim: yes/no).
2. Assume there is no correlation between the death claims among individual policies. Thus, the standard deviation for stochastic mortality risk, S, is $S = \sqrt{\sum_{allpoliciesP} Var_P}$.
3. Because the loss given a death claim is the sum assured plus the loss of future profits (PVFP), we have: $Var_P = q_x(1-q_x)(PVFP + SA)$ where q_x is rate of death in the first year of the projection.

5.2 Risk stresses

The individual risk stresses for Solvency II and the SST are shown in Figure 10.

Figure 10

Risk Type	Risk Driver	Solvency II Stress	SST Stress
Mortality	*Death Rate*	15%	+/- 10%
Morbidity	*Disability Rate (year 1)*	35%	+/- 10%
	Disability Rate (thereafter)	25%	+/- 10%
Recovery Rates	*Recovery Rate*	-20%	+/- 10%
Longevity	*Death Rate*	-20%	+/- 10%
Expenses	*Maintenance Expenses*	10%	+/- 10%
	Expense Inflation	1%	n/a
Lapses	*Lapse Rate*	+/- 50%	+/- 10%
	Mass Lapse (retail/non-retail)	40%/70%	n/a
CAT	*Death Rate (additive, year 1)*	15%	n/a
Revision	*Annuities Paid*	3%	n/a
Uptake of Options	*Take Up Rate*	+/- 50%	+/- 10%

5.3 Risk aggregation

Under Solvency II, the individual life sub-modules are aggregated using the correlation matrix shown in Figure 11 to determine SCR_{life}.

Figure 11

	$LIFE_{mort}$	$LIFE_{long}$	$LIFE_{dis}$	$LIFE_{lapse}$	$LIFE_{exp}$	$LIFE_{rev}$	$LIFE_{CAT}$
$LIFE_{mort}$	1	-0.25	0.25	0	0.25	0	0.25
$LIFE_{long}$	-0.25	1	0	0.25	0.25	0.25	0
$LIFE_{dis}$	0.25	0	1	0	0.5	0	0.25
$LIFE_{lapse}$	0	0.25	0	1	0.5	0	0.25
$LIFE_{exp}$	0.25	0.25	0.5	0.5	1	0.5	0.25
$LIFE_{rev}$	0	0.25	0	0	0.5	1	0
$LIFE_{CAT}$	0.25	0	0.25	0.25	0.25	0	1

Under the SST, the capital requirements for parameter risk and stochastic risk are aggregated for each risk type in turn, assuming independence. The risk capital for each factor is then aggregated using the correlation matrix M, shown in Figure 12.

Figure 12

	$LIFE_{mort}$	$LIFE_{long}$	$LIFE_{dis}$	$LIFE_{lapse}$	$LIFE_{exp}$	$LIFE_{rev}$	$LIFE_{CAT}$
$LIFE_{mort}$	1	0	0	0	0	0	0
$LIFE_{long}$	0	1	0	0	0	0	0
$LIFE_{dis}$	0	0	1	0	0	0	0
$LIFE_{rec}$	0	0	0	1	0	0	0
$LIFE_{exp}$	0	0	0	0	1	0	0
$LIFE_{lapse}$	0	0	0	0	0	1	0.75
$LIFE_{take}$	0	0	0	0	0	0.75	1

Note that under the SST there is no correlation assumed between the vast majority of risk factors, which is a conservative assumption.

Because BVG business is measured and tested separately, the capital requirement between BVG and non-BVG business must also be aggregated. This is done using the matrix shown in Figure 13.

Figure 13

	BVG	NON BVG
BVG	M	M
NON-BVG	M	M

5.4 Stand-alone insurance risk charges

The level of insurance capital requirements for a given business under each regime depends heavily on the type of business, the actual distribution of the change in NAV to a given risk factor, and the relative importance of the life risk factors. As such, it is not possible to generalise and numerically compare the capital requirements under the two regimes.

However, if we consider individual business and assume the change in available capital is linear with respect to the change in the risk factor (this is often true for expenses, mortality, longevity, and disability, but almost always not true in the case of lapses), a broad numerical comparison is possible.

As an example, under Solvency II the mortality stress is 15%. Because of linearity the change in NAV given a 15% stress is 1.5 times the change in NAV given a 10% stress. Under the SST, linearity implies there are no second-order Gamma terms and that the change in NAV given a 10% stress + the change in NAV given a -10% stress = 0.

Making use of this enables us to express the individual (parameter risk only, in the case of the SST) risk capital amounts under both regimes in terms of an equivalent stress as shown in Figure 14.

Figure 14: Stand Alone Capital Requirements per Risk Factor / Change in NAV given 10% shock in Risk Factor

Risk Type	Solvency II Stress	SST Stress Equivalent
Mortality	1.5	133%
Morbidity (in all but the first year)	2.5	267%
Recovery Rates	2	267%
Longevity	2	267%
Expenses levels	1	267%
Lapse rate	5	666%
CAT	1	n/a
Revision	0.3	n/a
Uptake of Options	5	267%

Thus, if the change in available capital for a given block of business (under the above linearity assumptions) with a 10% increase in lapses was -100, then the Solvency II capital requirement would be 500 and the SST requirement 666.

6. Required capital: Market risk

6.1 Overview

A major difference between both Solvency II and the SST on one hand, and the Solvency I regime on the other, is in relation to market/ALM risk. The Solvency I regime takes no account of the risks arising from assets and the interaction between assets and liabilities. In this section we look at the key differences in the allowance for market and ALM risk between Solvency II and the SST.

The risk factors shown in Figure 15 are considered under each regime.

Figure 15

RISK FACTOR	SOLVENCY II	SST
INTEREST RATES	YES	YES
INTEREST RATE VOLATILITY	NO	YES
EQUITY	YES	YES
EQUITY VOLATILITY	NO	YES
PROPERTY	YES	YES
CURRENCY	YES	YES
CURRENCY VOLATILITY	NO	YES
SPREADS	YES	YES
CONCENTRATION	YES	N/A

Concentration risk is deemed to be dealt with fully in the credit default risk module under the SST.

The SST also has stresses to volatility risk factors which are not included in the draft Solvency II requirements.

6.2 Risk methodology

The standard scenario approach, as described in Section 4.1.2 above, is used for all market risk sub-modules under Solvency II.

Similarly, for all market risk factors the standard methodology based on the Delta-Gamma model, as described in Section 4.2.2 above, is used for the SST.

6.3 Risk stresses

6.3.1 Interest rate risk (MKT_{INT})

For Solvency II, this sub-module assesses the impact that changes in the term structure of interest have on the basic own funds.

Two shocks are to be performed—an upward and a downward. Multiplicative increases/decreases to the yield curves in all currencies are specified, as well as limits on the absolute stress at any given duration. They are:

- Relative increases in interest rates ranging from 70% at durations of two years or less to 20% at 90-year durations
- Relative decreases in interest rates ranging from -75% at durations of two years or less to -20% at 90-year durations
- The requirement that the absolute change in interest rates must be at least 1%, subject to the floor that interest rates are not allowed to become negative

By way of example, for a base interest rate of 3.57% at a duration of 20 years, a 26% up-shock and a 29% down-shock are applicable. This would result in stressed rates of 4.50% and 2.54% respectively. However, the 4.50% stress is within 1% of the base rate and so would be increased to 4.57%.

The capital requirement for interest rate risk is then derived as the change in BOF under the shock that gives rise to the highest capital requirement including the loss-absorbing capacity of technical provisions.

Under the SST, the yield curves for four major currencies are split into 13 duration buckets. For each of these 54 risk factors +/- 100 bps shocks are performed and the capital is estimated using the Delta-Gamma model.

It is worth noting that the shocks to the yield curve are to be quantified as a whole under Solvency II. In contrast, under the SST, a number of independent changes to specific parts of the yield curve are quantified separately and then aggregated later.

In order to compare the capital requirements in respect of the interest rate risk for various risk-free coupon bonds, we have calculated the interest rate stresses for fictitious 5-, 10-, and 20-year 5% coupon-paying AAA-rated German government bonds denominated in EUR, using the yield curve published by FINMA as part of the 2012 year-end SST. The capital charges as a percentage of market value are summarised in Figure 16.

Figure 16

	Solvency II Interest Rate Capital Charge %	SST Interest Rate Capital Charge %
5 year Bond	*4.5%*	3.6%
10 year Bond	*8.1%*	5.9%
20 year Bond	*14.7%*	10.0%

Note that these capital charges are for interest rate risk only and do not take into account spread and default risk or correlations between them.

6.3.2 Interest rate volatility risk ($MKT_{INT\text{-}VOL}$)

There are no volatility stresses in the Solvency II framework. For the SST the distribution is estimated via +/- 10% shocks to implied volatility and based on a volatility parameter of 30% (for the year-end 2012 SST).

6.3.3 Equity risk (MKT_{EQ})

For Solvency II, the equity risk sub-module assesses the impact on the BOF of a fall in the level of equities.

The technical specifications set the level of the assumed fall as 39% in the case of Type I equity (equities listed in regulated markets that are members of the EEA or Organisation for Economic Co-operation and Development [OECD]) and 49% for the other (Type 2) equities. This 'standard' stress is further adjusted using a symmetrical adjustment, or dampener, in order to avoid pro-cyclicality and any potential fire sales of equities. This adjustment increases or decreases the standard stress in relation to the current level of global equity prices relative to their recent averages. Under the LTGA the dampener reduced both equity stresses to 22%. This treatment also applied to private equity, hedge funds, other types of alternative equity-style investment, and participations classified as nonstrategic. Strategic participations are stressed by 22%.

The overall equity risk sub-module capital is determined by aggregating the shocks for these two categories using the matrix shown in Figure 17.

Figure 17

	Type1	Type2
Type1	*1*	0.75
Type2	*0.75*	1

For the SST, a separate shock is performed for groups of equities by major market and type, as shown in Figure 18.

Figure 18

Risk Factor	Shock (%)	Volatility (%)
Swiss Shares	10%	13.5%
EU Shares	10%	17.8%
USA Shares	10%	15.0%
UK Shares	10%	14.0%
Japanese Shares	10%	19.0%
Other Asian Shares	10%	22.3%
EU Small Cap Shares	10%	26.1%
Hedge Funds stock	10%	5.6%
Private Equity stock	10%	25.2%
Particaptions	10%	25.0%

By considering each type of equity alone (in the absence of liability mitigation and diversification effects), it is possible to compare the capital charge under both regimes for a range of equities, as shown in Figure 19.

Figure 19

Type of Share	SST Capital Charge (%)	Solvency II Capital Charge (%)
Swiss Shares	**36%**	**39%**
EU Shares	47%	39%
USA Shares	**40%**	**39%**
UK Shares	37%	39%
Japanese Shares	**51%**	**39%**
Other Non-OECD Asian Shares	60%	49%
EU Small Cap Shares	**70%**	**39%**
OECD Hedge Funds stock	15%	39%
OECD Private Equity stock	**67%**	**39%**
Strategic Particaption	67%	22%
Non Strategic Particaption	**67%**	**39%**

Swiss, US, and UK equities receive broadly the same shock under both regimes. In contrast, Asian equities, private equity, participations, and EU small caps are more heavily penalised under the SST. The exception to this is hedge funds, which have a low volatility under the SST and thus a low capital charge.

However, it should be noted that, under the SST standard model, firms should change the volatility of certain key risk factors (implied interest rate volatility, direct Swiss commercial property, hedge funds, private equity, and participations) depending on the characteristics of the precise investments they hold (e.g., the volatility of hedge funds pursuing different investment strategies could be significantly different).

6.3.4 Equity volatility risk ($MKT_{EQ\text{-}VOL}$)

There are no volatility shocks in the Solvency II framework.

For the SST, the impact is assessed in the standard manner with 10% up and down shocks to equity-implied volatility based on an assumed volatility of 63.5% in the case of the year-end 2012 SST.

6.3.5 Property risk (MKT_{PROP})

For Solvency II, this sub-module measures the immediate effect on the net value of assets and liabilities expected in the event of an instantaneous decrease of 25% in the value of all real estate.

For the SST, property is classified under three categories and, under the standard model, is heavily based on Swiss-specific property. This is reflected in the relatively low levels of assumed volatility in comparison to other markets, such as the UK. This results in lower capital charges for stand-alone Swiss property under the SST than under Solvency II.

A criticism of Solvency II in the past is that the property capital charge has been heavily influenced by the more volatile UK market and, as such, the charge is considered by many to be too high for property in continental Europe.

Figure 20

Risk Factor	Shock (%)	Volatility (%)	SST Capital Charge (%)	Solvency II Capital Charge (%)
Swiss Residential Property	10%	3.9%	10%	25%
Swiss Commercial Property	10%	6.5%	17%	25%
Swiss Property Funds	10%	6.5%	17%	25%

It is worth noting that under Solvency II a property fund would be subject to a look-through approach and not treated separately, as in the SST.

6.3.6 Currency risk (MKT_{FX})

Under Solvency II the currency risk sub-module assesses the change in BOF arising from changes in the level of currency exchange rates. The standard shock measures the impact of an increase (and decrease) of 25% in the value of the currency considered against the local currency. Having calculated the change in NAV for each currency, the effects are summed to derive the overall requirement.

For the SST, the currency level shocks are performed independently and the standard formula has four risk factors corresponding to the exchange rate between CHF and a foreign currency, as shown in Figure 21.

Figure 21

Currency Risk Factor CHF/XXX	Shock (%)	Volatility (%)	SST Capital Charge (%)	Solvency II Capital Charge (%)
EUR	10%	6.7%	18%	25%
USD	10%	11.7%	31%	25%
GBP	10%	10.3%	28%	25%
JPY	10%	12.3%	33%	25%

The SST capital charge represents the capital charge per unit of net position in a foreign currency, before diversification.

6.3.7 Currency volatility risk ($MKT_{FX\text{-}VOL}$)

There are no volatility shocks in the Solvency II framework.

Under the SST the usual methodology applies, The volatility of the risk factor was taken as 37% for the 2012 year-end SST, which is based on at-the-money 3-month USD/CHF options.

6.3.8 Spread risk (MKT_{SP})

Spread risk results from the sensitivity of the value of assets and liabilities to changes of credit spreads over the risk-free interest rate term structure.

Under Solvency II, spread risk is tested for bonds, subordinated debt, and hybrid debt, as well as all asset-backed securities (ABS). The capital requirements are determined separately for bonds, instruments based on repackaged loans, and credit derivatives. Here we focus on bonds.

The bond spread risk capital is defined as the change in the BOF resulting from a shock to each bond or loan that is sensitive to spread risk. For each position, the size of the shock is determined by duration and credit quality step.

Under the SST there are 10 spread risk factors, which correspond to combinations of credit rating and regions of the world (broadly grouped into 'USA' and 'Europe'). Additionally, there is a risk factor representing the spread between government bond rates and swaps. The methodology is as per other market risk factors with an additive increase and decrease shock to spreads of 1%.

The table in Figure 22 shows illustrative stand-alone capital charges under both regimes for a number of different bonds. In calculating the SST capital charges we have used year-end 2012 volatilities and have assumed that the bonds are zero-coupon bonds with no convexity and that the change in a bond's price is fully described by the duration multiplied by the change in yield. It is further assumed the 'Europe' bonds are denominated in EUR and those from the 'USA' in USD.

Figure 22

Bond Issuing Country (SST Grouping)	Rating	Duration	SST Capital Charge (%)	Solvency II Capital Charge (%)
"Europe"	AAA	5	4.0%	4.5%
"Europe"	A	5	7.8%	7.0%
"Europe"	BB	5	19.0%	22.5%
"Europe"	Unrated	5	19.0%	15.0%
"Europe"	AAA	10	7.9%	7.2%
"Europe"	A	10	15.5%	10.5%
"Europe"	BB	10	37.6%	35.1%
"Europe"	Unrated	10	37.6%	23.4%
"Europe"	AAA	20	15.9%	12.2%
"Europe"	A	20	31.0%	15.5%
"Europe"	BB	20	75.0%	46.6%
"Europe"	Unrated	20	75.0%	35.0%
"USA"	AAA	5	5.9%	4.5%
"USA"	A	5	8.1%	7.0%
"USA"	BB	5	18.9%	22.5%
"USA"	Unrated	5	18.9%	15.0%
"USA"	AAA	10	11.8%	7.2%
"USA"	A	10	16.0%	10.5%
"USA"	BB	10	37.4%	35.1%
"USA"	Unrated	10	37.4%	23.4%
"USA"	AAA	20	23.5%	12.2%
"USA"	A	20	32.0%	15.5%
"USA"	BB	20	74.7%	46.6%
"USA"	Unrated	20	74.7%	35.0%

6.3.9 Concentration risk (MKT_{CONC})

Concentration risk is not explicitly required for the SST, although if it is deemed material it would be appropriate for inclusion as a self-defined extreme scenario.

However, for Solvency II, concentrations in assets with the same counterparty above a certain threshold are subject to a stress that examines a fall in value of these excess assets. Both the concentration threshold and the shock size depend on the credit quality step of the counterparty. For credit quality steps 0 to 2, the threshold is 3%, otherwise it is 1.5%. The shock to be applied ranges from 12% for AAA-rated assets to 73% for assets rated BB to unrated. Thus, if a company had 5% of its assets held with a single AAA-rated counterparty the concentration risk charge would be 12% x 2% = 0.24% of total assets.

These charges are computed independently for each counterparty and then the total capital requirement is aggregated assuming independence among all counterparties.

6.4 Risk aggregation

Under Solvency II, the individual sub-modules are aggregated to produce the SCR_{mkt} using the matrix shown in Figure 23.

Figure 23

	MKTint	MKTeq	MKTprop	MKTsp	MKTfx	MKTconc
MKTint	1	A	A	A	0.25	0
MKTeq	A	1	0.75	0.75	0.25	0
MKTprop	A	0.75	1	0.5	0.25	0
MKTsp	A	0.75	0.50	1	0.25	0
MKTfx	0.25	0.25	0.25	0.25	1	0
MKTconc	0	0	0	0	0	1

The factor A is 0 if the interest shock that gives rise to the MKT_{int} is that resulting from an increase in interest rates, when calculating including the loss-absorbing impact of technical provisions, otherwise A is 0.5.

Under the SST standard model, the individual risk capital amounts for each market risk factor are aggregated by using a large 82 by 82 correlation matrix. For this, the aggregation is performed at the level of risk factors not of actual capital requirements. See Section 4.2.2 above for details.

It is difficult to compare the underlying correlations between the two regimes that is due to the multitude of risk factors for the SST and the difference in aggregation approaches. However, we make the following comments on correlations between significant risk factors, based on the correlation matrices issued based on data as at year-end 2012:

- **Interest rates and equity:** Under the SST, the correlation between individual equity factors and the various risk factors making up the yield curve may vary between 5% and 56%, with a simple average of around 31%. For Solvency II the correlation is either 0 or 50% depending on whether the company is more exposed to an up or down shock in the yield curve.
- **Interest rates and spreads:** Solvency II assumes that there is no correlation between an increase in interest rates and spreads but that a downshift in the yield curve has a 50% positive correlation with spreads. Under the SST, the correlation between the relevant risk factors is negative, varying from -13% to -61%, with a simple average of -35%. There is a variety of academic literature on the correlation between rates and spreads, but it is generally accepted that as long-term interest rates rise, companies find it harder to finance themselves and thus spreads rise.
- **Equity and spreads:** Solvency II assumes a high degree of correlation between equity levels and spreads of 75%. The level of correlation assumed in the SST is slightly lower, varying from -32% to -68%, with a simple average of around -53%.
- **Equity and property:** Solvency II assumes a high degree of correlation between equity levels and property levels of 75%. The SST has correlations ranging from -26% to 0% for equity and residential property but 12% to 29% for equity and property funds.

7. Required capital: Credit risk

7.1 Overview

Credit risk can generally be classified into default, spread, and migration risk.

Under both the SST and Solvency II, spread risk is treated within the market risk module. The remaining credit risks are treated by the SST credit risk module and the Solvency II counterparty default risk (CDR) module. Generally the largest default/mitigation risks for an insurer arise from their bond portfolios, reinsurance arrangements, and any cash or liquid positions. All of them are captured in the SST credit risk module, but under Solvency II the risk from bonds is deemed to be entirely allowed for in the spread risk module and is thus not subjected to the CDR module.

7.2 Risk classification

The various positions subject to this module are classified differently under the two regimes. Solvency II classifies exposures in terms of the balance sheet item of the exposure, as follows:

- **Type I:**
  - Reinsurance arrangements
  - Securitisations and derivatives
  - Other risk-mitigating contracts
  - Cash at bank and other deposits if the number of independent counterparties is less than 15
  - Capital, initial funds, and letters of credit if the number of independent counterparties is less than 15
- **Type II:**
  - Receivables from intermediaries
  - Policyholder debtors, including mortgage loans
  - Other deposits if the number of independent counterparties exceeds 15
  - Capital, initial funds, and letters of credit if the number of independent counterparties exceeds 15

The SST classifies exposures according to the institution to which the insurer is exposed, as follows:

- Central government and banks
- Public sector entities
- Multilateral development banks, the Bank of International Settlements (BIS), and the International Monetary Fund (IMF)
- Banks and stockbrokers
- Joint institutions of banks
- Stock exchanges and clearinghouses
- Companies
- Securitisations
- Individuals and small businesses
- Mortgage bonds
- Positions secured directly or indirectly by charges on real estate
- Subordinated positions
- Overdue positions
- Other positions, including cash

A key difference between the regimes is that sovereign credit risk is reflected in the SST, via the spread charges, and is due to the fact that central government/central bank bonds are considered in the credit risk module. Under Solvency II they are explicitly excluded.

7.3 Risk methodology

There are three credit models to consider: Solvency II Type 1, Solvency II Type 2, and the SST standard model.

7.3.1 Solvency II Type 1 exposures

The Solvency II Type 1 default model is broadly based on the so-called Common Shock Model. Under this model, it is assumed that a particular credit shock affects all counterparties in the economy and that the probability of default for a given counterparty depends both on a baseline probability of default as well as a common shock across the economy. Probabilities of default per rating category, p_i, are specified in the regulation (see Section 7.4 below).

The loss given default for a particular position i is calculated as

$$y_i = R \cdot \ (MV\ Asset + Risk\ Mitigating\ Effect - Collateral)$$

where *R* is a specified recovery rate, depending on position type; for example, for reinsurance assets, *R* is taken as 50% and 90% for derivatives.

From the mathematical definition of this model it is then possible to estimate the variance of the loss given default, which can be shown to be given by:

$$Var(L) = \sum_{(i,j)} \varpi_{ij} y_i y_j + \sum_i \varpi_{ii} {y_i}^2$$

where: $\varpi_{ij} = \frac{p_i(1-p_i)p_j(1-p_j)}{1.25\,(p_i+p_j)-p_i p_j}$ for $\neq j$, and $\varpi_{ii} = \frac{1.5\, p_i(1-p_i)}{2.5-p_i}$, and where y_j is the sum of the loss given defaults (LGD) from counterparties with probability of default p_j.

Using this variance, an estimate of the 99.5% percentile of the loss distribution is:

$$3\sqrt{Var(L)}$$

where 3 is a prudent quantile factor approximately close to that needed for the normal distribution, $\Phi^{-1}(99.5\%) \approx 2.58$.

The final capital requirement for Type I is then capped as:

$$SCR = \begin{cases} 3\sqrt{Var(L)} & if\ \sqrt{Var(L)} < 7.05\%y \\ 5\sqrt{Var(L)} & if\ 7.05\%y \leq \sqrt{Var(L)} \leq 20\%y \\ y & if\ \sqrt{Var(L)} > 20\%y \end{cases}$$

where the total LGD across all counterparties is $y = \sum y_j$.

7.3.2 Solvency II Type 2 exposures

The capital requirement for Solvency II Type 2 exposures is taken as the change in the basic own funds following a 15% fall in the value of the exposures due within three months and a 90% fall for those due for more than three months.

7.3.3 Credit risk under the SST

The SST approach to credit risk is based on Basel III, the European banking supervisory regime. Here the capital charge for a given position depends on its market value, classification (see Section 7.2 above) and its credit rating.

The capital charge for a given position is an 8% charge on the risk-weighted asset (RWA). The RWA is defined as RWA = Risk Weight x [Asset Market Value - Market Value of Credit Risk Mitigating Instruments] where the risk weight is specified in the regulation as a factor of credit rating and classification.

7.4 Solvency II probabilities of default

For Solvency II Type 1 exposures, the probabilities of default for a given counterparty depend on the counterparty's rating. If the exposure is unrated and subject to Solvency II the probabilities are determined by the solvency ratio of the counterparty. These probabilities are summarised in Figure 24.

Figure 24

Credit Quality Step	Solvency II Ratio (Insurers only)	Probability of Default
0	Any/Non Insurer	0.002%
1	Any/Non Insurer	0.010%
2	Any/Non Insurer	0.050%
3	Any/Non Insurer	0.240%
4	Any/Non Insurer	1.200%
5, 6	Any/Non Insurer	4.175%
Unrated	Any/Non Insurer	30.410%
Unrated	>=196%	0.010%
Unrated	175%	0.050%
Unrated	150%	0.100%
Unrated	125%	0.200%
Unrated	122%	0.240%
Unrated	100%	0.500%
Unrated	95%	1.200%
Unrated	<=75% or doesn't meet MCR	4.175%

Insurers with Solvency II ratios between those listed should interpolate the probability of default.

7.5 SST risk weightings

For each rated asset the credit rating is mapped to a rating class from 1 to 8 or the unrated class. The technical specification contains a mapping of credit ratings from various rating agencies to a rating class. For instance, for Standard & Poor's ratings, AAA to AA- are mapped to classes 1 to 2, A+ to A- are mapped to class 3, BBB to class 4, BB to class 5, B to class 6 and CCC to C to class 7. For unrated assets a single risk weighting is given. There is then a unique risk weight for a given position type and rating class.

Risk weights vary from 0% for AAA-rated government bonds to 1,250% for unrated long-term securitisations.

7.6 Risk aggregation

Under Solvency II, a low level of correlation between Type 1 and Type 2 exposures is allowed for by using the correlation matrix shown in Figure 25.

Figure 25

	Type I	Type II
Type I	1	0.75
Type II	0.75	1

Under the SST, the individual RWAs are simply summed to get the combined capital requirement, because any diversification is assumed to be taken account of in the risk weightings used.

7.7 Broad comparison of capital requirements

To understand the broad differences in the credit risk capital requirements we can consider reinsurance recoverables, e.g., outstanding claims payments that are due from the reinsurer under the two regimes. For this we consider a total amount outstanding of 700, which can be split up between a maximum of 7 differently rated reinsurers: AAA, AA, A, BBB, BB, B, and unrated (with Solvency II ratio of 100%).

The table in Figure 26 presents the different capital charges on this market value of 700.

Figure 26

Scenario	SST Capital	SII Capital	SST Capital Charge %	SII Capital Charge %
100 in each of the 7 differently rated reinsurers	43	60	6%	9%
700 in an AAA reinsurer	11	4	2%	1%
700 in an BBB reinsurer	56	40	8%	6%
700 in an unrated reinsuer	56	57	8%	8%
700 in 7 different AAA reinsurers	11	4	2%	1%
700 in 7 different BBB reinsurers	56	40	8%	6%
700 in 7 different unrated reinsurers	56	57	8%	8%

Scenario	SST Capital	SII Capital	SST Capital Charge %	SII Capital Charge %
100 in each of the 7 differently rated reinsurers	43	47	6%	7%
700 in an AAA reinsurer	11	4	2%	1%
700 in an BBB reinsurer	56	40	8%	6%
700 in an unrated reinsuer	56	57	8%	8%
700 in 7 different AAA reinsurers	11	1	2%	0%
700 in 7 different BBB reinsurers	56	15	8%	2%
700 in 7 different unrated reinsurers	56	22	8%	3%

8. Required capital: Operational risk

Operational risk is often considered to be one of the most difficult risk types to quantify. The Solvency II standard model is considered by many to be fairly arbitrary and unsuitable as a quantification of the risk. In contrast, the SST does not attempt to quantify this risk type and thus contains no allowance for it.

Under Solvency II, the SCR_{op} comprises an allowance for operational risk for unit-linked contracts based on expenses and for all other business based on the level and growth in premiums and BEL. The non-unit-linked allowance is further capped at 30% of the BSCR.

The formula can thus be expressed as:

- OP_{ul} = 25% of the annual expenses incurred in respect of unit-linked business
- OP_{bel} = 4.5% of the technical provision for non-linked business, subject to a floor of 0
- OP_{prem} = 4% of earned premium from non-linked business + 4% of any earned premiums from non-linked business in excess of 120% of the earned premium from the previous 12 months
- $SCR_{op} = OP_{ul} + \text{MIN} \{ 30\% \text{ BSCR}, \text{MAX} \{ OP_{bel}, OP_{prem} \} \}$

9. Required capital: Scenario add-on

9.1 Risk methodology

Another difference between Solvency II and the SST is the role that scenario testing plays in the SST. Under Solvency II as part of the Pillar 2 Own Risk and Solvency Assessment (ORSA) it is necessary to test the impact of extreme scenarios on the financial position of the company. Under the SST, this is also the case but the results of these extreme scenarios actually affect the required capital.

The analytical Delta-Gamma model assumes the change in RTK depends on a quadratic function of the change in risk factors, no matter how large the changes are. Moreover, the underlying assumption of a multivariate normal distribution means that the approach neglects the empirical evidence that loss distributions are generally heavy-tailed and that there is often tail dependency between risk factors.

Several (*m*) extreme scenarios are assigned a probability of occurrence (p_i) by FINMA and, in some cases, by the company, and the impact on the RTK $(\delta\mathrm{RTK}_i)$ is assessed. The Delta-Gamma model is then modified to allow for the impact of these extreme scenarios as follows:

$$\delta RTK = \Delta\delta RF + \frac{1}{2}\delta RF\,\Gamma\,\delta RF^T + \sum_{i=0}^{m}\delta RTK_i[i]$$

where *[i]* represents the indicator function of whether or not scenario *i* occurs and the 0^{th} scenario is defined to be the situation where no extreme scenarios occur and has probability $\mathrm{p}_0 = 1 - \sum_{i=1}^{m} p_i$.

Thus we now have a multinomial distribution with probabilities p_i.

The combined insurance and market risk distribution is then adjusted to better allow for the impact of these scenarios and the TVaR is measured. The impact of the extreme scenario (ZK_{SCEN}) is taken as the difference between the TVaR before and after allowance for the scenarios.

The extreme scenario aggregation aspect of the SST is currently under review and the year-end 2012 SST contained additional reporting requirements for so called 'quadrant requirements,' a set of extreme scenarios, calibrated differently. This follows a paper, 'Scenarios and their Aggregation in the Regulatory Risk Measurement Environment,' published by FINMA employees.

9.2 Extreme scenarios definitions and probability of occurrence

The scenarios, which are relevant for life insurers and affect the ZK, are shown in Figure 27.

Figure 27

Code	Scenario	Probability of Occurrence
eS1	self defined scenario	[entity specific input]
eS2	self defined scenario	[entity specific input]
eS3	self defined scenario	[entity specific input]
eS4	self defined scenario	[entity specific input]
Sz1	Equity drop -60%	0.1%
Sz2	Real estate crash combined with increase in interest rates	0.1%
Sz3	Stock market crash (1987)	0.1%
Sz4	Nikkei crash (1990)	0.1%
Sz5	European currency crisis (1992)	0.1%
Sz6	US interest rate crisis (1994)	0.1%
Sz7	LTCM (1998)	0.1%
Sz8	Stock market crash (2000/2001)	0.1%
Sz11	Financial crisis 2008	0.1%
S1	Longevity	0.5%
S2	Disability	0.5%
S4	Lapses	0.1%
S10	Pandemic	1.0%
S11	Financial Distress	0.5%
S13	Terrorism	0.5%

In addition, scenarios Sz9 and Sz10, Global Inflation and Deflation respectively, must be quantified and reported but do not affect the target capital.

The definitions of the extreme scenarios are set out in the following sections.

9.2.1 S1: Longevity improvements

In this scenario it is assumed that mortality decreases twice as quickly as assumed in the base scenario.

If no mortality improvement is modelled in the base scenario then this scenario will have no effect.

9.2.2 S2: Disability

One of the following scenarios must be used (the company may choose):

- Increase in disability rates of 25% in first year and 10% thereafter
- Increase in disability rates of 25% in first year and average lengthening of disablement by one year

9.2.3 S4: Lapses

- Increase in interest rates for all durations and all currencies by 100 bps
- Relative increase in lapse rates of 50%
- Relative increase in option take-up rates of 25%

9.2.4 S10: Pandemic

This considers the worldwide spread of disease. It is modelled on pandemics such as Spanish Flu in 1918 to 1919, Asian Flu in 1957 to 1958, and Hong Kong Flu in 1968 to 1969.

Modelled effects are both biometric and market-based.

Biometric effects are taken from a public health study and are:

- Increased deaths
- Increased hospitalisation
- Increased number of days absent from work

The market effects are:

- Depreciation against CHF of JPY by 10%, other Asian currencies by 35%, and other emerging market currencies by 25%
- Decreases in short- and long-term interest rates by duration for CHF, EUR, GBP, USD, and JPY.
- Increase in spreads of 75 bps for AAA, 100 bps for AA, 150 bps for A, 200 bps for BBB, and 400 bps for lower-rated assets
- Increase in pharmaceutical share prices by 25%
- Decrease in tourism and transport share prices by 50%
- Decrease of 25% for shares from the following sectors: luxury goods, construction, resources, oil and gas, banks, insurance, and food.

9.2.5 S11: Financial distress

In this scenario, the following occur:

- The first year lapse rate becomes 25% and then reverts to normal
- New business volumes reduce by 75%
- Interest rates increase by 300 bps at all durations and for all currencies
- The value of all equities, hedge funds, and real estate falls by 30%

9.2.6 S13: Terrorism

The terrorism scenario is defined as the most extreme of the other scenarios (i.e., the effect of the terrorism scenario on the RTK is equal to the maximum change from the other extreme scenarios).

9.2.7 Historic market event scenarios

The scenarios with the Sz prefix are all market-based and are defined in terms of changes in the 82 market risk factors. They are thus defined as follows:

- **Sz1: Equity crash**
  All equity risk factors fall 60%, hedge funds fall 30%, private equity falls 70%, and participations fall 65%.
- **Sz2: Property crash**
  All property risk factors fall 50%.
- **Sz3: Stock market crash of 1987**
  Large decreases in interest rates for all currencies, tightening of credit spreads, falls in the value of the CHF relative to other currencies, increases in exchange rate, interest rate, and equity volatilities, combined with falls in the value of equities and property.
- **Sz4 Nikkei crash of 1989 and 1990**
  Large increases in interest rates for all currencies, widening of credit spreads, falls in the value of the CHF relative to other currencies, large increases in exchange rate, interest rate, and equity volatilities, combined with falls in the value of equities and property.
- **Sz5 European currency crisis of 1992**
  Large increases in USD and EUR interest rates as well as large decreases in GBP and CHF rates, widening of credit spreads, falls in the value of the CHF relative to other currencies, increases in exchange rate, interest rate, and equity volatilities, combined with relatively small falls in the value of equities and property.
- **Sz6 US interest rate crisis of 1994**

Large increases in interest rates for all currencies, changes in credit spreads, falls in the value of the CHF relative to other currencies, increases in exchange rate, interest rate, and equity volatilities, combined with falls in the value of equities and property.

- **Sz7 Russian long-term capital management (LTCM) crisis of 1998**
  Large decreases in interest rates for all currencies, widening of credit spreads, falls in the value of the CHF relative to other currencies, increases in exchange rate, interest rate, and equity volatilities, combined with falls in the value of equities and property.
- **Sz8 Stock market crash of 2000 and 2001**
  Large decreases in interest rates for all currencies, changes in credit spreads, falls in the value of the CHF relative to other currencies, increases in exchange rate, interest rate, and equity volatilities, combined with large falls in the value of equities and moderate falls in property values.
- **Sz11 2008 Financial crisis**
  Large decreases in interest rates for all currencies, dramatic widening of credit spreads, falls in the value of the CHF against other currencies except JPY, extremely large increases in exchange rate, interest rate, and equity volatilities, combined with large falls in the value of equities and moderate falls in property values.

9.2.8 Entity-specific scenarios

In addition to these specified scenarios, companies must come up with four entity-specific scenarios and estimate the probability of occurrence for each.

The range of chosen scenarios varies dramatically but some typical examples include:

- Natural catastrophe events such as an earthquake
- Further economic scenarios, such as strongly increasing short-term interest rates combined with strongly decreasing long-term rates.
- Terrorism-related events
- Different operating assumptions for certain products, for example BVG business.

9.3 Risk aggregation

In order to allow for the impact of the extreme scenarios on the combined market and insurance risk, it is assumed that whenever an extreme scenario occurs the base distribution is simply shifted by the amount of the shock (i.e., the impact on RTK).

Thus if *F(x)* is the cumulative distribution function (CDF) of the combined market and insurance risk (base distribution), then the CDF after the aggregation of the extreme scenarios is given by:

$$\tilde{F}(x) = \sum_{i=0}^{m} p_i F(x - \delta RTK_i)$$

This aggregation can then either be performed by Monte Carlo simulation (in a similar way to that done to calculate the capital under the Delta-Gamma model in Section 4.2.2 above) or via the standard FINMA template, which is implemented via the following process:

1. From the Monte Carlo simulations (see Section 4.2.2.2 above), determine the CDF of the base distribution for a large number of equally spaced amounts *(x)*.
2. Determine the post-aggregation CDF ($\tilde{F}(x)$) using the results of the extreme scenario stresses and the above formula.
3. Compute the TVaR for the combined insurance, market, and extreme scenario capital ($ZK_{LIFE,MKT,SCEN}$) from $\tilde{F}(x)$ by numerical methods, i.e., choose the largest *x* for which $\tilde{F}(x) < 1\%$ (the confidence level) will give the value at risk. The TVaR can then be approximated numerically, for instance by summing $\frac{1}{1\%}\frac{(x+s)+s}{2}[F(x+s) - F(x)]$ for all *x* less than the VaR and where *s* is the step size between consecutive *x*.

10. Required capital: Other components

Solvency II contains several additional modules, as follows:

- Intangible asset SCR (SCR_{int})
- Adjustment for the loss absorbency of deferred taxes (Adj(DT))
- Adjustment for the loss absorbency of technical provisions (Adj(TP))

These modules are not explicit parts of the ZK under the SST. We consider each in turn in the following sections.

10.1 Intangible assets

Under the SST, all intangible assets are written down and do not form part of the RTK. As such, there is no capital requirement relating to these assets.

Under Solvency II, intangible assets with a clearly established market price will retain value on the balance sheet and are thus subjected to the SCR_{int}. The capital requirement is 80% of their value.

10.2 Adjustment for technical provisions

Under Solvency II, the loss-absorbing capacity of technical provisions, arising from the ability to vary discretionary benefits (e.g., policyholder bonuses) in stress scenarios, is presented explicitly. In order to determine the adjustment to be applied, it is necessary to calculate the impact of the various life and market risk sub-module stresses on a basis of both gross and net of discretionary benefits, where the gross stress assumes the value of the discretionary benefits is unaffected by the given stress.

The stated aim of this approach is to prevent a double-counting of the risk mitigation effect in the modular approach. Additionally, the difference between the aggregated capital using the gross and the net approaches represents the value created from realistic management actions taken in given tail events. In assessing these actions, due consideration needs to be given to any legal, regulatory, or contractual restrictions, as well as to best practice.

To calculate the adjustment for the loss absorbency of technical provisions (Adj_{TP}), companies need to recalculate BSCR on the net of discretionary benefits basis, known as n_{BSCR}. Adj_{TP} is then taken as the difference subject to the cap that the loss-absorbing effect cannot be greater than the unstressed value of the relevant future discretionary benefits (FDB). Thus:

$$Adj_{TP} = MAX\ \{\ MIN\ \{BSCR - nBSCR, FDB\}, 0\}$$

As mentioned in Section 3.3 above, future discretionary benefits under the SST do not form part of the BEL and thus there is no corresponding ZK module or adjustments.

10.3 Adjustment for deferred taxes

Similarly, deferred taxes have a loss-absorbing capacity and this risk-mitigating effect is shown separately under Solvency II. Here the adjustment is defined as the difference between the value of the net deferrable taxes on the base balance sheet and the corresponding value under each relevant scenario, where an instantaneous loss of amount $BSCR + Adj_{TP} + SCR_{op}$ is suffered.

As mentioned in Section 3.3 above, future corporation tax payments are not valued under the SST and do not influence the RTK. There is thus a corresponding ZK module or adjustments.

11. Internal models

11.1 Overview

Under both regimes insurers have the option of using an internal model as alternatives to the standard approach. Internal models must fulfil certain criteria and better represent the risk of the business being modelled.

Generally companies will try to use an internal model where they believe the standard approach does not appropriately capture or quantify their risks. There are a number of possible issues with the standard approaches (under both the SST and Solvency II), but generally the overarching concerns are that the standard approaches:

- Assume that changes in risk factors have a linear impact on own funds
- Do not sufficiently represent the heavy tails in the loss distributions
- Do not adequately reflect tail dependency (often through inappropriate aggregation techniques)
- Are based on parameters appropriate for the entire EU single market (such as shock amounts under Solvency II) which may not be appropriate for the products or market the insurer operates in
- Do not appropriately aggregate group entities nor treat capital and risk transfer instruments (CRTIs) within a group.

In general large multinationals and specialist niche insurers use Internal Models (IM), as they either have the resources to go about building an IM and go through the application process or the impact on capital requirements of not using an IM is too great. Additionally, under the SST, it is more common for medium sized companies and all reinsurers to use an IM due to pressure from the regulator.

11.2 Requirements

In order to use an internal model it must be approved by the regulator.

The SST sets out a number of requirements for the use of internal models. Models may be approved in part or in full and there is a predefined model approval process. While the approval process is ongoing the model may provisionally be used, with the understanding that FINMA may apply a capital add-on until approval is granted.

- **Methodology and parameter test:** The risks covered by the model must correspond to those in the standard model. Unknown parameters are to be modelled as random variables and the risk model must establish the common distribution function of all the risk factors (i.e., the model must be distribution-based). Dependencies between risk factors must be modelled. Assumptions need to be realistic and credible. Aggregation of sub-module-based capital needs to be explained. Data must be complete and correct and parameters estimated using sound statistical estimation.
- **Model changes and changes in risk profile:** Material changes must be approved by the regulator and any material changes in the company's risk profile reported. The regulator may require a company to update its internal model to take account of general advances in modelling.
- **Documentation:** Must explain the general methodology and theory that the model is based on, as well as any limitations and weaknesses. Parameter estimation must be fully described and data quality confirmed.
- **Calibration Test:** Certain core elements of the SST may not be modified by an internal model. These include the risk measure (a 1-year 99% confidence level TVaR), the risk margin cost of capital, and the use of the FINMA-published yield curves.

In addition to a company applying to use an internal model, regulators may demand the use of an internal or partially internal model where they view the standard model as inappropriate.

Under Solvency II, an internal model application process (IMAP) is clearly specified, including significant levels of documentation. The main requirements of the internal model from a Pillar 1 quantitative perspective are similar to the SST and can be summarised as:

- **Statistical quality standard**: This considers the requirement for data quality, for generally accepted statistical/actuarial techniques to be used, and for realistic assumptions to be justified. All material risks and their mitigating effects must be captured by the internal model.

- **Validation standards:** A regular process of validating model assumptions and parameters in the light of recent experience must be undertaken and documented. Furthermore, the whole model process and supporting systems should be subject to validation. Additional validation would often focus on management actions, treatment of tax, back testing, and stress testing.
- **Profit and loss attribution:** An analysis of profit-by-source must be performed in terms of the categorisation of risk drivers used in the model. This represents a specific validation element and is used to check that the model behaviour is plausible given actual experience.
- **Documentation:** Generally as per the SST.
- **Calibration test:** As per the SST, the requirement that the model capital corresponds to the relevant standard i.e., 1-year 99.5% VaR.
- **Use test:** Under Solvency II, a company must demonstrate that an internal model is used throughout the business and plays a central part in the decision-making processes of management and the board.

11.3 Areas in which internal models deviated from the SST and Solvency II standard models

Internal models generally have similarities to the standard models under both regimes. Many companies attempt only to replace or improve certain modules, stresses, or areas of the models, as opposed to an approach based on first principles.

To understand the structural differences between these internal models and their standard equivalents it is important to point out that the allowance for the interaction between risk types is handled differently between the two regimes (see also Section 4.3.3 above). Under the SST, the dependency structure of the life and market risk factors is taken account of when generating the Monte Carlo simulations to calculate the combined risk capital. Thus the process can be thought of as:

1. Create a set of realisations of risk factors (i.e., addressing 'which risk factors are included and what are their distributions.'
2. Correlate them to allow for the dependencies between risk factors.
3. Calculate the impact of the joint scenarios by evaluating them using a liability proxy (in this case the Delta-Gamma formula).
4. Calculate the risk measure (in this case TVaR) empirically.

Solvency II, however, first evaluates the impact of uncorrelated single risk factor stresses on the capital and then aggregates these impacts to calculate the capital required. Thus the order of calculation corresponds to something like Step 1, Step 3, Step 4, and then Step 2 above.

Most internal models, under both regimes, are based on the 'SST process' as described above. Thus the main areas of deviation from the SST standard model tend to be:

- **Different risk factors,** e.g., EU firms may not have volatility risk factors. Other risks that are often used include sovereign credit risk, liquidity, hedging, and operational.
- **Different assumed distributions of the risk factors,** e.g., lognormal instead of normal distribution for some risk factors or the use of stochastic simulation for the risk factors. Undertaking specific parameters (USPs) under Solvency II are a further example of this. Here firms might use, for example, a company-specific mortality stress (instead of the 10% standard shock) based on historical company/market analysis of mortality claims (without moving to a full or partial internal model).
- **Differing dependency structures between risk factors,** e.g., the use of Gaussian or non-Gaussian copulas instead of correlation matrices.
- **Different liability proxies,** e.g., replicating portfolios, least squares Monte Carlo, full nested stochastic.
- **Different risk measures or confidence intervals** (where allowed by the regulator).

12. Quantitative reporting requirements

12.1 Overview

Solvency II sets out extensive reporting and disclosure requirements both publicly and to regulators. While public disclosure is only required on an annual basis, firms will be required to produce quantitative reporting to supervisors on an annual and quarterly basis. Qualitative reporting is required through the publicly disclosed Solvency and Financial Condition Report (SFCR) and the private Regular Supervisory Report (RSR).

Once Solvency II is in application, annual reporting must be submitted within 14 weeks after year-end, while firms will have five weeks after each quarter-end to submit quarterly reporting (with a further six weeks permitted for groups). In both cases this is likely to be subject to a phasing-in period during the first few years of application.

At the moment the SST does not specify any public disclosure requirements (i.e., to financial analysts, investors, shareholders, rating agencies, etc.). However, there is a requirement to produce a comprehensive SST Report for the regulator, detailing the methodology and results of the SST, as well as two sets of data requirements.

12.2 The SST Report

The SST Report is a full description of the business and the SST calculations and results and must include information on the following items:

- Description of the business, products, and reinsurance arrangements
- Changes since the last report:
  - Changes in the risk structure of the business
  - Modelling changes
- Valuation:
  - Commentary on assets held, their valuation, reconciliation from statutory to market value, the value of capital and risk transfer instruments, and description of marking-to-model.
  - Assumptions, parameters, methodology, and data used to calculate BEL. Commentary on the liability cash flows and options and guarantees. Commentary on any deviations from market-consistent valuation.
  - Presentation of and commentary on the RTK.
- Required capital:
  - Information on the economic capital model used and all the modules/elements
  - Description of deviations from the standard model
  - Description of the self-defined scenarios and commentary on the effect of all scenarios
  - Information on the projection of the future capital requirement used to determine the MVM
  - Information on the aggregation of the ZK and presentation of its components
- Commentary on the SST ratio
- Description of other non-quantified risks, such as concentration and operational risks

12.3 SST fundamental data

The following data is to be delivered to the regulator as part of the SST reporting package:

- Market Value Balance Sheet, broken down by all major asset classes and liability types
- A breakdown of the RTK into capital tiers
- Solvency ratio
- Split of ZK into components
- A split of market risk by major risk factor type (interest rates by currency, equity, etc.)

- A split of life underwriting risk by major risk factor type (mortality, expenses, etc.)
- A split of credit risk into default and migration risk
- The impact on RTK of each of the extreme scenarios
- A split of bonds by type and rating
- The amount and Fischer-Weil duration of the fixed interest instruments and insurance liabilities
- The impact on RTK of a number of additional scenarios:
  - +/- 100 bps parallel shift in the yield curves of all currencies
  - +/- 10% movements in the USD/CHF and EUR/CHF exchange rates
  - Global inflation and deflation extreme scenarios (which do not impact ZK)
  - 25% increase in interest rate volatility and separately equity and property volatilities
  - 10% falls in equity and property

12.4 SST additional data request

The following data is to be delivered to the regulator as part of the SST reporting package:

- Yield curves, inflation, and implied volatility assumptions.
- For group life business, individual life business, and unit-linked business separately, the following information:
  - Number of policies projected in each future year
  - The projected revenue account (liability and reinsurance items only), e.g., premiums, benefits, expenses, reinsurance for each future year, and the present value of these items at the valuation date, using the risk-free and the risk discount rates
  - Statutory profit, pre- and post-tax, in each future year
  - The BEL and post-tax present value of future profits (PVFP) in each future year, using the risk-free and the risk discount rates
  - The bonus fund in each future year
  - A reconciliation between BEL and statutory reserves as at the valuation date.
- The same information for each foreign branch of the company.

12.5 Solvency II qualitative reporting

Under Solvency II, qualitative reporting will be done under the publicly disclosed Solvency and Financial Condition Report (SFCR) and the private Regular Supervisory Report (RSR).

The areas that the two reports should cover are broadly consistent, although the information provided will vary to reflect the supervision and disclosure purposes of the respective reports. The topics that the reports should cover include:

- Business and performance
- System of governance
- The risk profile of the firm
- Valuation for solvency purposes
- Capital management

12.6 Solvency II QRTs

The data requested as part of the Pillar 1 reporting under Solvency II is known as quantitative reporting templates (QRTs). Some QRTs are to be reported annually, others quarterly. Additionally there are extra requirements for groups.

The QRTs are fairly comprehensive and resource-intensive to collate. While all firms falling under the Solvency II requirements will be required to produce annual and quarterly reporting, there are a number of materiality thresholds and potential exemptions included on specific templates. Below we summarise the information required.

12.7 QRTs

The following is a list and brief description of the QRTs. They must be provided to supervisors on an annual basis. In addition, certain key QRTs are required quarterly. These are shown in green.

- **Balance sheet:** Detailed split of assets and liabilities on a Solvency II and a statutory accounting basis.
- **Off-balance sheet items:** Details on off-balance sheet items.
- **Assets and liabilities by currency:** Split of main types of asset and liability positions by currency.
- **Activity by country:** Premiums, claims, and commission by class of business and country written in.
- **Premiums, claims, and expenses:** Split by type, line of business, and country with a simplified version for quarterly reporting.
- **Own funds:** Very detailed split of own funds items by type of own funds and tier with a simplified version for quarterly reporting.
- **Participations:** Details on companies where there's a participation.
- **Summary analysis of changes in BOF:** Analysis of change in basic own funds over a one-year period.
- **Analysis of changes that are due to investments and financial liabilities**
- **Analysis of changes that are due to technical provisions:** Detailed analysis of change in BEL.
- A series of QRTs on the SCR and its breakdown into modules and sub-modules, including details on the amount of relevant shocks and intermediate calculations:
  - **Solvency capital requirement: For undertakings on standard formula or partial internal models.**
  - **Solvency capital requirement: For undertakings on partial internal models.**
  - **Solvency capital requirement: For undertakings on full internal models.**
  - **Market risk**
  - **Counterparty default risk**
  - **Life underwriting risk**
  - **Health underwriting risk**
  - **Operational risk**
- **Minimum capital requirement (MCR):** Details of the components of the MCR and intermediate calculations/data.
- A series of QRTS detailing the assets, positions, and details on particular classes of assets:
  - **Structured products data: Portfolio list.**
  - **Return on investment assets**
  - **Investment funds (look-through approach)**
  - **Securities lending and repos**
  - **Assets held as collateral**
- **Life and health SLT technical provisions:** Split of BEL, risk margin, and reinsurance recoverables by type of business, breakdown of BEL into PV of cash flows, breakdown of the reinsurance recoverables, split of BEL by country. A simplified version is set out for quarterly reporting.
- **Projection of future cash flows (best estimate, life):** Cash flows for each future year and each type of business, split by premiums, benefits, other outflows, and other inflows.
- **Life obligations analysis:** Log of key features of products and key statistical data such as sum assured, premiums, and number of contracts.
- **Only for variable annuities, description of guarantees by product:** Details of guarantees for VA products.
- **Only for variable annuities, hedging of guarantees:** Details on the type of hedging undertaken for each VA product and the quantitative effect of this.
- **Duration liabilities:** A requirement to provide the duration of the liabilities.
- **Outgoing reinsurance program in the next reporting year:** Description of reinsurance treaties and key features.
- **Share of reinsurers:** Split of reinsurance recoverables and guarantees by reinsurer.
- **Special purpose insurance vehicles (SPVs):** Details on SPVs and risks transferred.
- **Profit or loss sharing:** Requirement to provide average profit sharing amount.

In addition to the above, a number of templates are only required as part of the quarterly reporting submissions:

- **Asset templates:**
  - **Investments data, portfolio list (detailed list of investments)**
  - **Investments data, quarterly summary**
  - **Derivatives data: Open positions**
  - **Derivatives data: Historical derivatives trades**
- **Lapses:** Key information about the overall evolution in lapse rates for life business as an indicator for the potential liquidity drain that is due to policyholder behaviour
- **Profit and loss:** The amount of the statutory profit or loss

12.8 Annual disclosure

The QRTs covering the following are required to be disclosed on an annual basis publicly:

- Balance sheet
- Premiums, claims, and expenses
- Own funds
- SCR
- MCR
- Life and health SLT technical provisions

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