Swiss Solvency Test

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Timeline

- Herbert Lüthy becomes new director of FOPI (Federal Office of Private Insurance) in Fall 2002
- Reorientation of FOPI to increased Prudential Supervision
- New draft insurance supervision act specifies solvency to be risk-based
- Start of Swiss Solvency Test Project May 2003
  - All large insurers, reinsurers, actuarial and insurance association participated
- Finished first conceptual work December 2003
- Up to Mai 2004, work on nonlife standard model, formulation of scenarios, asset model and high-level documentation for test-run, simpler model for health insurers
- Test-run started Mai 2004
  - Large life and nonlife companies participate
  - B&W Deloitte, Ecofin, E&Y, MOW, Tillinghast run project office
- Insurance supervision act (likely) to be implemented mid-2005 or 1.1. 2006. Irrespective of date, 2005 field-test with all companies will be run
- Reinsurers and groups will have to have internal model compatible with SST
General Framework

- Minimum solvency level: based on statutory calculation (Solvency I), target capital based on economic risk
- Target capital covers insurance, market and credit risks
- Target Capital: Expected Shortfall of change of risk-bearing capital
- Target capital for risks emanating during time horizon (1 year), safety margin for risks emanating after 1 year
- Risk-bearing capital based on market-consistent valuation (market value for assets, best-estimate + safety margin for liabilities)
- Market consistent valuation: Best estimate (discounted cash flows + valuation of all relevant options and guarantees) and safety margin
- Analytical models for normal situation, scenarios take into account situation when models break down
- Results of analytical models and scenarios are aggregated to arrive at target capital
General Framework

- Risk-based
- Consistent valuation of assets and liabilities
- Compatibility with EU (Solvency II)
- Compatibility with regulatory demands on other market participants
- Principle based

Aims:

- Regulatory density should stay reasonable
- Extra effort for SST should add value to companies
- Results should enable companies to manage risks more effectively
- SST should give incentives to development of internal models
Appointed Actuary has to write SST-Report together with calculation of target capital

- Qualitative and quantitative description of risk situation of company
- Market consistent valuation of assets and liabilities
- Discussion of assumptions and parameters
- Discussion of situation of company given scenarios (specified by regulator and company specific)
- Description of internal models
- Analysis of reinsurance program, quantification of true risk transfer
- Target capital
General Framework

- **Analytical models**: for normal situation where statistical data, normality assumption etc. are valid
- **Scenarios**: to supplement analytical models
  - To model additional risks
  - To reduce model risk
  - To take into account extreme events where model assumptions break down
- **Aggregation**: weighted (quantile-adjusted) average of scenarios with results from analytical model
General Framework

Problems of regulatory models

- **Systemic risks**
  - Insensitivity to equity risk of Solvency I lead to large share exposures of European insurers
  - Coarse rating separation of Basel I was partly reason for Asian crisis
  - Regulatory arbitrage between insurers and banks and pension funds

- Systemic risks can be reduced by making model more risk specific -> but model becomes very complicated and intransparent, difficult to keep up,…
- SST tries to induce companies to develop internal models (within a given framework) and by integration models with scenarios. Companies can deviate from models, parameters etc. with permission of supervisor
- Appointed actuary has to evaluate effect of scenarios on risk-bearing capital of company. Some scenarios are given by regulator, some have to be tailored by actuary to reflect specific situation of company

*To convert a model into a quantitative formula is to destroy its usefulness as an instrument of thought.*

*J.M. Keynes*
General Framework

Statutory provisions

Market consistent provisions

Early warning signal: risk specific but model dependent. If target capital condition is not achieved, company is not insolvent but graded regulatory measures are implemented

Minimal solvency

Target capital

Last step before insolvency. Not risk sensitive but model-independent and 'objective'

Accounting values

Solvency I

Minimal solvency

Market consistent valuation

SST

Target capital
Asset Model

- Simple risk-metrics type model with specified covariance matrix
- Risk Factors: Interest rates (10 time buckets), interest rate volatility, FX rates (EUR, USD, GBP, YEN), FX volatility, equity return, equity volatility, ai returns, property return
- Correlations: stressed
- Companies need to calculate sensitivities w.r.t. risk factors
- Asset Model -> normal distributed with zero mean and given volatility

The asset model will be supplemented with scenarios to take into account non-normality
Asset Scenarios

For test run: historical scenarios:

- Stock Market Crash 1987
- Nikkei Crash 1989
- European Currency Crisis 1992
- US Interest Rates 1994
- Russia / LTCM 1998
- Stock Market Crash 2000

- Effects are mapped on risk factors -> Evaluation of scenarios can be done using sensitivity analysis

- Default of reinsurer
- Downrating of company to subinvestment grade
- Credit risk (e.g. Basel II, include capital charge as scenario with probability 0.25%, or Credit Risk+,...)
Life Insurance

• Analytical Model:
  - Risk Factors: Mortality, longevity, morbidity, recovery rates, lapse, option exercise, costs
  - Assumptions:
    • Changes of risk factors are normally distributed
    • Specified covariance for test-run
    • Life model -> normal distribution with zero mean and given volatility
    • Biometric risks are assumed to be independent to market risk factors

• Scenarios:
  - Pandemic (Spanish Flu 1918 translated to 2004)
  - Disability scenario (short term increase + systemic increase)
  - Mortality: long term changes (to take into account of systemic over- or underestimation)
  - Longevity
  - Lapse scenario (combined with interest rate increase)

• Scenarios are defined via simultaneous changes of risk factors -> no extra work when sensitivities are already calculated
Nonlife Insurance

- **Analytical Model:**
  - Framework rather than black box
  - Modular, parts of all can be replaced with internal models (with permission of supervisor)
  - Split into current year and previous year
  - Normal claims, large claims and catastrophes
    - Aggregate normal claims modeled using parameterized distribution and specified correlation matrix
    - Large claims modeled using company specific data or specified distribution (e.g. Pareto,...)
    - Catastrophes modeled using scenarios or specified distributions
  - Parameters: some company specific, some supplied by regulator
  - Reinsurance: has to be modeled by companies
  - Pools (Nat cat, nuclear, airplane, dams): partly modeled by regulator for test-run, later has to be model by companies if capital relieve is to be granted

- **Scenarios:**
  - Pandemic (Spanish Flu 1918 translated to 2004)
  - Natural catastrophes (hail, windstorm, flood)
  - Industrial Accident/Catastrophe

- More detailed description in "Übersicht SST-Standardrahmen für das Nichtlebengeschäft", Damir Filipovic, BPV
Aggregation

Quantile of risk measure: $\alpha \sim 1\%$
Probability of extreme year: $p < \alpha$
Effect of scenarios: $c_i$
Adjusted quantile: $\alpha' = (\alpha - p)/(1-p)$
$p_i$: probability of scenario $i$ given that extreme year occurs
$ES_{\alpha}[\Delta R]$: Expected shortfall given by analytical model

Weights of scenarios:
$$\omega_i = \frac{p_i}{\sum_{j=1}^{k} p_j}$$

Target capital:
$$TC^+ = \frac{\alpha - \rho}{\alpha} ES_{\alpha'}[\Delta R] - \frac{\rho}{\alpha} \sum_{m=1}^{k} c_i \cdot \omega_i$$

Only scenarios are considered which exceed $\alpha'$ Quantile
Aggregation

Weighted result of analytical model, covers normal years

Quantile $\alpha'$

Scenario (does not count for aggregation)
Safety Margin

- Safety margin on best-estimate provisions:
  - Covers risks which emanate after 1 year time-horizon of SST (Run-off risks after 1 year) -> integral part of SST
- Safety margin = cost for future regulatory capital

Calculation of safety margin: Assume future target capitals are proportional to best-estimate provisions -> future target capitals are given by run-off pattern

Cost of capital $s$: 8-10% (subject to calibration)

Advantage of definition:
- Economic
- Market view enters calculation via cost of capital
- Depends on whole run-off
- Is easier to determine than a quantile approach
Safety Margin

Safety margin on top of best-estimate liabilities $K(t)$

Target capital at time $t=0$: $Z(0)$

Simplifying assumption: future regulatory capital (target capital) is proportional to best-estimate liabilities

$$\tilde{K}(1) \approx s E_Q \left[ \sum_{1 \leq t < T} \tilde{Z}(t) \right] = s \frac{Z(0)}{L(0)} \sum_{1 \leq t < T} E_Q[\tilde{L}(t)]$$
Controversies

- Scenarios: Concerns that they are difficult to evaluate
- Principle-based: Some prefer a more rule based approach with standard model
- Use of internal Models: Concerns that internal make target capitals less comparable
- Discounting of nonlife reserves
- Accounting matters: How to deal with intra-company loans etc.
- Disclosure of assumptions etc. to regulator
SST Project

For more information:

Philipp Keller: Philipp.Keller@bpv.admin.ch  
+41 31 324 9341 / +41 76 488 3141

Damir Filipovic: Damir.Filipovic@bpv.admin.ch  
+41 31 325 0172

Thomas Luder: Thomas.Luder@edf.admin.ch  
+41 31 325 0168