



Eidgenössische Finanzmarktaufsicht FINMA
Autorité fédérale de surveillance des marchés financiers FINMA
Autorità federale di vigilanza sui mercati finanziari FINMA
Swiss Financial Market Supervisory Authority FINMA

Towards Risk Based Supervision

Swiss Solvency Test: The Swiss Experience

SEMINAR ON RISK-BASED CAPITAL REGULATION: EXPERIENCES AND CHALLENGES

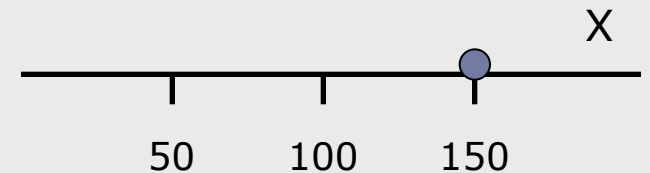
Santiago, December 12 & 13, 2011

Preamble: How to deal with Uncertainty?

Question: What is the value of liability X?

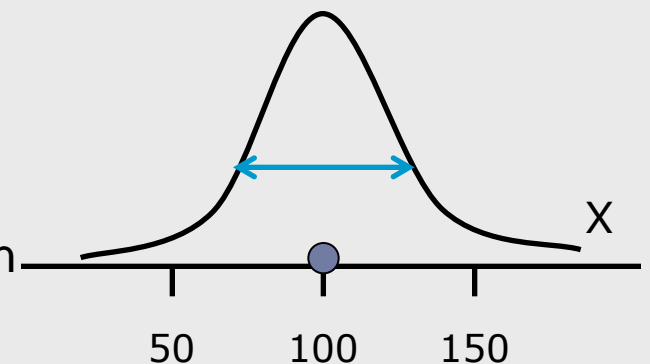
Answer A:

“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:

Risk taken by an insurer:
„How much risk is there?“

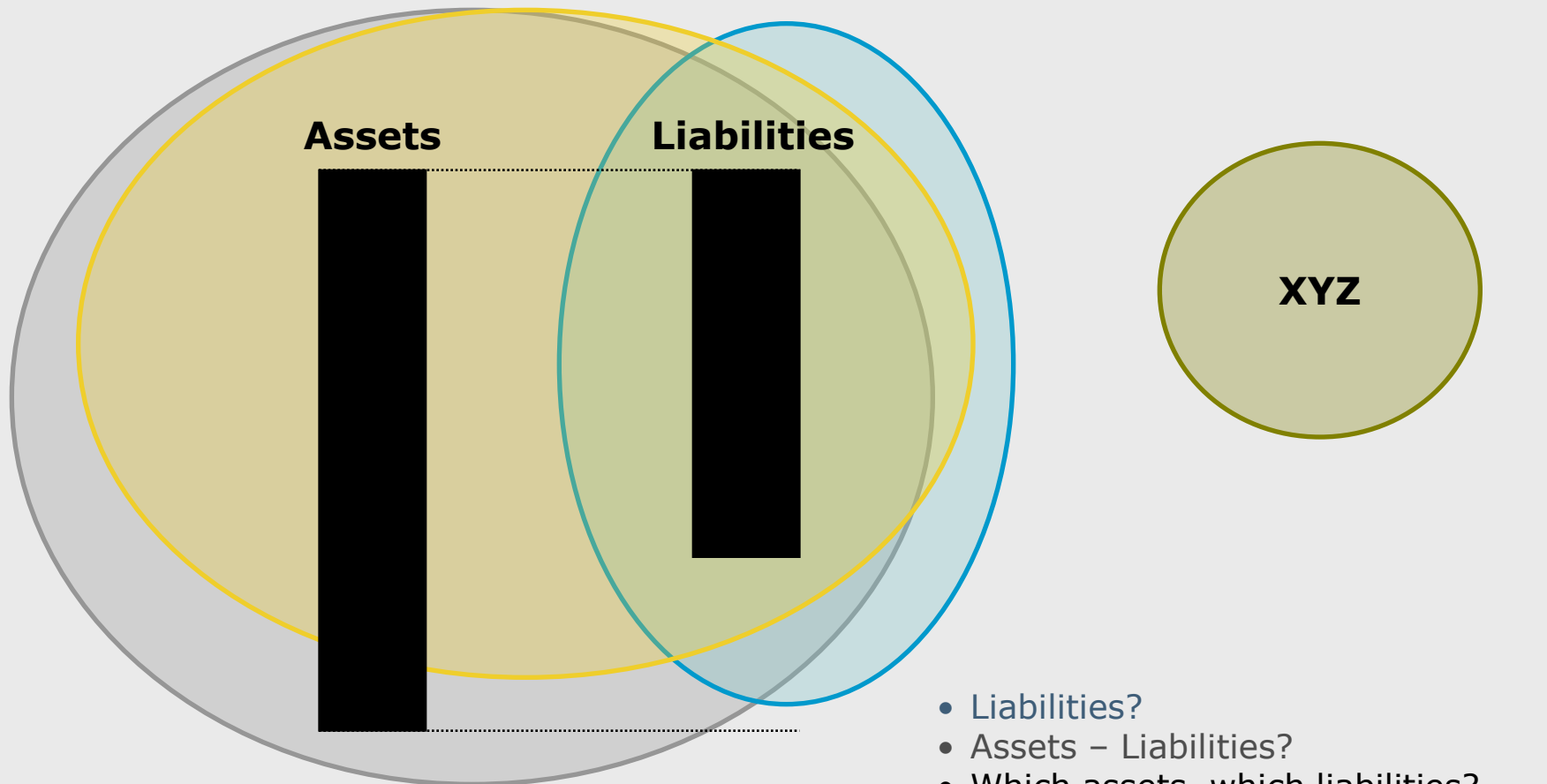
- Quantified by a number
- *Risk Measurement*
- *Risk Models*
- “Required capital”
- “SCR”
- “PCR”
- “Target Capital”

Insurer’s ability to take risk:
„How much resources are there?“

- Quantified by a number
- *Valuation*
- *Valuation Models*
- “Available capital”
- “Capital resources”
- “Risk capacity”
- “Risk Bearing Capital”

(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?

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

small number of principles

Rules regulate the detail.

Principles must be powerful and general.

Answers

Swiss Solvency Test (SST): Economic Balance Sheet

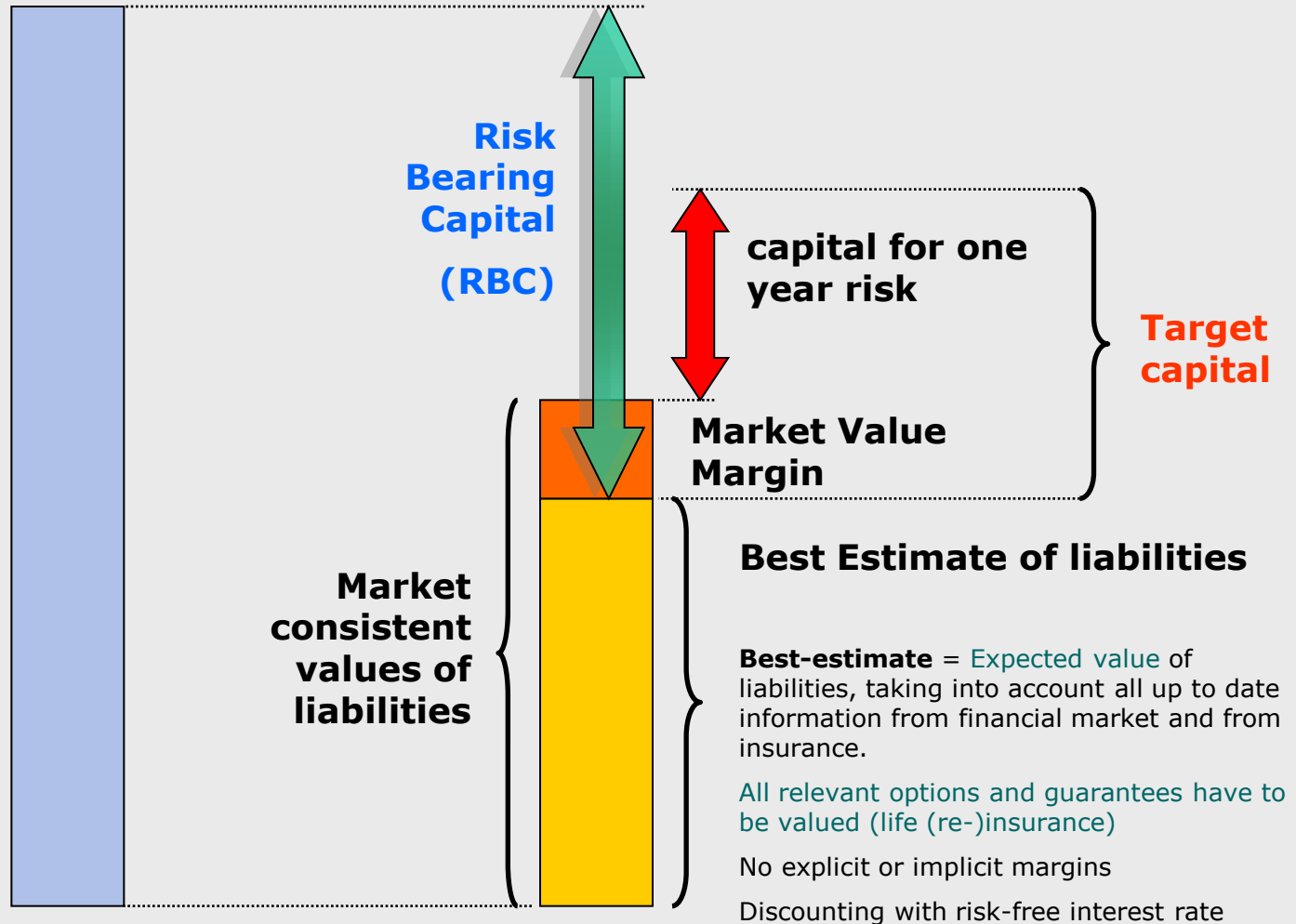
Market Value of Assets

Liabilities

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



Market consistent values of liabilities

Best Estimate of liabilities

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

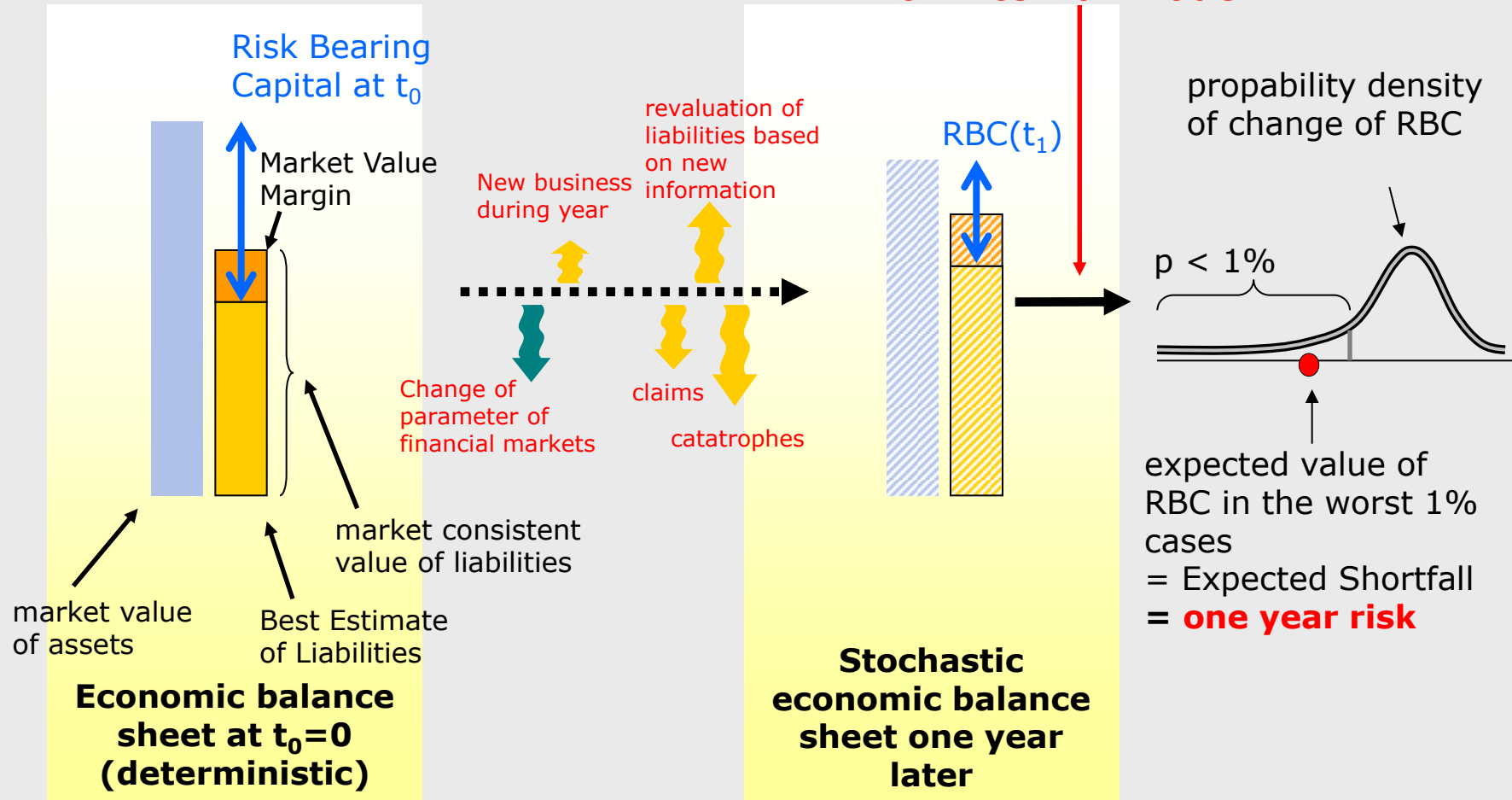
All relevant options and guarantees have to be valued (life (re-)insurance)

No explicit or implicit margins

Discounting with risk-free interest rate

Risk under the SST-regime

Risk quantification using standard model or internal model

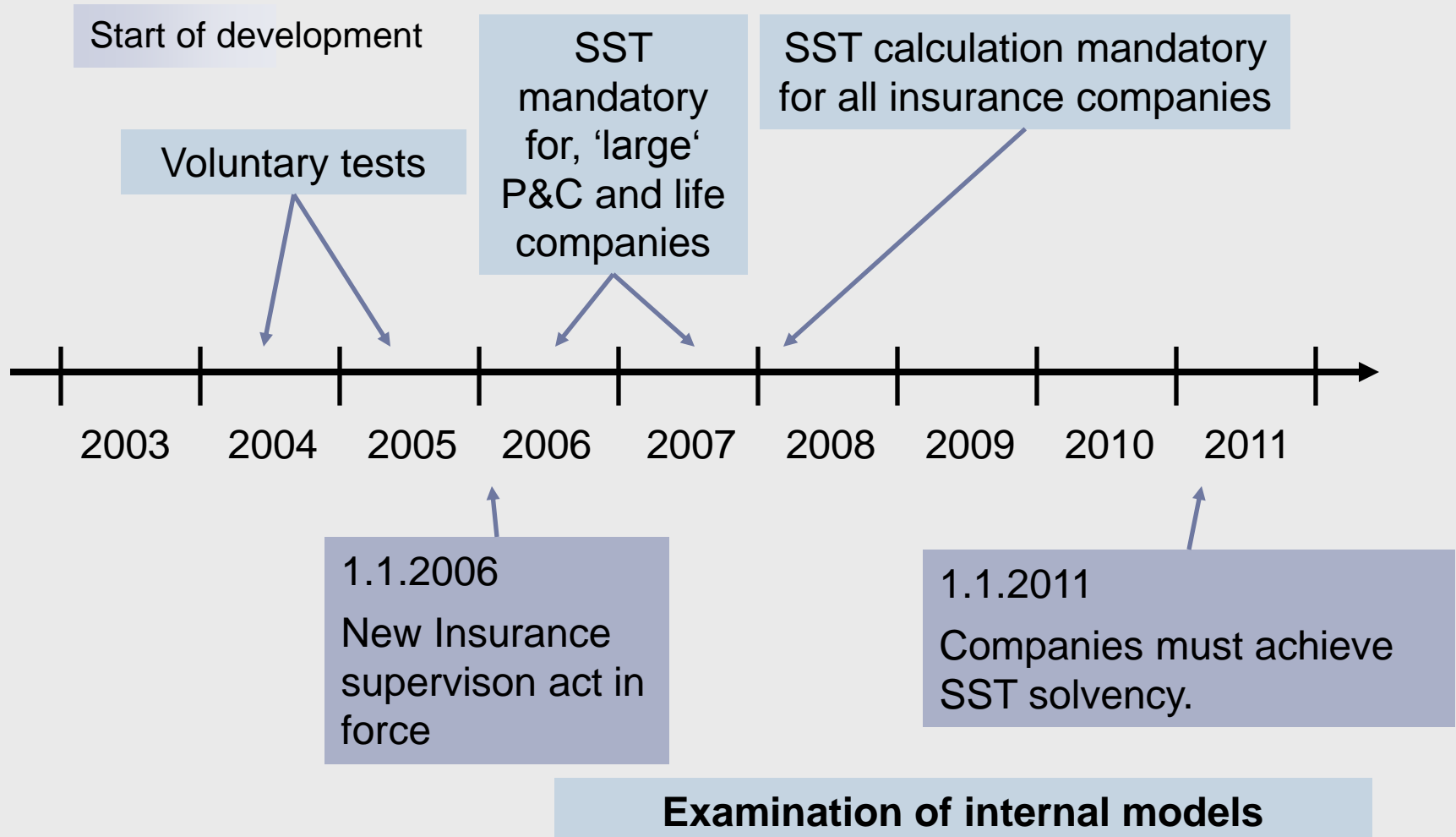


IAIS Requirements on Insurer's Risk Management for *Solvency Purposes*



- 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



- 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 2011

Some results



SST 2011

- Valuation: portfolio at January 1, 2011
- Risk measurement: development of portfolio in 2011
- End date: December 31, 2011
- First “sharp” calculation
- Had to be performed by all insurers
- 128 solo entities participating
- Results now may lead to supervisory intervention

Overview: SST 2011, split of entities



	Considered 2011 (*)	Participants 2011	SST Ratio <100% (**)	Considered 2010	Considered 2009
Life	21	21	5	21	21
Non-life	58	59	0	59	51
Health	19	20	0	19	18
Reinsurer	22	28	0	26	10
Total	120	128	5	125	108

Table 1: (*) Number of (solo-) companies whose data are used in the present survey, split by the different branches. (**) Figures stem from the total number of participants, before FINMA corrections.

Overview: SST 2011, split of entities



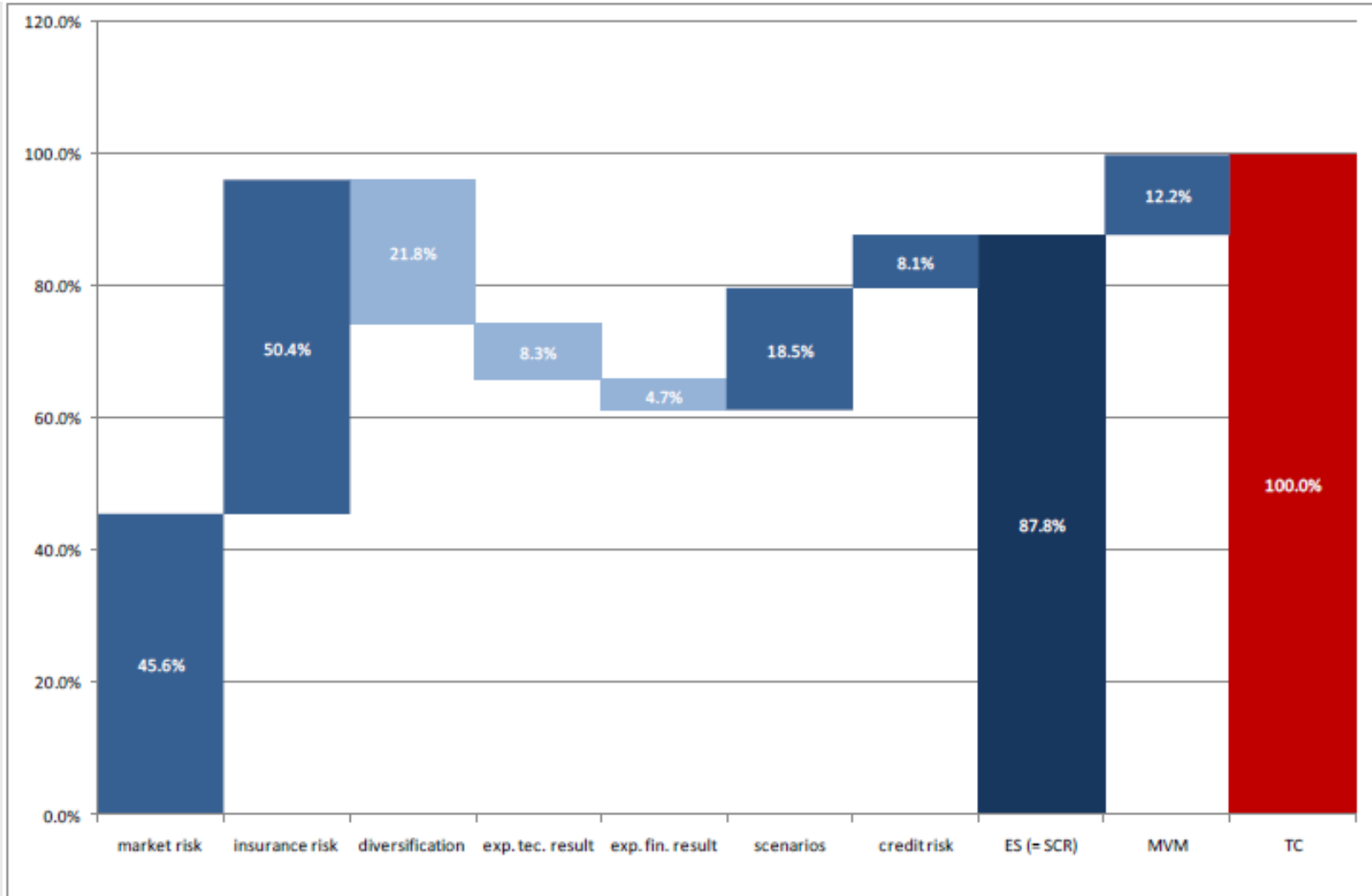
	Category 2	Category 3	Category 4	Category 5	Sum
Life	2	11	7	1	21
Non-life	2	9	17	30	58
Health	0	4	13	2	19
Reinsurer	1	8	11	2	22
Total	5	32	48	35	120

Table 2: Split of all companies according to branch and supervisory category.

Components of Target Capital (SCR)



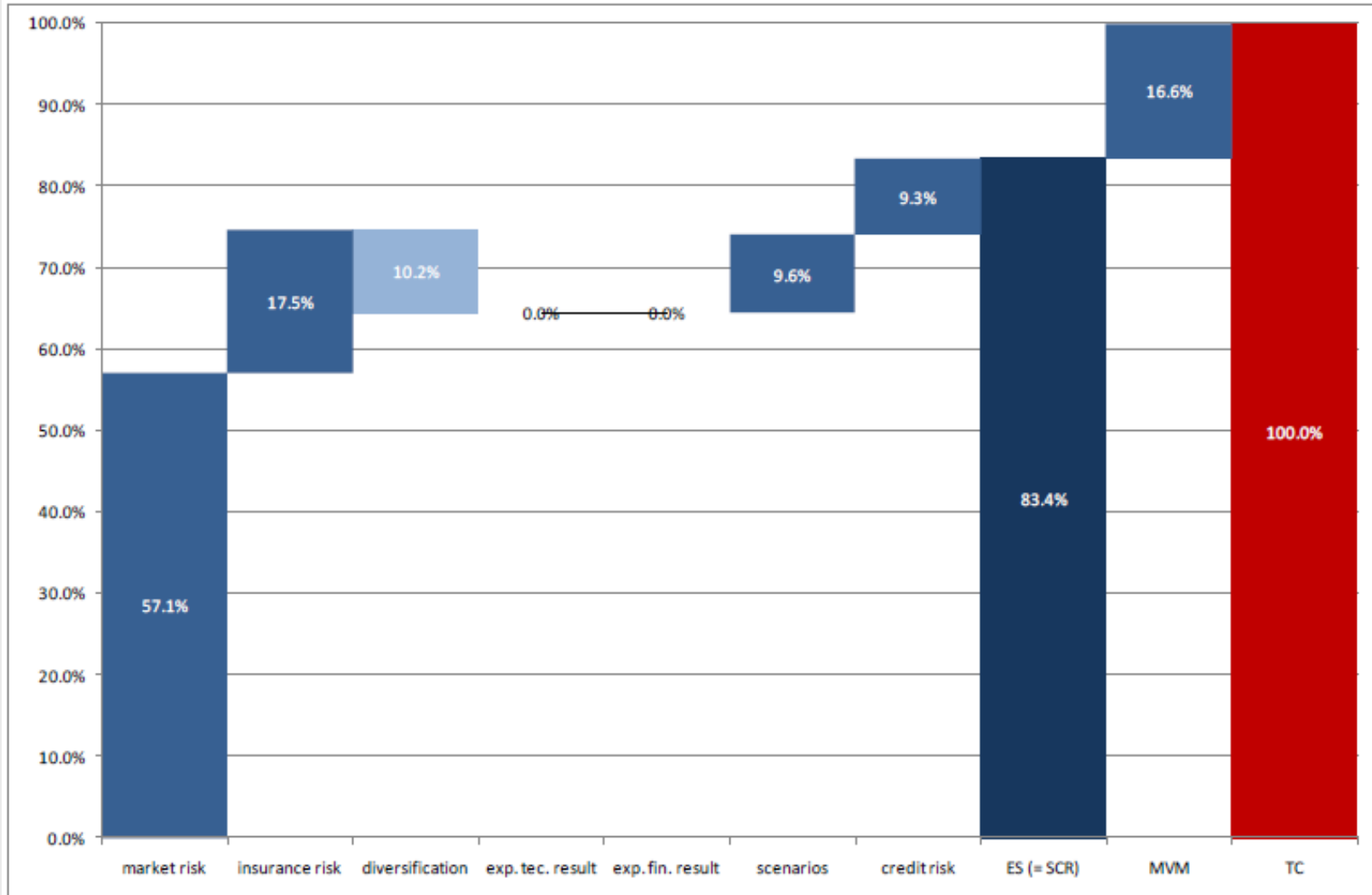
Non-life companies, 2011



Components of Target Capital (SCR)

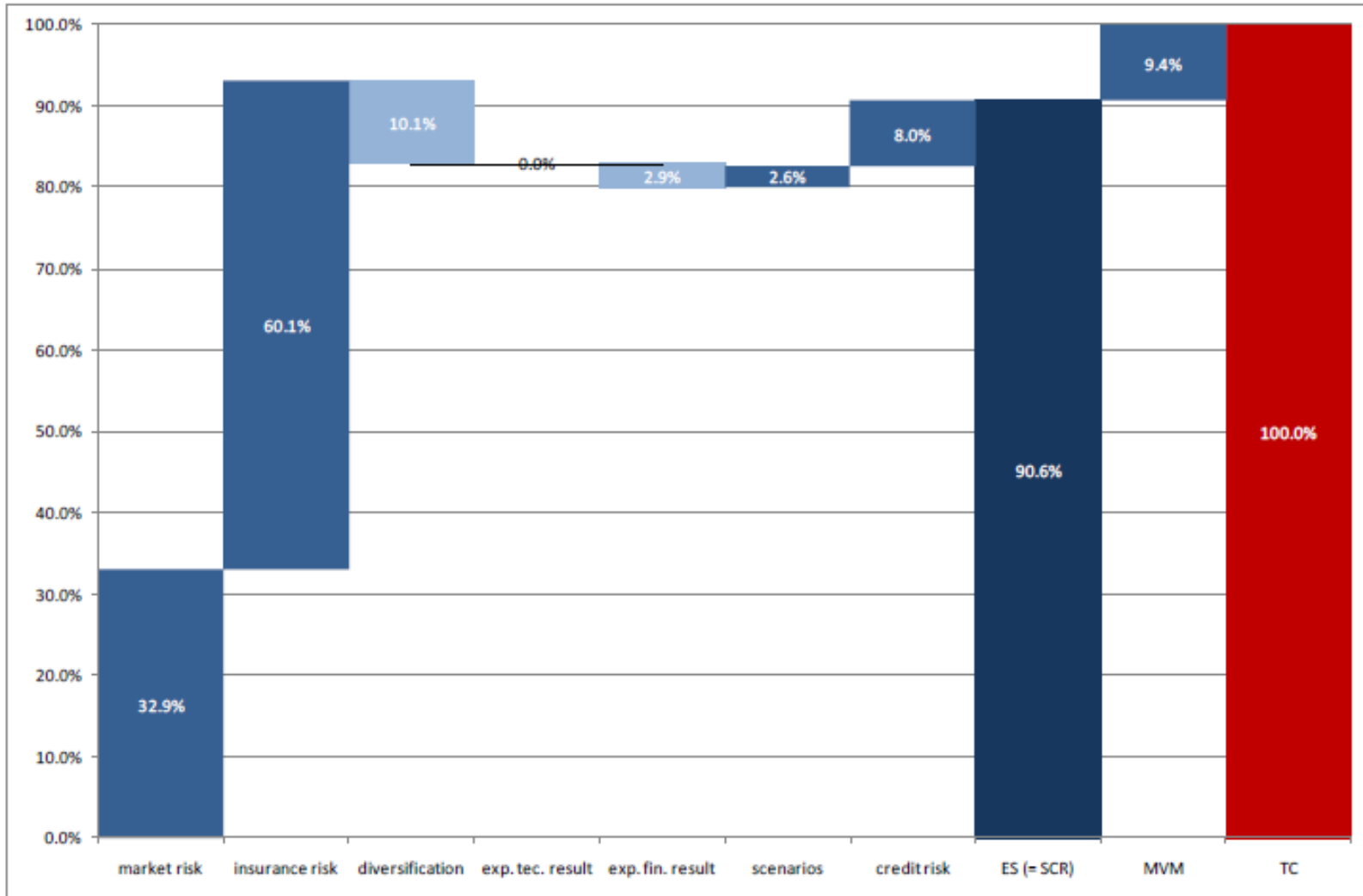


Life companies, 2011



Components of Target Capital (SCR)

Reinsurance companies, 2011



Solvency II and SST

Preamble



Solvency II covers pillars I, II and III



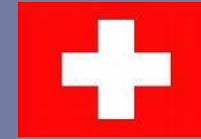
SST focuses on pillar I aspects including elements of pillar II.

A full comparison of both supervisory regimes would consist in a comparison of Solvency II with the Swiss Insurance Supervision Act.

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



Total balance sheet approach

Total balance sheet approach

Market-consistent valuation

Market-consistent valuation

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 yet modeled; capital add-ons considered.

Solvency II and SST Calibration



Value at risk of the change in available capital at 99.5% confidence level.

Time horizon: one year

Yield curve based on swap rates and a liquidity premium depending on nature of liability.



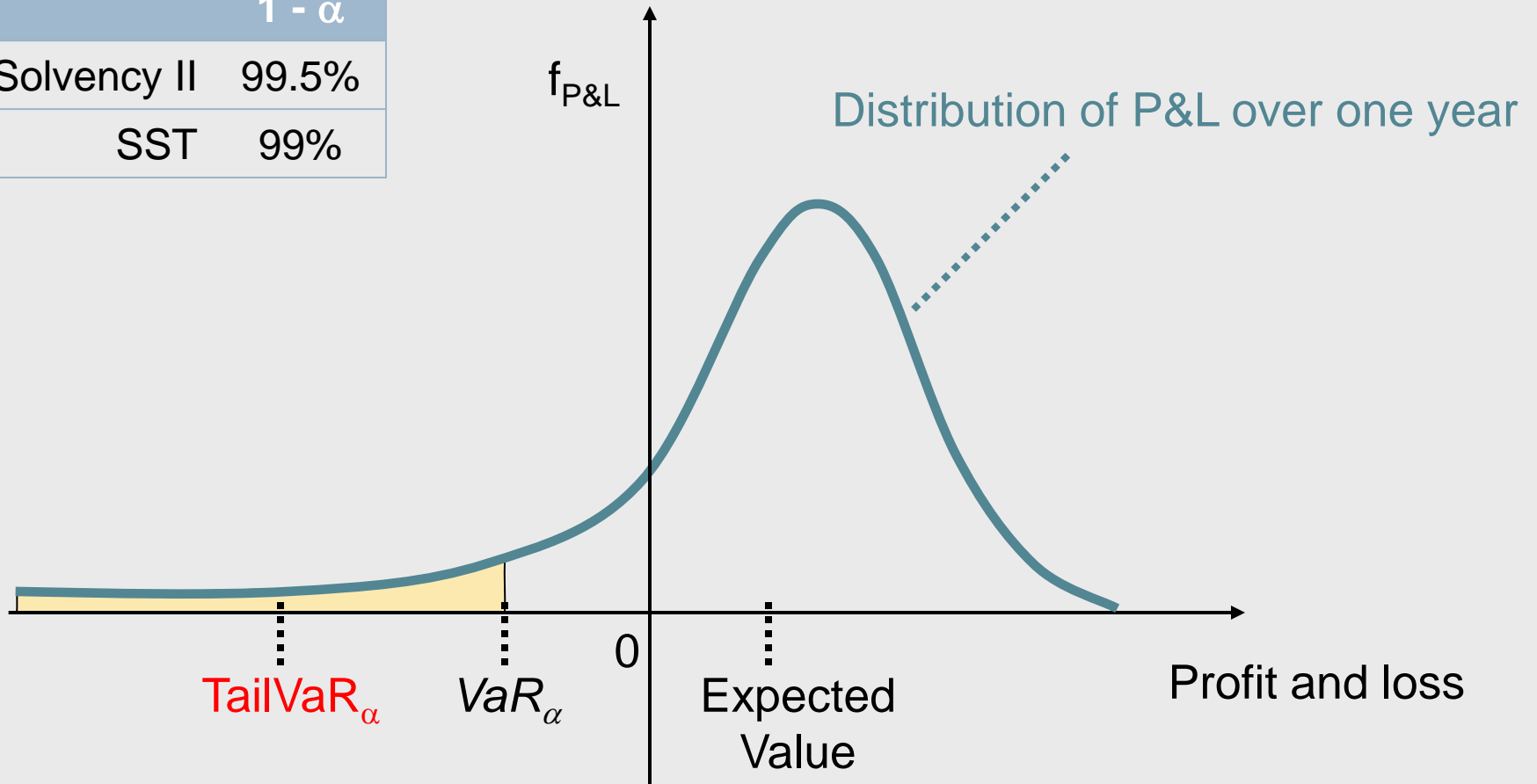
Expected shortfall of the change in available capital at 99% confidence level.

Time horizon: one year



Yield curve based on government bonds.

Calibration: VaR and TailVaR

	$1 - \alpha$
Solvency II	99.5%
SST	99%



Solvency II and SST Risk Model

	
Standard model: formula.	Standard model: stochastic model.
Standard model is default choice.	SST emphasizes principles and encourages the use of internal models.
All companies may use the standard model.	Internal models are mandatory for certain companies and groups.
Similar requirements on internal models.	Similar requirements on internal models.
	SST makes extensive use of <i>scenarios</i> (to reflect tail risk, tail dependencies, concentration risk, etc.).

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

Internal Models for *Market Risk*

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.

Internal Models for *Credit Risk*

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

Industrial



Pandemic



Accident:
works outing

Health: anti selection

Hail



disability; longevity,
lapses

Daily allowance

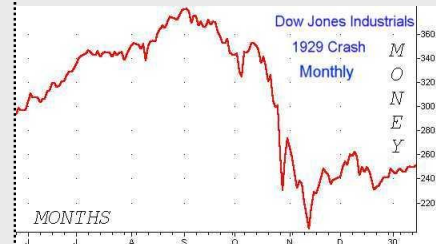


Claims provisions:
+10%

Failure of
reinsurance

Financial Distress

Financial Market



Terror

- Since 2006 the calculation of the SST has been mandatory.
- By 1.1.2011 required capital must be covered by eligible own funds.
- As most internal models have not reached the status of approval, FINMA in 2010 defined per insurer an individual provisional internal model to be used for the SST in 2011.
- So far, 28 decisions on internal models in 2011.
- As not all internal models have reached the status of approval, FINMA defined in October 2011 per insurer an individual provisional internal model to be used for the SST in 2012.

Any Questions??



You can buy it for only 50 CHF in every Swiss shop...

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Back Up Material

SEMINAR ON RISK-BASED CAPITAL REGULATION: EXPERIENCES AND CHALLENGES

Santiago, December 12 & 13, 2011

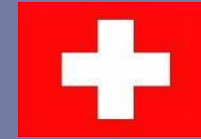
Solvency II and SST

Valuation: Market Consistency



Directive stresses market-consistent valuation as an autonomous principle.

IFRS fair values are default choice for assets (QIS 4).
IFRS fair values are acceptable if market-consistent (QIS 5).



Market-consistent valuation is an autonomous principle.

IFRS fair values are acceptable if market-consistent.

Internal Models for *Valuation*

- In particular the following items and financial instruments have led to internal valuation methods:
 - Embedded options and guarantees (valued using economic scenario generator or replicating portfolio)
 - Embedded value (MCEV)
 - Participations (economic net asset value)
- Balance sheet of P&C companies: correction to statutory balance sheet vs. true market consistent balance sheet (on an underwriting year basis)

Solvency II and SST

Scope



“small” companies not subject to risk based capital requirements.

All legal entities must satisfy risk based capital requirements.

Use of a simplified model is acceptable depending on risk profile of entity.

Most reinsurance captives may use a formula based approach.

Solvency II and SST Implementation



Numerous impact assessments before final roll out (QIS1,2,3,4, 5,...).

Solvency II capital requirements will probably become binding in 2013.



Numerous field tests (impact assessments) before final roll out (field tests 2004 to 2007, tests 2008 to 2010), mandatory participation since 2006 for large insurers.

SST capital requirements are fully binding since 2011.

Solvency II and SST

Group Solvency



Operational entity approach (reflects management view).	Legal entity approach (reflects insured's view).
Based on the consolidated accounts .	Based on the specific structure of the group.
Assumes full diversification of risks within the group.	Diversification effects depend on actual capital and risk transfer instruments.
Capital is assumed to be fully transferable and fungible within group.	Model takes into account <ul style="list-style-type: none"> • Restricted fungibility of capital and • Limited liability of shareholders.
Focus: solvency of consolidated group.	Focus <ul style="list-style-type: none"> • Solvency of each legal entity • Dependencies between legal entities

A model is a framework of an insurer to discuss risk and capital.

The point of the model is not (solely) the calculation of risk and capital but to have a common framework for discussion of risks, of dependencies, of links between different areas of the business etc.

It consists of :

- **Methodology:** Assumptions, models, mathematics, mapping of the real world to a conceptual framework, quality of the mathematical description of the portfolio...
- **Parameters:** estimates, mortality tables, claim size estimates,...
- **Data:** Position data, data on financial instruments, insurance policies,...
- **Implementation:** Software code, IT platforms, data warehouses, ...
- **Processes:** Testing, back-testing, falsification, plausibility, estimation,...
- **Company:** Does the management understand & use the results of model?

Internal Models for Regulatory Solvency Purposes

- Before an insurer's internal model can be used for regulatory purposes, it must be approved by the supervisor.
- If an internal model is used for internal purposes only, it does usually not have to be approved by the supervisor.

Internal Model Review: Challenge for the Supervisor

When allowing internal models for **regulatory capital calculation**, the problems a regulator faces are:

- How to ensure that the results are **comparable** between different companies?
 - same risk, same result
 - common granularity of results
- How to ensure that a company is not punished if it models risks more conscientiously than its peers?
- How to be able to distinguish between acceptable and not acceptable models?
- How to be certain that a model is deeply embedded within a company?

Internal Model Review: Challenge for the Supervisor

For some type of insurers, models are often assumption driven: Up to 90% of the economic capital requirement due to insurance risks emanates from assumptions and only 10% from historical data.

Often models can not be back-tested.

The review has to rely less on formalized requirements as for VaR market risk engines;

The assessment of models has to rely more on experience, comparison with similar models and embedding of the model within the company.

The regulatory review of models will rely heavily on discussions with quants and actuaries, assessment of company's know-how of the model and its limitations and public transparency.

Regulator needs specialists!

There are limits on what a regulator can demand from internal models of insurers and reinsurers:

- Model verification is impossible.
- Falsification is in many cases unpractical.
- The scientific method cannot be formalized. There can be no set of guidelines codifying the model approval process.
- We need to accept that some properties of a model cannot be ,proven` statistically (e.g. some dependency structures, some parameters).
- Models can, however, be persuasive.

Internal Models: Déjà vu?

- The term "internal model" is usually applied to models which determine risk.
- Some supervisors show **reluctance** for the use of internal models.
- However, internal models have been used since the beginning of insurance for valuing technical provision.

The **IAIS** suggest that an internal model should pass **three tests** before it can be used for determining the regulatory capital requirement:

"Statistical quality test" is about quality of the quantitative part of the model: Are all risks taken into account? Is data complete? Are methods appropriate? Are the distributions reasonable? ...

"Calibration test": The internal model has to provide the risk statement on the level which is prescribed by the solvency regime (e.g. time horizon, risk measure; "modelling criteria")

"Use test": The internal model, its methodologies and its results have to be fully embedded into the risk strategy and the processes of company.

Even worse than having a bad model is having any kind of model – good or bad – and not understanding it.

If internal models are used for regulatory purposes, it will be unacceptable if the model is not understood within the company.

There needs to be

- deep and detailed knowledge by the persons tasked with the upkeep and improvement of the model,
- Knowledge on the underlying assumptions, methodology and limitations by the CRO, appointed actuary etc.,
- Sufficient knowledge to be able to interpret the results and awareness of the limitations by senior management and the board.

The review of internal models can be based on 4 pillars

- Internal Review;
- External Review;
- Review by the Supervisor;
- Public Transparency.

Senior management is responsible for internal models.

The **regulator** is responsible for ascertaining that the review process is appropriate.

Companies using internal models have to disclose publicly the methodology, valuation framework, embedding in the risk management processes etc.

Example of a Process for an Internal Model Review

- **Prephase:** If model is under construction: regular exchange between insurer and supervisor.
- Insurers writes **documentation**. It contains at least the mathematical description of the model. Additionally it should contain: Justifications; how are parameters determined
- Not to forget: Supervisor must have information on the actual portfolio.
- Supervisor performs review of model based on documentation and gives written feedback to insurer.
- **On site inspection:** supervisor visits insurer to look at actual calculations and to interview people.
- The **final** approval or rejection of the model is based both on documentation and on site inspection.



- **Insurers have the right to apply** for the use of a (partial) internal model.



- If the standard model is not suitable, the **FINMA requires insurers** to develop and use (partial) internal models. In particular, the following companies must use an internal model:

- Reinsurers (~30)
- Insurance groups (9)
- Most life insurance companies (~20)
- Etc.

Corresponds to Article 119 of the Solvency II Framework Directive.

- There is a large overlap of A and B. In total, approximately 80 (includes partial) internal models are in use. (135 insurers have to perform an SST.)

Approval of Internal Models takes a long time.

- A full internal model of an insurance company is a complex system.
- Documentation is often inappropriate for approval process.
- Many internal models do not sufficiently reflect the risks according to SST requirements.
- Insurers resist to apply changes of internal models required by the supervisor.
- Internal Models change over time (e.g. annually).

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

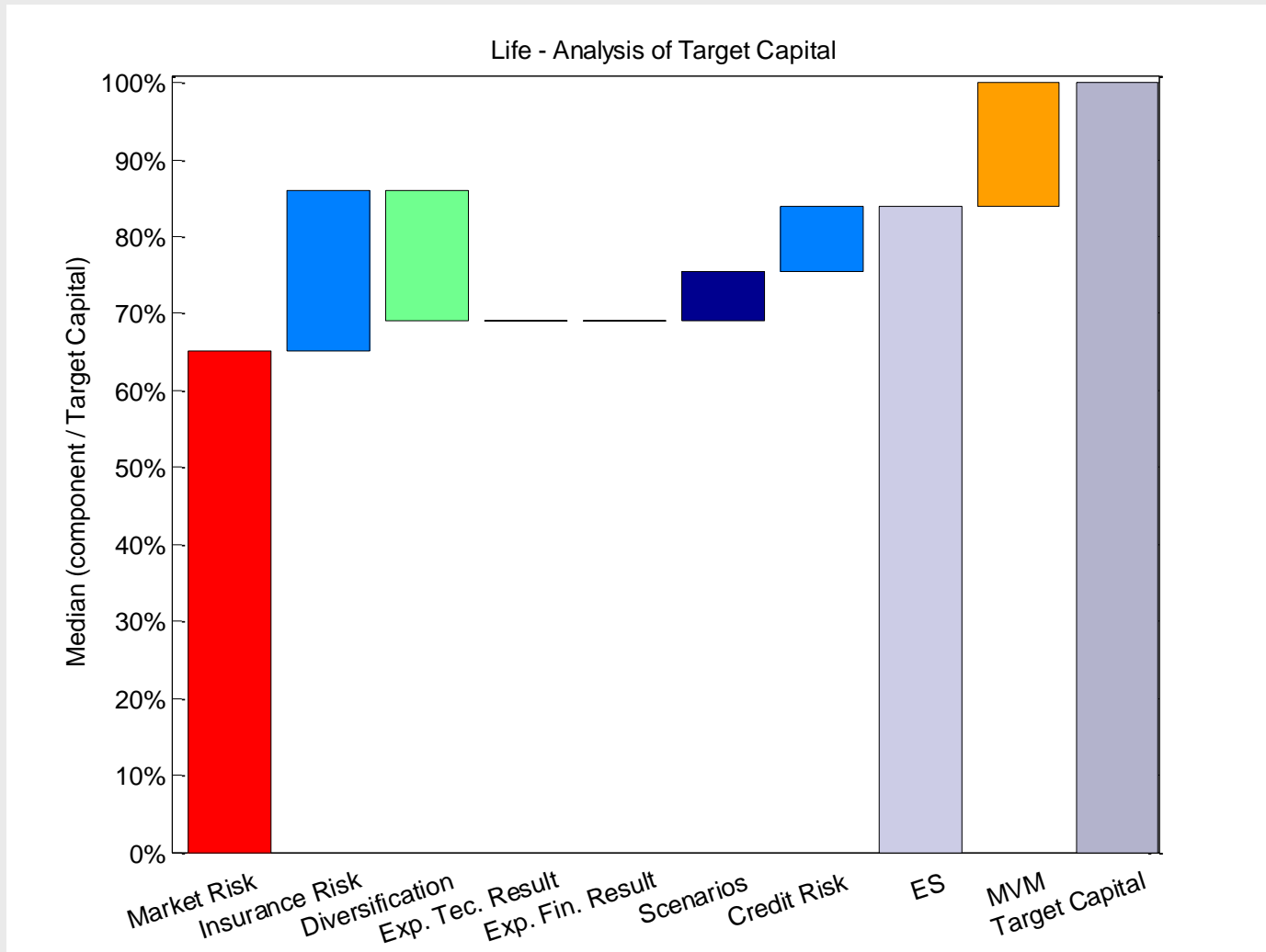
Overview: SST results 2009 and 2008



	2009		2008	
	Number of SST Reports	Number with SST-Ratio <100%	Number of SST Reports	Number with SST-Ratio <100%
Life	21	9	21	1
Nonlife	58	4	57	5
Health	19	0	18	0
Reinsurers	30	2	29	2
Total	128	15	125	8

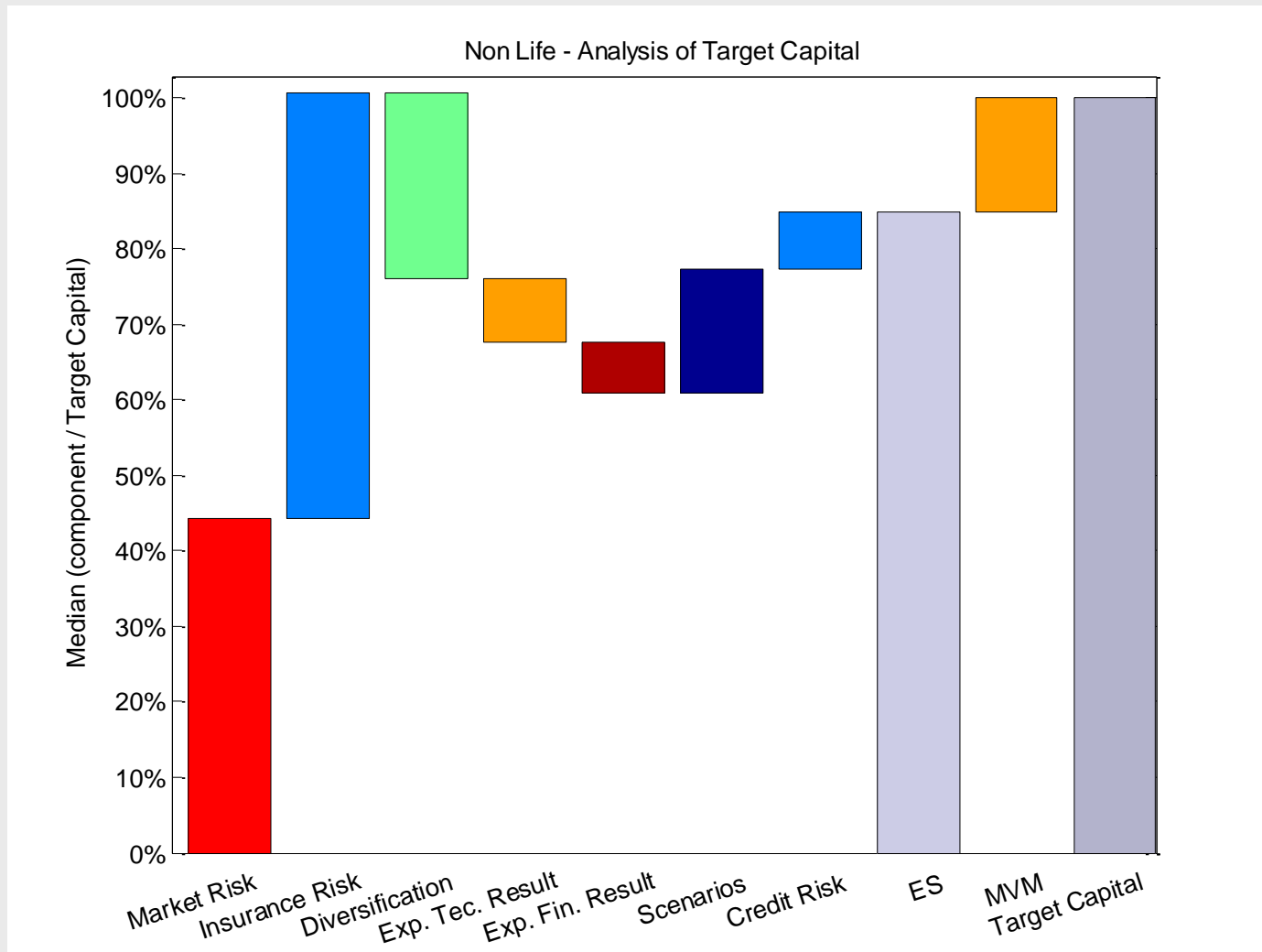
Components of Target Capital (SCR)

Life companies, 2009



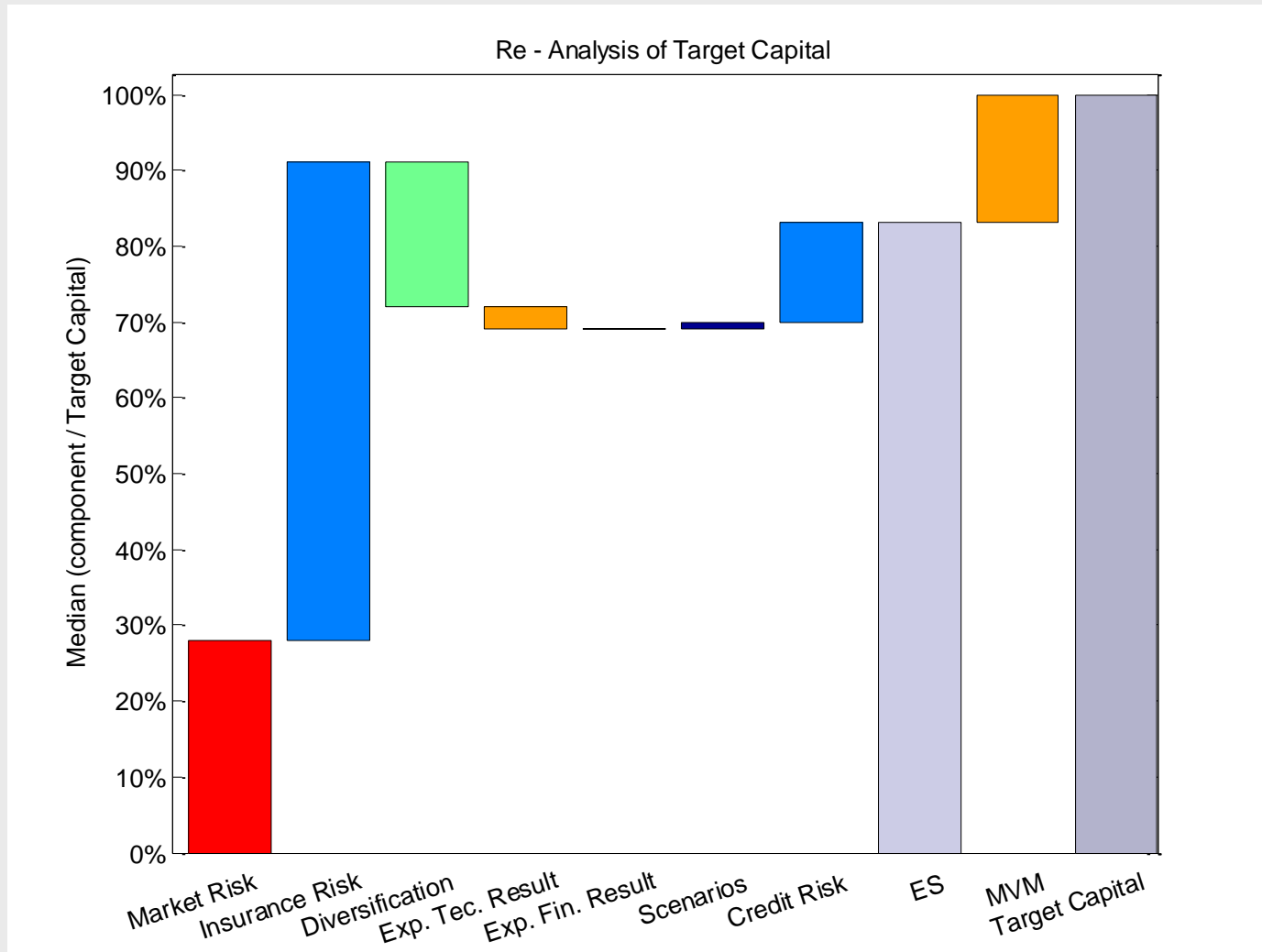
Components of Target Capital (SCR)

Non life companies, 2009



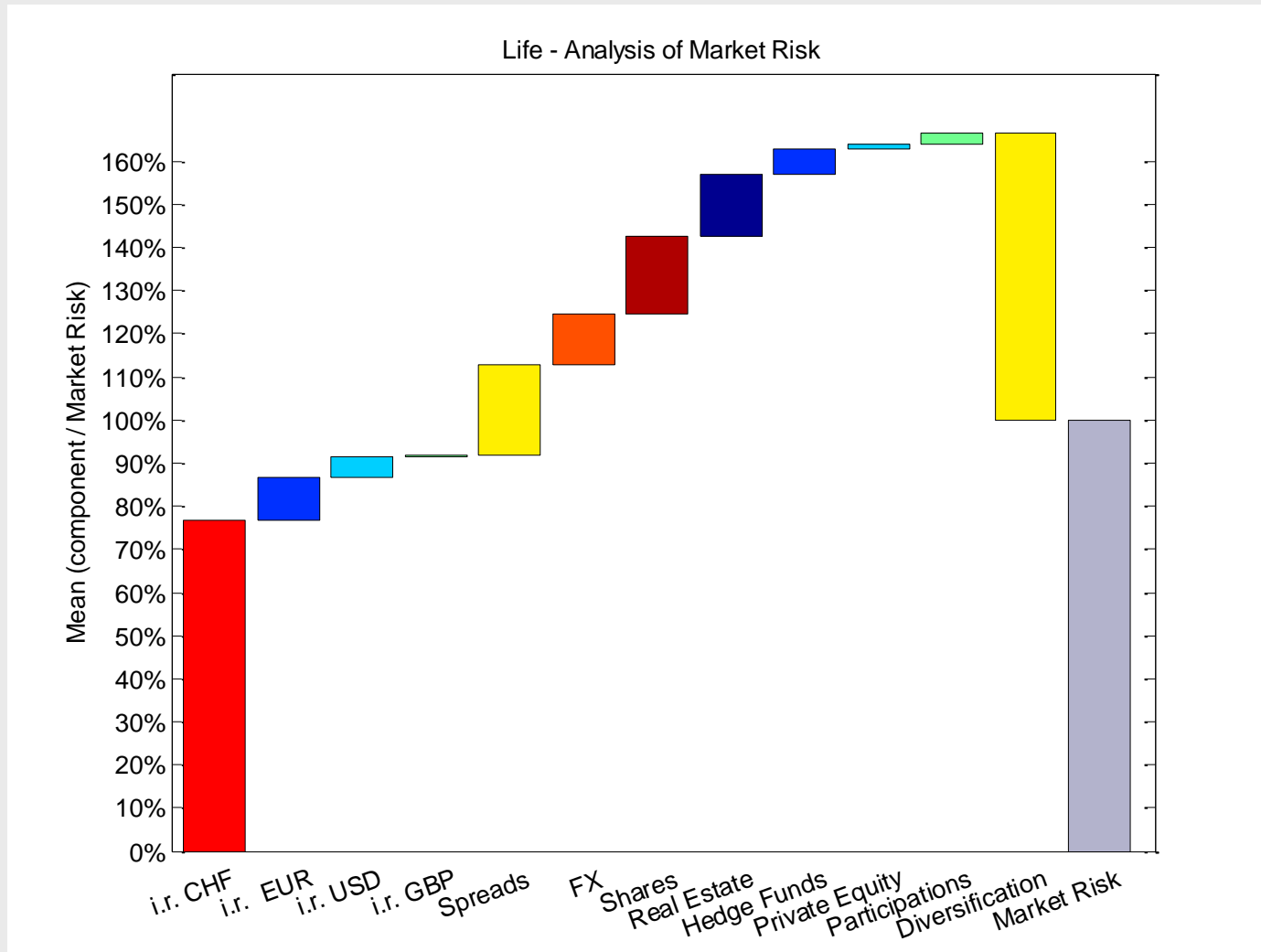
Components of Target Capital (SCR)

Reinsurers, 2009



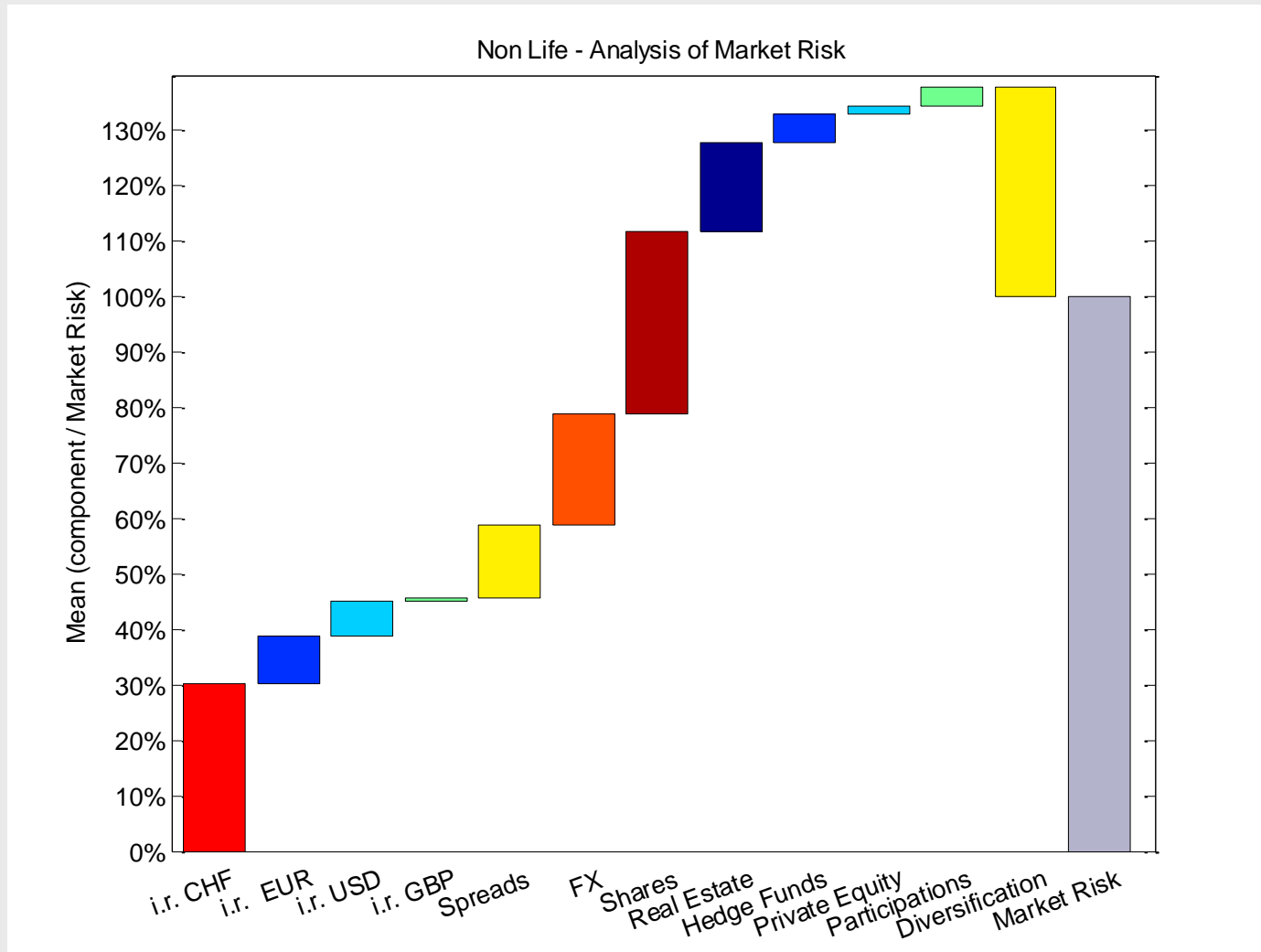
Market risks

Life companies, 2009



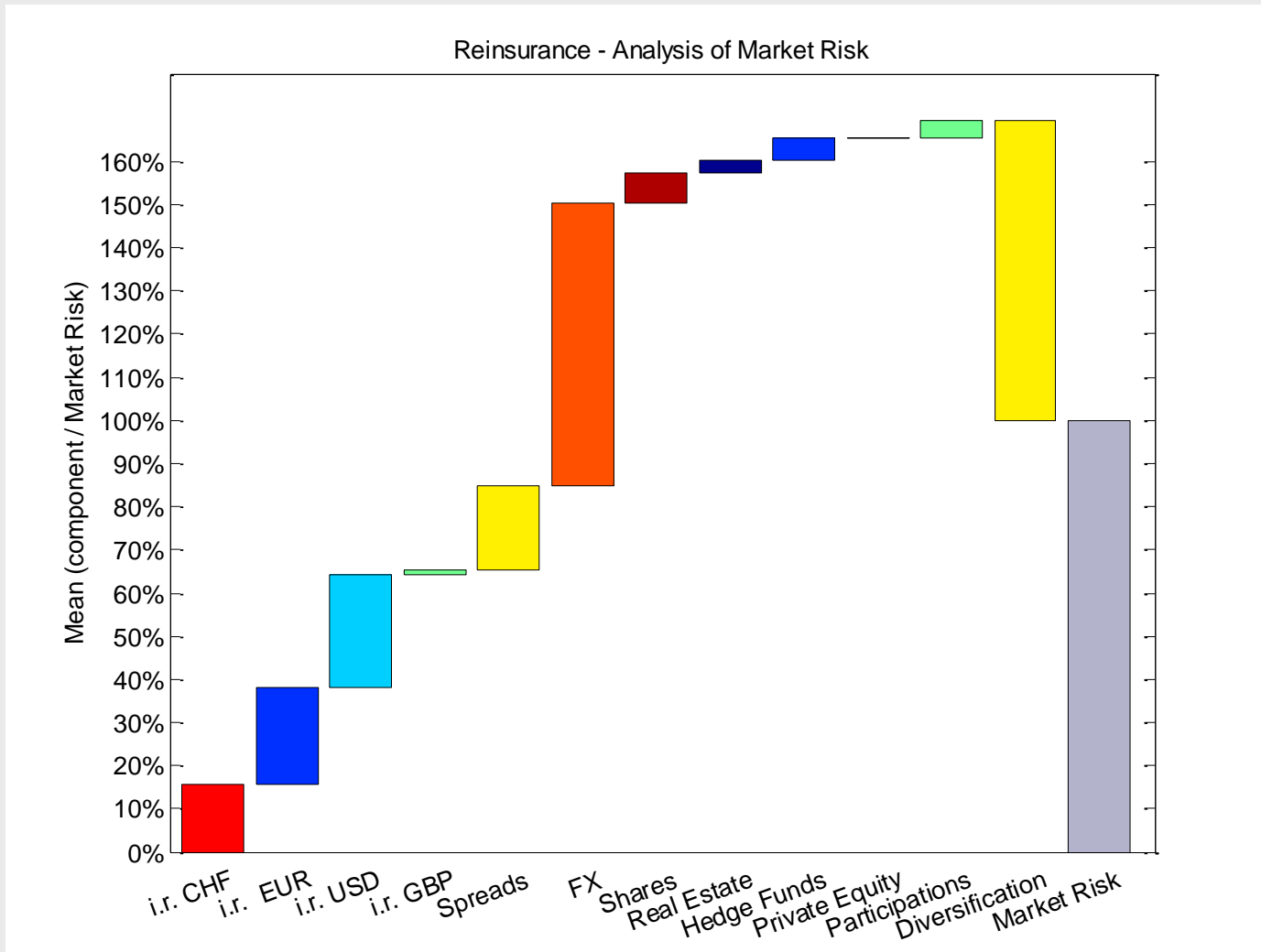
Market risks

Non life companies, 2009



Market risks

Reinsurers, 2009



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<http://www.finma.ch/e/beaufsichtigte/versicherungen/schweizer-solvenztest/pages/default.aspx>