Towards Risk Based Supervision

Swiss Solvency Test: The Swiss Experience

Market & Credit Risk Measurement

XXI CNSF’S INTERNATIONAL SEMINAR ON INSURANCE AND SURETY

November 19, 2010
Preamble: How to deal with Uncertainty?

Question: What is the value of liability $X$?

Answer A:
“We do not know exactly. We will have to pay most probably less than 150. Let's be prudent, so we value it at 150.”

Answer B:
“We do not know exactly. We have calculated an estimation of the expected value which is neither optimistic nor conservative: 100. That is the value we use. But we keep in mind that there is uncertainty. The standard deviation is 30.”
(A) Usually, regulatory solvency regimes compare:

<table>
<thead>
<tr>
<th>Risk taken by an insurer</th>
<th>Insurer’s ability to take risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantified by a number</td>
<td>Quantified by a number</td>
</tr>
<tr>
<td>Risk Measurement</td>
<td>Valuation</td>
</tr>
<tr>
<td>Risk Models</td>
<td>Valuation Models</td>
</tr>
<tr>
<td>“Required capital”</td>
<td>“Available capital”</td>
</tr>
<tr>
<td>“SCR”</td>
<td>“Capital resources”</td>
</tr>
<tr>
<td>“PCR”</td>
<td>“Risk capacity”</td>
</tr>
<tr>
<td>“Target Capital”</td>
<td>“Risk Bearing Capital”</td>
</tr>
</tbody>
</table>

(B) Alternative: regulate premiums and insurance products.
Object under Consideration for Regulatory Solvency Purposes

- Liabilities?
- Assets – Liabilities?
- Which assets, which liabilities?
  E.g. only those from the statutory balance sheet?
- Something completely different?

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Principles versus Rules as a Basis of Regulation

1000+ Questions

e.g.: Is a grocery store an eligible asset to cover liabilities?
What about an old people's home? What about a football stadium?
What is the value of the discount rate for my insurance liabilities?

1000+ rules

Rules regulate the detail.

small number of principles

Principles must be powerful and general.

Answers
Wherever possible, **market-consistent valuation** is based on observable market prices (*marking to market*).

If such values are not available, a market-consistent value is determined by examining comparable market values, taking account of liquidity and other product-specific features, or on a model basis (*marking to model*).

Market-consistent means that up to date values are used for all parameters.

**Best-estimate** = Expected value of liabilities, taking into account all up to date information from financial market and from insurance.

All relevant options and guarantees have to be valued (life (re-)insurance).

No explicit or implicit margins.

Discounting with risk-free interest rate.
Risk under the SST-regime

Risk quantification using standard model or internal model

Risk Bearing Capital at \( t_0 \)

Market Value Margin

New business during year

market consistent value of liabilities

Best Estimate of Liabilities

Economic balance sheet at \( t_0 = 0 \) (deterministic)

Change of parameter of financial markets

claims

catastrophes

RBC(\( t_1 \))

Expected value of RBC in the worst 1% cases

one year risk

Stochastic economic balance sheet one year later

probability density of change of RBC

\( p < 1\% \)
The insurer should have a *risk policy*, how to deal with all relevant types of risk. This can take many forms: to *bear risk*, *mitigate* risk, set up a limit system, …

- Insurer should specify the *maximum of risk* he is willing to take (*risk tolerance statement*).
- Insurer should *quantify its risks*.
- Insurer should perform its *own risk and solvency assessment* (ORSA).
- Senior Management should be responsible for the whole *Risk Management Process*.
- *Risk Management* should be integrated into the company.
- Insurer should have an *asset liability management* (ALM).
- Insurer should evaluate *scenarios and stress tests*. 
Swiss Solvency Test: Timeline

- **Start of development**
- **Voluntary tests**
- **SST mandatory for large P&C and life companies**
- **SST calculation mandatory for all insurance companies**

Timeline:
- 2003: SST calculation mandatory
- 2006: SST mandatory for large P&C and life companies
- 2008: SST calculation mandatory for all insurance companies
- 2009: Examination of internal models
- 2010: SST solvency
- 1.1.2011: Companies must achieve SST solvency.
- 1.1.2006: New Insurance supervision act in force

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SST team consists almost of 20 quantitative specialists from economics, *mathematics*, and natural sciences with background in *mathematical* finance, life, nonlife, health, and reinsurance.

Each company is assigned a team out of these 20 people.

Each internal model is assigned a team out of these 20 specialists.

Special attention is needed for keeping decisions on models and calculations consistent over companies and over time.

Need for defining a proper collaboration between **SST specialist and general supervisors**.

Approving annual SST reports and internal models is a field of potential conflicts with insurers!
SST team evaluates approximately 130 annual SST reports

Produces written feedback to insurers regarding:
  – Solvency ratio (SST ratio)
  – Quality of calculations
  – Quality of documentation

SST team evaluates approximately 80 (partial) internal models
  – Complex and time-consuming task
  – Some insurers try to make intensive use of powerpoint presentations in lieu of self contained documentation
  – Written documentation is often insufficient for a proper review.

Process database for housekeeping and following progress
SST 2008 and 2009

Some results

SST 2008
- Valuation: portfolio at January 1, 2008
- Risk measurement: portfolio in 2008
- First official calculation, had to be performed by all insurers

SST 2009
- Valuation: portfolio at January 1, 2009
- Risk measurement: portfolio in 2009
- Mandatory for all insurers for the second time
Overview: SST results 2009 and 2008

<table>
<thead>
<tr>
<th></th>
<th>2009 Number of SST Reports</th>
<th>Number with SST-Ratio &lt;100%</th>
<th>2008 Number of SST Reports</th>
<th>Number with SST-Ratio &lt;100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Life</td>
<td>21</td>
<td>9</td>
<td>21</td>
<td>1</td>
</tr>
<tr>
<td>Nonlife</td>
<td>58</td>
<td>4</td>
<td>57</td>
<td>5</td>
</tr>
<tr>
<td>Health</td>
<td>19</td>
<td>0</td>
<td>18</td>
<td>0</td>
</tr>
<tr>
<td>Reinsurers</td>
<td>30</td>
<td>2</td>
<td>29</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>128</td>
<td>15</td>
<td>125</td>
<td>8</td>
</tr>
</tbody>
</table>
Components of Target Capital (SCR)
Life companies, 2009

Life - Analysis of Target Capital

Median (component / Target Capital)

- Market Risk
- Insurance Risk
- Diversification
- Exp. Tec.
- Result
- Exp. Fin.
- Result
- Scenarios
- Credit Risk
- ES
- MVM
- Target Capital
Components of Target Capital (SCR)
Non life companies, 2009

Non Life - Analysis of Target Capital

- Market Risk
- Insurance Risk
- Diversification
- Exp. Tec. Result
- Exp. Fin. Result
- Scenarios
- Credit Risk
- ES
- MVM
- Target Capital

Median (component / Target Capital)
Components of Target Capital (SCR) Reinsurers, 2009

Re - Analysis of Target Capital

Median (component / Target Capital)

- Market Risk
- Insurance
- Risk Diversification
- Exp. Tec. Result
- Exp. Fin. Result
- Scenarios
- Credit Risk
- ES
- MVM
- Target Capital
Solvency II and SST

Preamble

<table>
<thead>
<tr>
<th>Solvency II covers pillars I, II and III</th>
<th>SST focuses on pillar I aspects including elements of pillar II.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A full comparison of both supervisory regimes would consist in a comparison of Solvency II with the Swiss Insurance Supervision Act.</td>
<td></td>
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</tbody>
</table>

For the following slides we focus on pillar I aspects of supervision and compare the SST with the pillar I aspects of Solvency II.
### Solvency II and SST

#### Defining principles

<table>
<thead>
<tr>
<th>EU</th>
<th>Switzerland</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total balance sheet approach</strong></td>
<td><strong>Total balance sheet approach</strong></td>
</tr>
<tr>
<td><strong>Market-consistent valuation</strong></td>
<td><strong>Market-consistent valuation</strong></td>
</tr>
</tbody>
</table>
| **Risk based capital requirements**  
  - Insurance risks  
  - *Market risks*  
  - *Credit risks*  
  - Operational risks | **Risk based capital requirements**  
  - Insurance risks  
  - *Market risks*  
  - *Credit risks*  
  - Operational risks not modeled; capital add-ons considered. |
## Solvency II and SST

### Calibration

<table>
<thead>
<tr>
<th>EU</th>
<th>Switzerland</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Value at risk</strong> of the change in available capital at 99.5% confidence level.</td>
<td><strong>Expected shortfall</strong> of the change in available capital at 99% confidence level.</td>
</tr>
<tr>
<td>Time horizon: one year</td>
<td>Time horizon: one year</td>
</tr>
<tr>
<td>Yield curve based on swap rates and a liquidity premium depending on nature of liability.</td>
<td>Yield curve based on government bonds.</td>
</tr>
</tbody>
</table>
Calibration: VaR and TailVaR

<table>
<thead>
<tr>
<th>1 - $\alpha$</th>
<th>Solvency II</th>
<th>99.5%</th>
</tr>
</thead>
<tbody>
<tr>
<td>SST</td>
<td>99%</td>
<td></td>
</tr>
</tbody>
</table>

Distribution of P&L over one year

$\text{TailVaR}_{\alpha}$, $\text{VaR}_{\alpha}$, Expected Value

Profit and loss
## Solvency II and SST

### Risk Model

<table>
<thead>
<tr>
<th>EU</th>
<th>Switzerland</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Standard model:</strong> formula.</td>
<td><strong>Standard model:</strong> stochastic model.</td>
</tr>
<tr>
<td><strong>Standard model is default choice.</strong></td>
<td><strong>SST emphasizes principles and encourages the use of internal models.</strong></td>
</tr>
<tr>
<td><strong>All companies may use the standard model.</strong></td>
<td><strong>Internal models are mandatory for certain companies and groups.</strong></td>
</tr>
<tr>
<td><strong>Similar requirements on internal models.</strong></td>
<td><strong>Similar requirements on internal models.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>SST makes extensive use of <em>scenarios</em> (to reflect tail risk, tail dependencies, concentration risk, etc.).</strong></td>
</tr>
</tbody>
</table>
The SST standard model is a stochastic model for each of the risk types:

- **Market risk**: Risk Metrics, *a covariance model*
- **Credit risk**: Basel II *standard approach*, *a factor model*
- **Insurance risk**:
  - Life: *a covariance model*
  - P&C: *a dedicated stochastic risk model*
  - Health: *a simplified version of the P&C model*
Limitations of standard market risk model:

- Linearity assumption between risk factors and capital of insurer.
- Multivariate normal assumption

Types of internal models:

- Slight modifications of standard model: different risk factors, different estimators for volatilities and correlations
- Different model for dependency between available capital and risk factors
  - Use of grids
  - Delta-Gamma models
  - Full revaluation
Internal Models for Market Risk

Types of internal models (continued):

- Different probability distribution functions for risk factors
  - Different marginal distributions (increased tail risk)
  - Different copulas (increased tail dependencies)
- Different model architecture
  - Historic simulation
  - Economic scenario generators (ESG)
    - For risk modeling purposes: physical probabilities
    - For risk modeling and valuation purposes: nested simulations
    - In practice combination of ESG (risk modeling) with replicating portfolios (valuation)
- No convincing attempt for dealing with dynamic hedging / dynamic portfolio management.
Market risks
Non life companies, 2009

Non Life - Analysis of Market Risk

Mean (component / Market Risk)

- i.r. CHF
- i.r. EUR
- i.r. USD
- i.r. GBP
- Spreads
- FX
- Shares
- Real Estate
- Hedge Funds
- Private Equity
- Participations
- Diversification
- Market Risk

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Reinsurance - Analysis of Market Risk

Mean (component / Market Risk)

- i.r. CHF
- i.r. EUR
- i.r. USD
- i.r. GBP
- Spreads
- FX
- Shares
- Real Estate
- Hedge Funds
- Private Equity
- Participations
- Diversification
- Market Risk

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27 | Swiss Solvency Test: The Swiss Experience

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Limitations of the standard credit risk model (Basel II)

- Rely on ratings from credit rating agencies.
- Do not properly take diversification into account.

Internal models

- Partial internal models to assess the EDF (expected default frequency) and LGD (loss given default) of certain names.
- Comprehensive models:
  - KMV
  - CreditMetrics
  - CreditRisk+
Internal Models for Credit Risk

Comprehensive models

- Enable a more realistic modeling of the stochastic dependency between counterparties
  - Diversification effects taken into account, however economic cycle, sector and country effects also reflected in the model
- Enable a realistic modeling of the stochastic dependency between credit and market risk.
- FINMA requires that companies model both default and migration risk.
- Credit Spread Risks are allocated under Market risk
Use of scenarios

- Generic and specific scenarios must be evaluated and in certain cases taken into account in the required capital
  - To compensate for model weaknesses
    - Underestimation of tail risk (financial market risk scenarios)
    - To take into account tail dependency (e.g. pandemic scenario)
  - To take into account company specific risks, e.g. concentration risk
# Impact of SST-Scenarios are aggregated via mix of df

<table>
<thead>
<tr>
<th>Industrial</th>
<th>Pandemic</th>
<th>Accident: works outing</th>
<th>Health: anti selection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
<tr>
<td>Hail</td>
<td>Daily allowance</td>
<td></td>
<td>Claims provisions: +10%</td>
</tr>
<tr>
<td></td>
<td>disability; longevity, lapses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Failure of reinsurance</td>
<td>Financial Distress</td>
<td></td>
<td>Financial Market</td>
</tr>
<tr>
<td></td>
<td>Terror</td>
<td></td>
<td></td>
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</tbody>
</table>
Any Questions??

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(advertising)

Swiss Solvency Test: The Swiss Experience
Thorsten Pfeiffer
Swiss Financial Market Supervisory Authority FINMA
Einsteinstrasse 2
CH-3003 Bern
Switzerland

Mobile: +41 797 455 104
Thorsten.Pfeiffer@finma.ch