Solvency II: Principi e modelli per il calcolo del rischio nell'assicurazione vita

Milano, 11 ottobre 2012

AGENDA

Solvency II Framework

1. An Introduction to Solvency II
2. Solvency 2 Definitions: Available Capital and Capital Requirement
3. Best Estimate of Liabilities: calculation process and examples
4. Required Capital: calculation process and examples
5. Applying Solvency II models: Risk Drivers and Practical Examples
6. New Products and Capital Absorption: definitions and examples

AGENDA

Solvency II Framework

1. An Introduction to Solvency II
2. Solvency 2 Definitions: Available Capital and Capital Requirement
3. Best Estimate of Liabilities: calculations process and examples
4. Required Capital: calculations process and examples
5. Applying Solvency II models: Risk Drivers and Practical Examples
6. New Products and Capital Absorption: definitions and examples

Where are we?

We are defining rules to ensure the financial stability of an insurance and reinsurance company

1. adequacy of **technical provisions** to meet insurance obligations towards the policyholders;
2. availability of **eligible and sufficient assets** to cover the technical provisions;
3. respect of a minimum capital adequacy requirement (SCR)
   1. **Calculation of the SH capital invested in the company (available capital)**
   2. **Calculation of the capital requirement**
   3. **Verify that Available Capital > Capital Requirement**

Where are we?

Current EU rule: “Solvency 1”

Available Capital = Net Asset Value (local GAAP) + adjustments for assets eligibility

Capital Requirement =

1. **4% x Reserves = “measuring the financial risks”**
2. **0.3% x Sum at Risk = “measuring the demographic risks”**

Next Future: “Solvency 2”

Available Capital = Net Asset Value (based on the market evaluation of assets and liabilities)
Capital Requirement (SCR) = The capital requirement is based on the market evaluation of assets and liabilities, considering the effective risks which the undertakings are exposed to

Solvency II Directive

Solvency II is based on a three pillars approach:

SOLVENCY II FRAMEWORK

Pillar I
Capital Requirements

- Assets and Liabilities Valuation (market consistent)
- Available Capital / Own Funds: Tier 1, Tier 2, Tier 3
- Capital Requirements:
  - Solvency Capital Requirement (SCR)
  - Minimum Capital Requirement (MCR)

«CALCULATIONS & NUMBERS»

Pillar II
Supervisory Review

- Supervisory power and processes
  - Capital add-ons
  - Pillar II dampener
- Corporate Governance
  - Risk Management
  - Internal Audit
  - Actuarial functions
  - Compliance
- ORSA (Own Risk and Solvency Assessment)

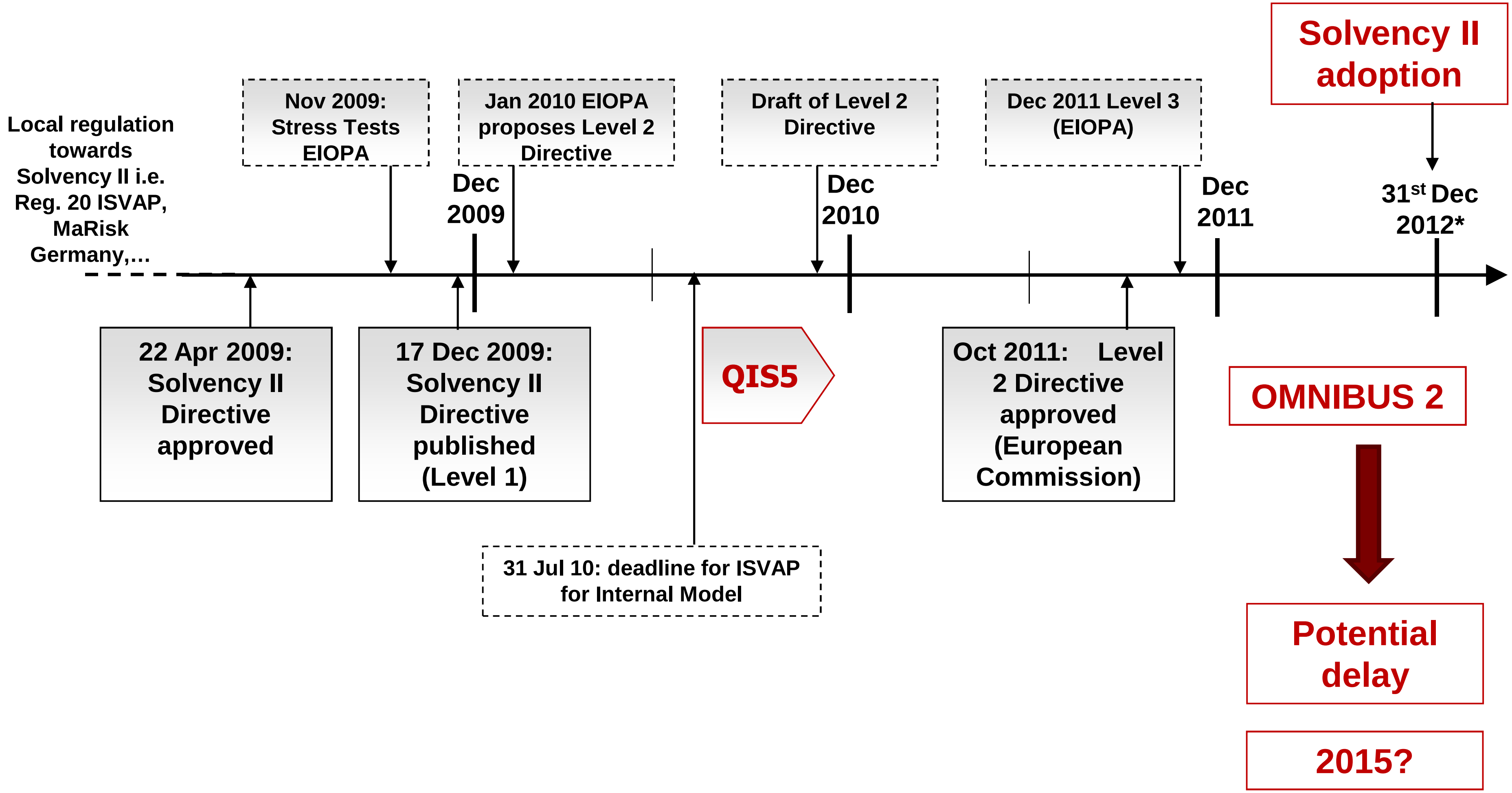
Fomal Requirement to enhance the real «Risk Management»

Pillar III
Disclosure Requirements

- Report to the market
- Report to the Supervisory Authority

Reporting Consistency between pillars and system

Solvency II timeline



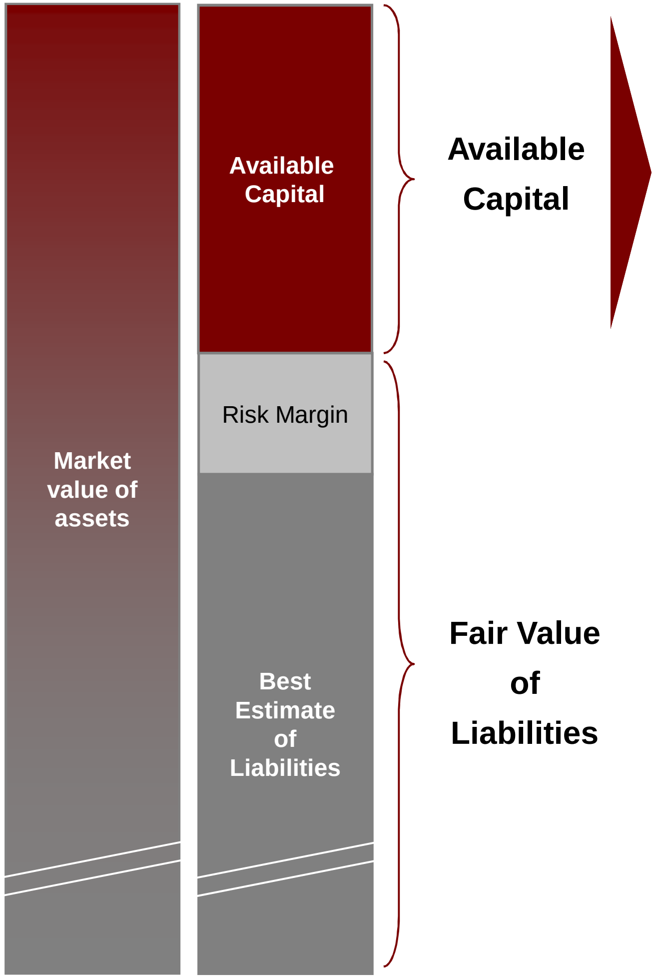
(*) The European Commission is considering the proposal of postponing the date of entry into force of the Directive from 31 October 2012 to 31 December 2012.

AGENDA

Solvency II Framework

1. An Introduction to Solvency II
2. Solvency 2 Definitions: Available Capital and Capital Requirement
3. Best Estimate of Liabilities: calculation process and examples
4. Required Capital: calculation process and examples
5. Applying Solvency II models: Risk Drivers and Practical Examples
6. New Products and Capital Absorption: definitions and examples

Methodology: Available Capital



Available Capital under Economic Balance Sheet

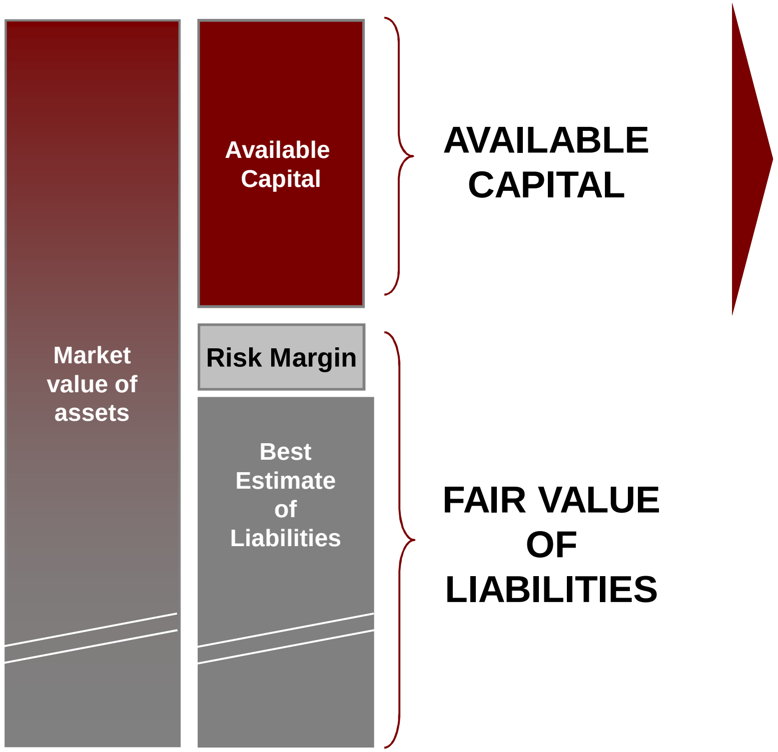
- **Available Capital** is the difference between the fair value of assets and the fair value of all liabilities
- **Fair Value of Insurance Liabilities** is estimated by projecting and discounting all future cash flows on a market consistent basis. It has two components: the Best Estimate Liability (BEL) and the Risk Margin.
  - BEL is based on market values where they exist, and on estimates of market values where they do not exist (mark to model approach)
  - Risk Margin reflects the margin required over BEL for situations where market prices cannot be observed, and is calculated using a cost of capital approach.
  - Fair Value of Liabilities also includes the **deferred tax liability** from tax on profits that are expected to emerge on the difference between fair values and fiscal values of assets and liabilities.

Methodology: Risk Capital

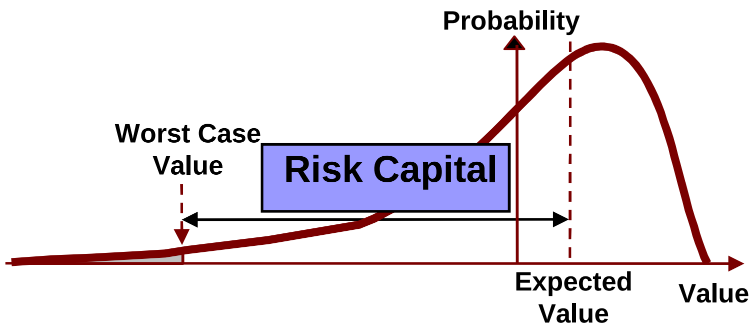
Risk Capital under Economic Balance Sheet

Risk Capital (SCR) is the capital necessary to absorb the maximum loss of Available Capital, identified according t**o a 1-year value** at risk approach, at a specified confidence level consistent with **the risk appetite**: at **99.5% (BBB) for Solvency II** purposes.

Total Balance Sheet Approach



Distribution of Available Capital

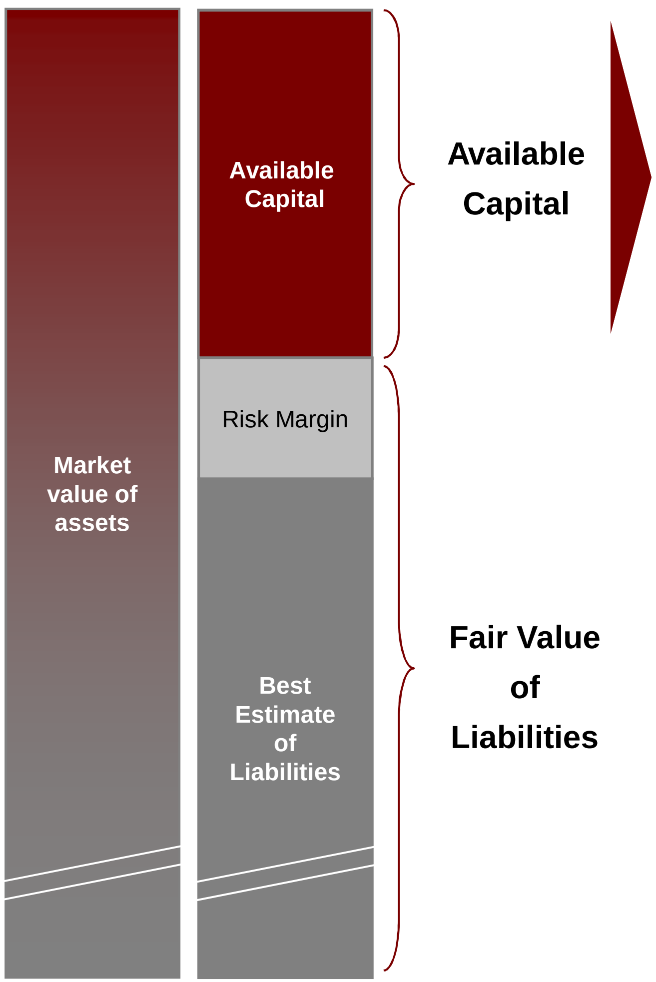


- **Risk Capital** is equal to the **difference between Available Capital (expected value) and Available Capital (worst case value) after the "worst-case scenario"** (1-year value at risk approach, at a confidence level consistent with the risk appetite)
- The mentioned **"worst-case scenario"** is referring to the joint occurrence of negative outcomes of the different risks

AGENDA

Solvency II Framework

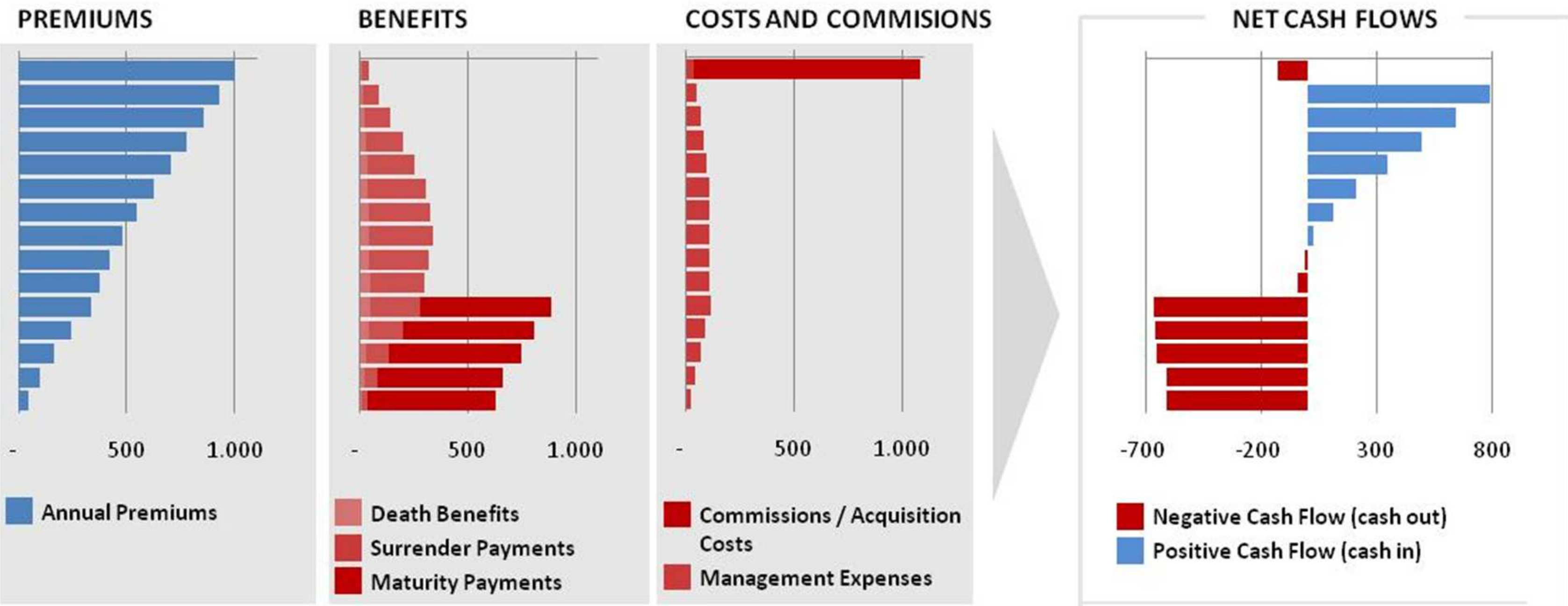
Methodology: Available Capital



Available Capital under Economic Balance Sheet

- **Available Capital** is the difference between the fair value of assets and the fair value of all liabilities
- **Fair Value of Insurance Liabilities** is estimated by projecting and discounting all future cash flows on a market consistent basis. It has two components: the Best Estimate Liability (BEL) and the Risk Margin.
  - BEL is based on market values where they exist, and on estimates of market values where they do not exist (mark to model approach)
  - Risk Margin reflects the margin required over BEL for situations where market prices cannot be observed, and is calculated using a cost of capital approach.
  - Fair Value of Liabilities also includes the **deferred tax liability** from tax on profits that are expected to emerge on the difference between fair values and fiscal values of assets and liabilities.

BEL = Present Value of Net Cash Flows



- Contractual rules on premium payments
- PHs persistency assumptions

- Biometric assumptions:
  - Mortality
  - Morbidity
- PHs beahviour:
  - rational (vs mkt)
  - «irrational»
- Benfits revaluation:
  - Minimum guarantee
  - Asset Allocation

- Contracts with distribution channels
- Maintenance/administrative expense assumptions
- Inflation assumption

- Assumptions on the PHs:
  - Behavioural (lapse);
  - Biometric (mortality/morbidity)
- Economic / Financial Assumptions
  - Investment return
  - Inflations, expenses

BEL: Assets Projection

Returns on investments are used to:
- Finance the minimun guarantees
- Finance the revaluation of benefits/payments
- Produce financial profits

Returns derive from:
- Fixed interests bonds
- Dividends, and rental incomes; floating bonds
- Trading activity (capital gains and losses)

FOCUS ON:
- The assessment is based on a «closed portfolio», without expected inflows deriving from future new contracts.
- The maturity mismatch between assets and liabilities can produce disinvestment and/or reinvestment costs.

How to project?

For each security the coupons /dividends and its market value have to be projected:

10-YEARS BTP PROJECTION

- The coupon is fixed until maturity (10 year). Thereafter it is re-set at the current market levels
- The market value is always sensitive to the interest rate levels

EQUITY PROJECTION

- Dividends are uncertain, starting from the first year
- The market value of the equity is more volatile than the market value of the bond

PORTAFOGLIO ATTIVI

After having defined the asset allocation (% Bond, % Equity,..) the expected returns of the portfolio are derived according to each asset class projection

BEL: Asset and Liabilities Projection

…how to project the cash flows considering the assets?

A scenario is defined

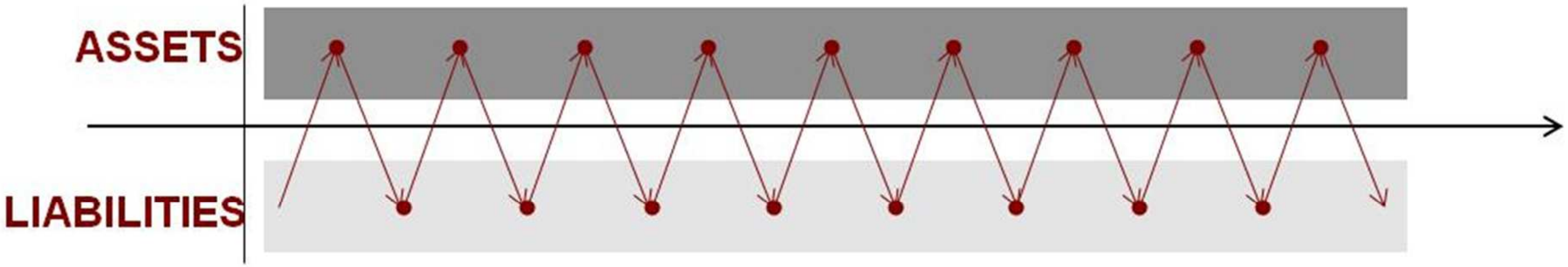
40 years projection for:

- Risk free interest rate term structure
- Corporate bond spread/migration
- Dividends and rental incomes / equtiy and real estate indexes

How is the scenario used?

In the projection, based on the net cash flows:

- the asset allocation must be defined
- the investment returns are derived based on the assets backing the liabilities
- the trading results (capital gains/losses) are calculated



Payments in period **T** depend on assets returns of the previous period (**T-1**).

The fund's return in **T-1** depends on the market returns defined in the scenario and on the **management actions** (i.e. buy/sell of securities).

BEL: Methodological Aspects

Future Cash Flows and Best Estimate Breakdown

TP.1.213. *Future cash-flows also need to be split into guaranteed and discretionary benefits because, as stated in Article 108 of the Level 1 text, the loss absorbing capacity of technical provisions is limited by the technical provisions relating to the future discretionary benefits. The risk mitigation effect provided by future discretionary benefits shall be no higher than the sum of technical provisions and deferred taxes relating to those future discretionary benefits.*

CEIOPS Committee of European Insurance and Occupational Pensions Supervisors

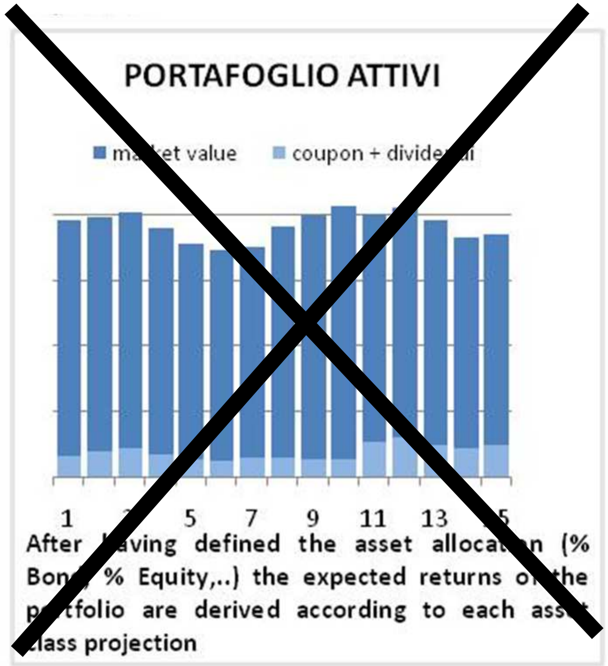
BEL = Minimum guaranteed provisions + Future Discretionary benefits (FDB)

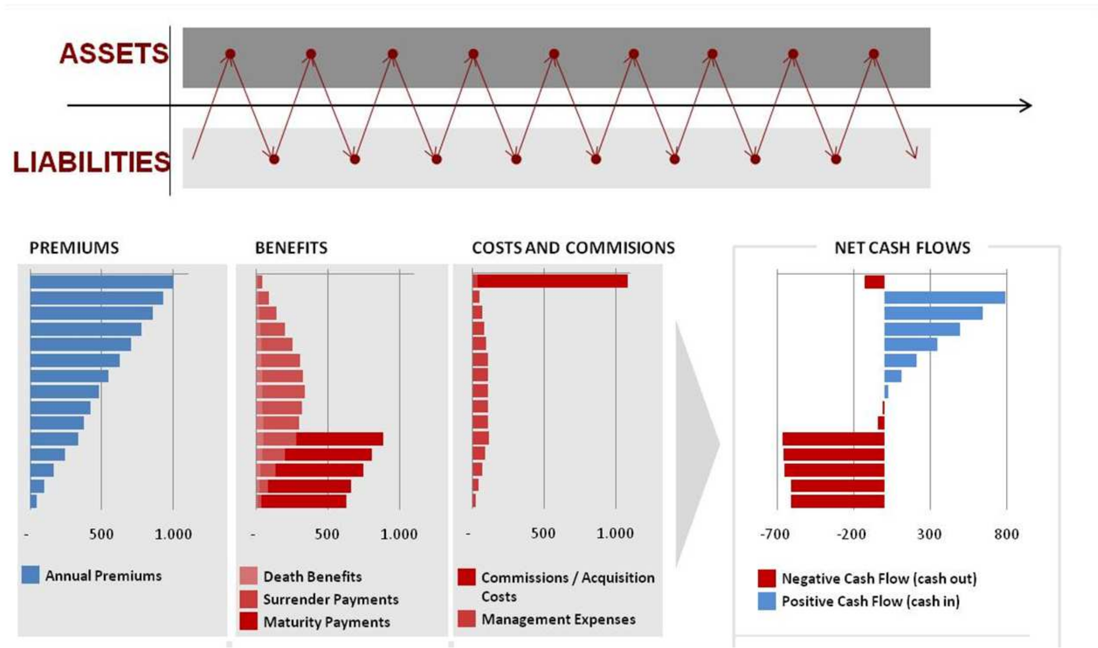
→ **FDB = BEL - Minimum guaranteed provisions**

BEL: Methodological Aspects

How to calculate the minimum guarantee provisions

Deterministic valuation where the revaluation of the benefits is equal to the minimum guaranteed rate of return





Methodology: Understanding the FDB

FDB = BEL - Minimum guaranteed provisions

Example:

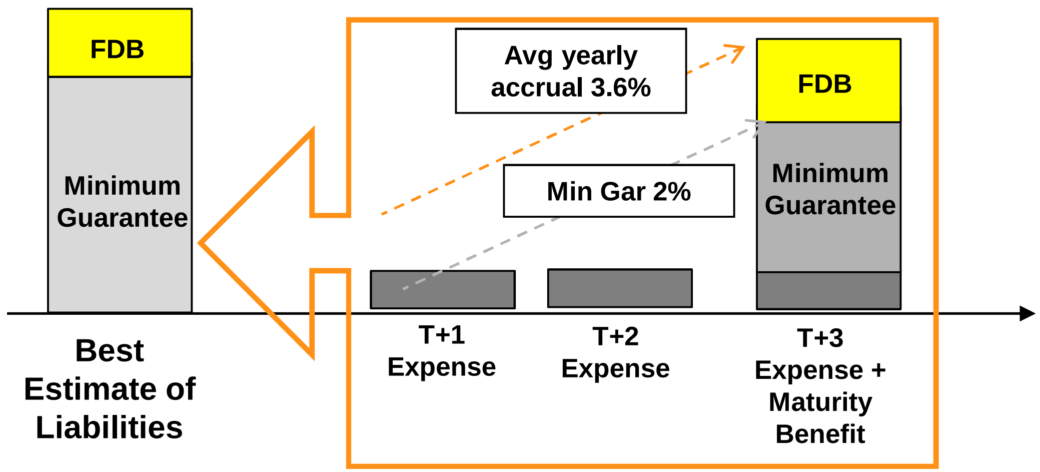
Premium = 100

minimum guarantee for maturity benefits = 2%

profit sharing = 60%

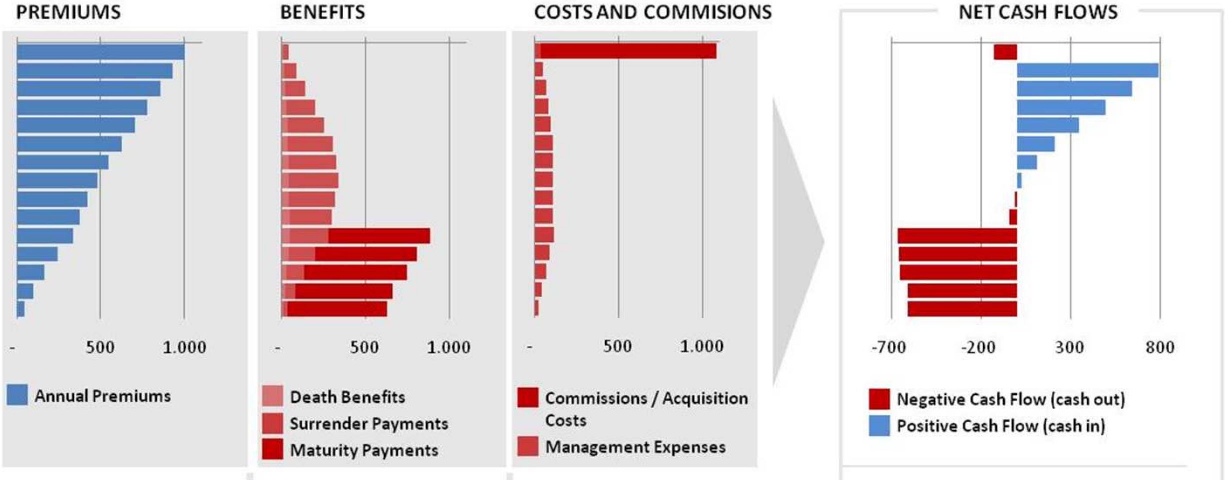
Revaluation = max (2%, 60% x investment return)

- **Projected Return on Asset = 6%**
- **Yearly revaluation**
  = max (2%; 60% x 6%) = 3.6%
- **Maturity Payment**
  = 100 x (1+ 3.6%)^3 = 111
- **Minimum Gurantee Benefit**
  = 100 x (1 + 2%)^3 = 106
- **FDB = 111 – 106 = 5**



BEL: Methodological Aspects

Is the "best estimate" a "good enough" estimate?



CEIOPS-SEC-52/10

***2.2.3.1 Definition** of "best estimate" and allowance for uncertainty*

TP.1.59. *The best estimate shall correspond to **the probability weighted average of future cash-flows taking account of the time value of money, using the relevant risk-free interest rate term structure**.*

TP.1.67. *Valuation techniques considered to be appropriate actuarial and statistical methodologies to calculate the best estimate as required by Article 86(a) include: **simulation, deterministic and analytical techniques** (based on the distribution of future of cash-flows) or a combination thereof.*

Present value of net cash-flows taking into consideration embedded options, if exist

BEL: Methodological Aspects

How the Embedded Options affects the BEL?

- Maturity Benefit before revaluation = 100
- Expected Return: 3 possible scenarios 0% - 5% - 10%

Deterministic (Traditional) Approach: Valuation in the Central Scenario:

return	Unit Linked w/o guarantee	Unit Linked 3% guarantee
5%	100 x (1 + 5%) = 105	100 x (1 + 5%) = 105

Correct Approach: Average of the valuation in all the scenarios

return	Unit Linked w/o guarantee	Unit Linked 3% guarantee
0%	100 x (1 + 0%) = 100	100 x (1 + 3%) = 103
5%	100 x (1 + 5%) = 105	100 x (1 + 5%) = 105
10%	100 x (1 + 10%) = 110	100 x (1 + 10%) = 110
avg	(100+105+110) / 3 = 105	(103+105+110) / 3 = 106

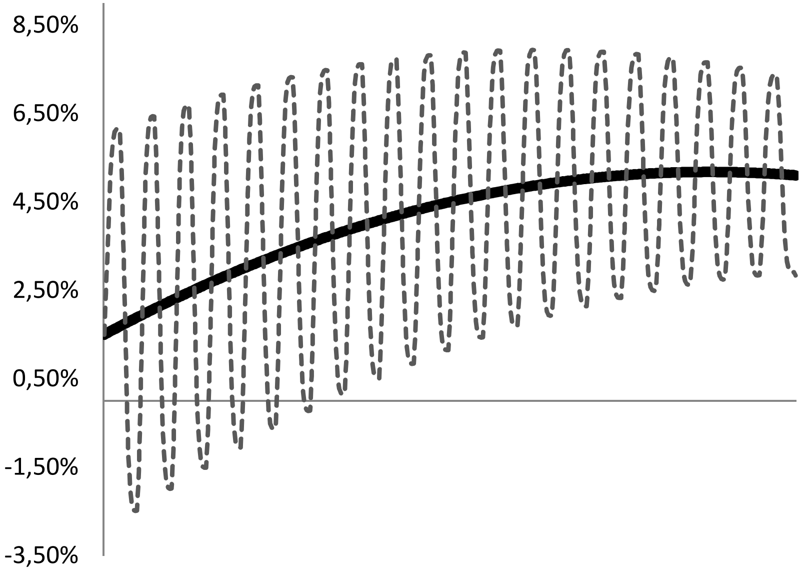
- For Unit Linked w/o guarantee: BEL (centrale) = average BEL (in all the scenarios)
- For Unit Linked with guarantee: BEL (centrale) < average BEL (in all the scenarios)

  106 – 105 = 1 is the cost of the guarantee

BEL: Methodological Aspects

CONTRACT W/O GUARANTEE

Central (no gar) = $AVG_{1000scen}$

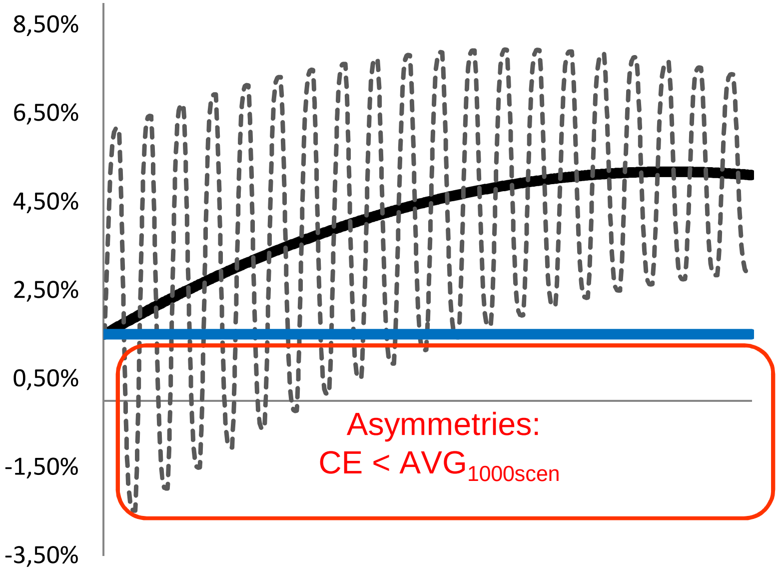


For product without guarantee CE = $AVG_{1000scen}$

No need for stochastic scenarios.

YEARLY GUARANTEE «OUT OF THE MONEY»

Central < $AVG_{1000scen}$



The guarantee is out of the money:

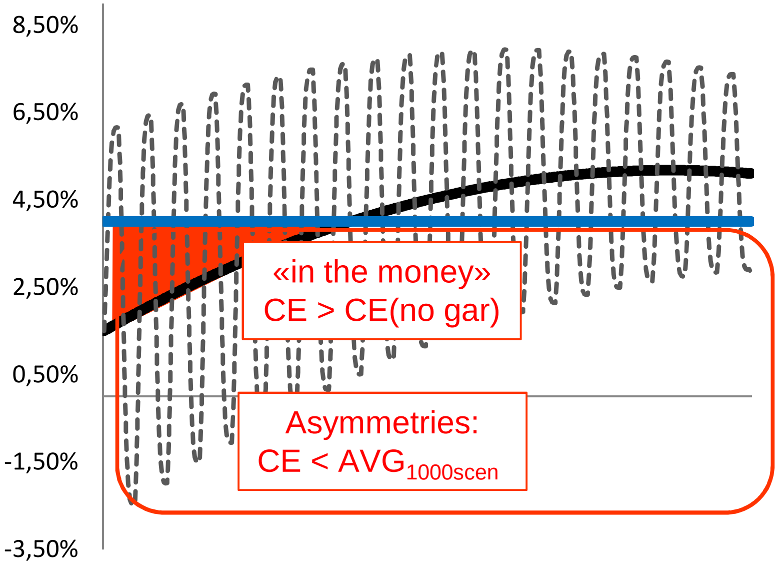
- CE = CE(no gar)
- Cost of the Guarantee = CE - $AVG_{1000scen}$

C.E. curve
Stochastic scenarios
Min Gar

BEL: Methodological Aspects

YEARLY GUARANTEE «IN THE MONEY»

Central < $AVG_{1000scen}$

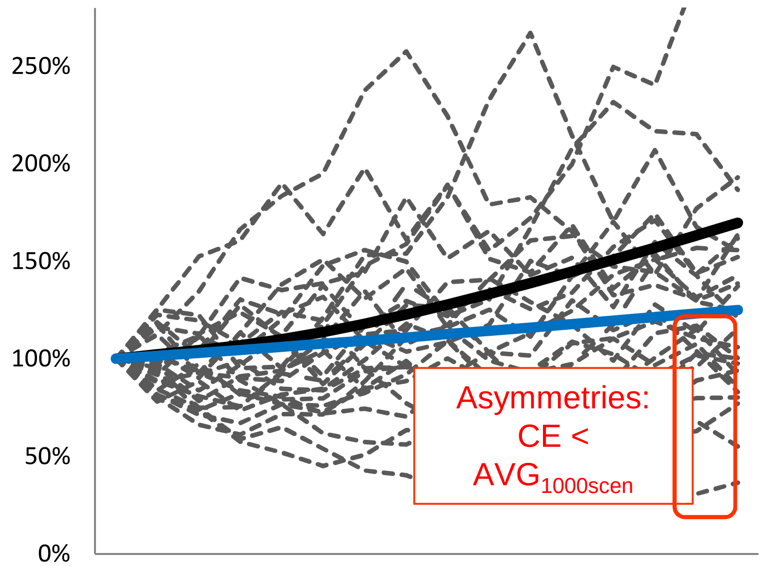


The guarantee is «in the money»:

- CE < CE(no gar)
- Cost of the Guarantee :
  Intrinsic Value = CE – CE(no gar) +
  Time Value = $AVG_{1000scen}$ – CE

AT MATURITY GUARANTEE

Central < $AVG_{1000scen}$



The guarantee is out of the money:

- CE = CE(no gar)
- Cost of the Guarantee = CE - $AVG_{1000scen}$

C.E. curve
Stochastic scenarios
Min Gar

Reserves in the C.E. curve
Reserves in the stochastic scenarios
Reserves at the minimum guarantee

BEL: Methodological Aspects

BEL Calculation: different approaches for different liabilities

Contracts w/o profit sharing and guarantees

1. **Deterministic approach:** for business where cash flows do not depend on, or move linearly with market movements (i.e. business not characterised by asymmetries in shareholder's results), the calculation can be performed using the certainty equivalent approach.
   - Definition of a central scenario to project assets and liabilities and to discount the cash flows

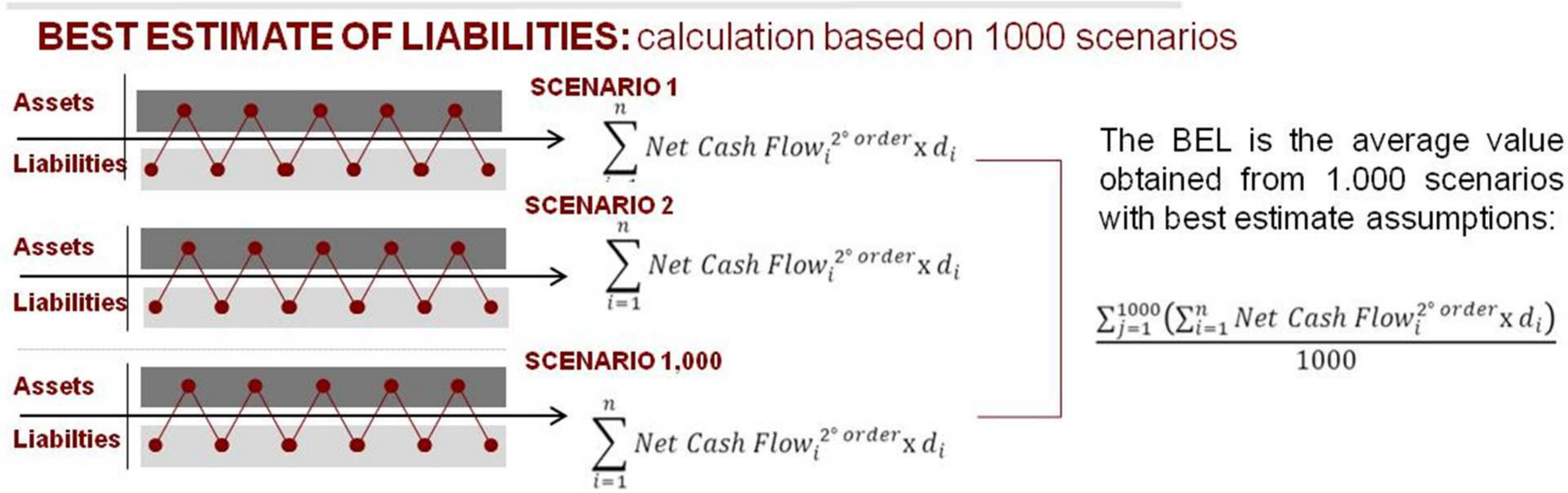
Contracts with "simple" financial options

2. **Analytic Approach:** In case of business where the cash flows generated by the financial options can be easily separated from the underlying liability (e.g. some unit-linked products), **closed form solutions** may be appropriate.
   - Deterministic valuation of the product ignoring the financial options
   - Closed form solutions to determine the value of the financial options (e.g. Black-Scholes formula)
   - It does not allow for any policyholder or management actions.

BEL: Methodological Aspects

Contracts with guarantee and profit sharing

3.Stochastic simulation approach : for business where cash-flows contain options and financial guarantees, characterised by asymmetric relationship between assets and liabilities, e.g. traditional participating business



- ❑ Availability of **Actuarial Tool** to project future cash flows of assets and liabilities (ALM view), which is able to run a full set of economic scenarios, tacking into consideration *management rules* and *policyholder behaviour*
- ❑ Availability of **Application Tool** to generate stochastic scenarios for projections of asset prices and returns

Market Consistent Valuation

A valuation algorithm is a method for converting projected cash flows into a present value. A valuation is *market consistent* if it replicates the market prices of the assets.

The natural method of valuing such assets (or liabilities) would be to calculate the expected value of present value of future cash flows

$$MV = E\left[\sum_t X_t D_t\right]$$

future cash flows at time t

discount factor

The calculation of expected value requires a probability distribution $f_x(x) = Pr(X = x)$

There are two ways of valuing cash flows which must produce equivalent values under the modern financial economic theory:

- discount cash flows at the reference risk rate using risk-neutral probabilities
- consider real world probabilities discounting cash flows with the use of risk-adjusted rate (deflator)

Market Consistent Valuation

Arbitrage-free pricing is the foundation for the basis of financial theory and pricing

If two assets yield the same set of future cash flows, they must have the same price in the market otherwise a risk-free profit (arbitrage opportunity) could be made by taking appropriate positions in the underlying assets

What is the forward price agreed today of an equity in 1 year having:

S = Equity price = 100
g = Expected equity yield = 7%
r = Risk-free growth rate = 3%

i. S*(1+g)/(1+r) = 100*1.07/1.03 = 103.88

ii. S*(1+r) = 100*1.03= 103

Contract	Answer	
	i	ii
Forward	Sell	Sell
Buy one share	-100.00	-100.00
Borrow 100 at risk free	100.00	100.00
Forward price receipts	**103.88**	**103.00**
Repay borrowings	103.00	103.00
Net cash flow	**0.88**	**0.00**

	Arbitrage opportunity	Arbitrage free

Market Consistent Valuation – Risk Neutral

One of the major consequences of the Black and Scholes result is that the value of an option does not depend on the risk preferences of the investor

From the other side, as the risk preferences of investors do not affect the value of the option, any equity risk premium is irrelevant

In the risk neutral valuation

- the expected excess return over the risk reference rate is zero for all the assets
- interest rate used to discount future cash flows is the reference risk rate
- As consequence, the probability are calibrated to the market

	time 0	time 1		
		Scenario 1	Scenario 2	Expected return
Reference rate		3%	3%	
Equity price	100	115	95	3%
Bond	100	103	103	3%
Probability		40%	60%	

$$100 = \frac{115 * p_1 + 95 * (1 - p_1)}{1 + 3\%}$$

Market Consistent Valuation – Real World

In the real world investors are not risk neutral and risk premiums are a fact of life in investment decisions which themselves affect the performance of assets.

Moving from a risk-neutral to real world

- The return of the assets changes, reflecting the risk premiums of investors for assets with different risk characteristics and this happen in tandem with the use of the real probability distribution of return
- To produce a market consistent valuation, the reference rate can no longer be used and a risk-adjusted rate for each scenario (deflator) has to be derived

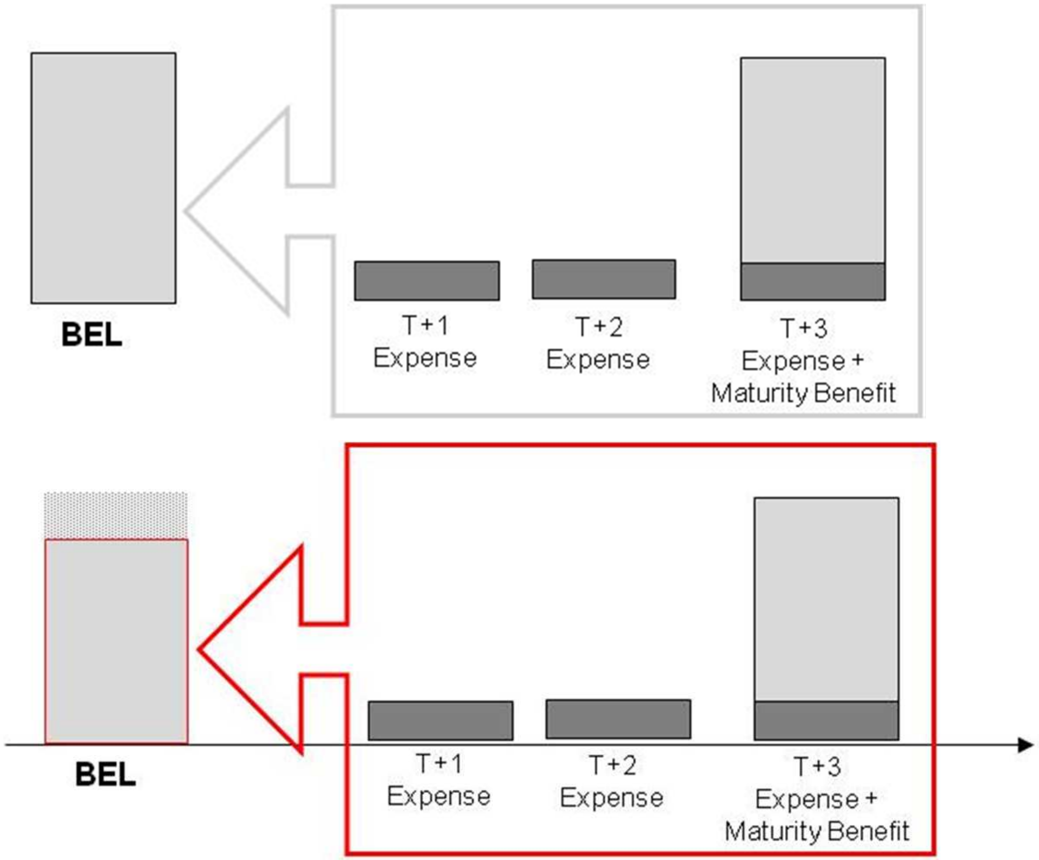
	time 0	time 1		
		Scenario 1	Scenario 2	Expected return
Deflator		86.3%	105.9%	
Equity price	100	115	95	4%
Bond	100	103	103	3%
Probability		45%	55%	

$$\begin{cases} 100 = 103 * p_1 * d_1 + 103 * p_2 * d_2 \\ 100 = 115 * p_1 * d_1 + 95 * p_2 * d_2 \end{cases}$$

Market Consistent Valuation

In the Risk Neutral Environment, setting the risk free rates has always 2 effects on the calculation of the Best Estimate of the Liabilities:

A: It defines the "discount factors"

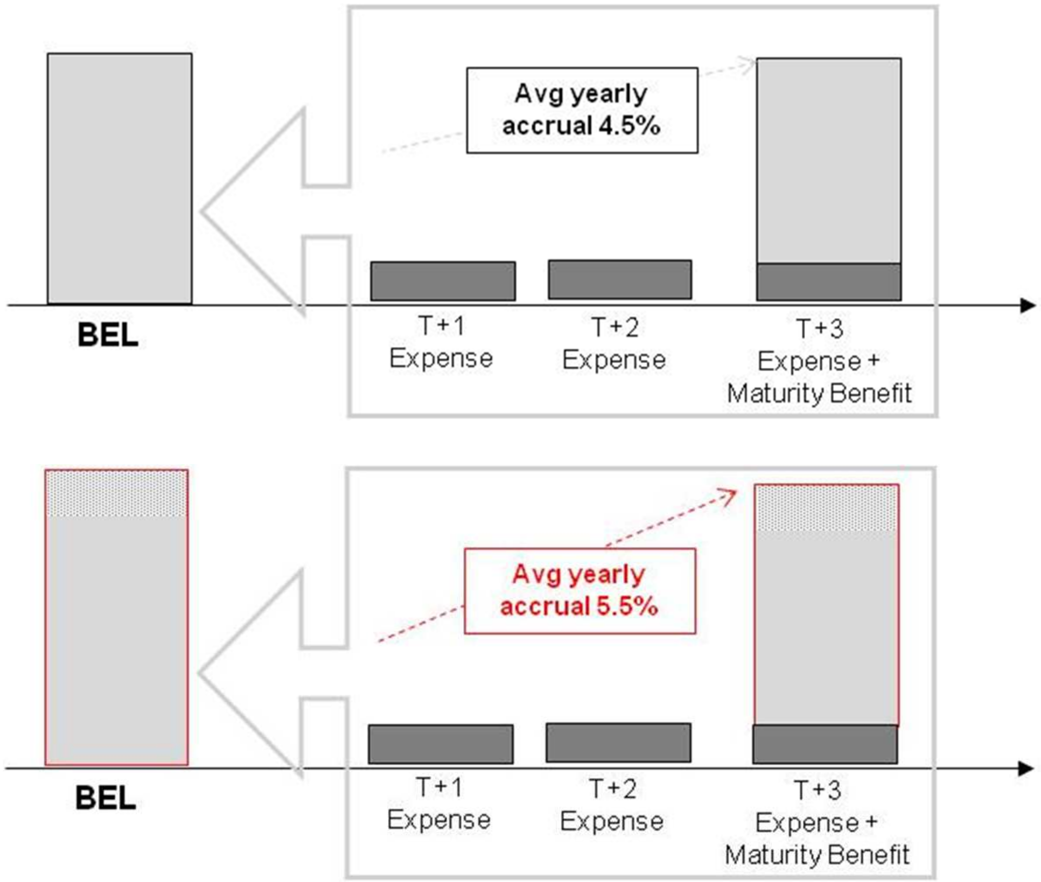


Increasing the risk free rates, increase the discount factors, decrasing the BEL

Market Consistent Valuation

In the Risk Neutral Environment, setting the risk free rates has always 2 effects on the calculation of the Best Estimate of the Liabilities:

B: It defines the average expected return on the assets



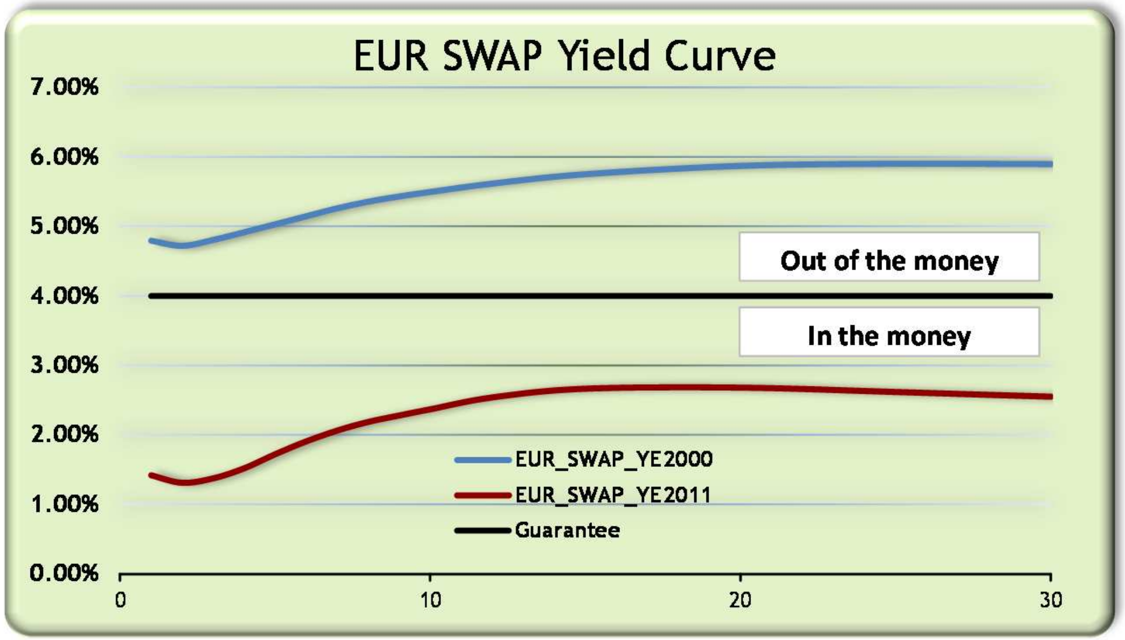
Increasing the risk free rates, increases the projected returns, increasing the BEL

Why Economic Scenario Generators?

The financial products sold by insurance companies often contain guarantees and options of numerous varieties, (i.e. maturity guarantee, multi-period guarantees)

At the time of policy initiation, the options embedded in insurance contracts were so far out-of-the-money, that the companies disregarded their value as it was considered negligible compared with the costs associated with the valuation.

In light of current economic events and new legislations, insurance companies have realised the importance of properly managing their options and guarantees and it is one of the most challenging problems faced by insurance companies today.



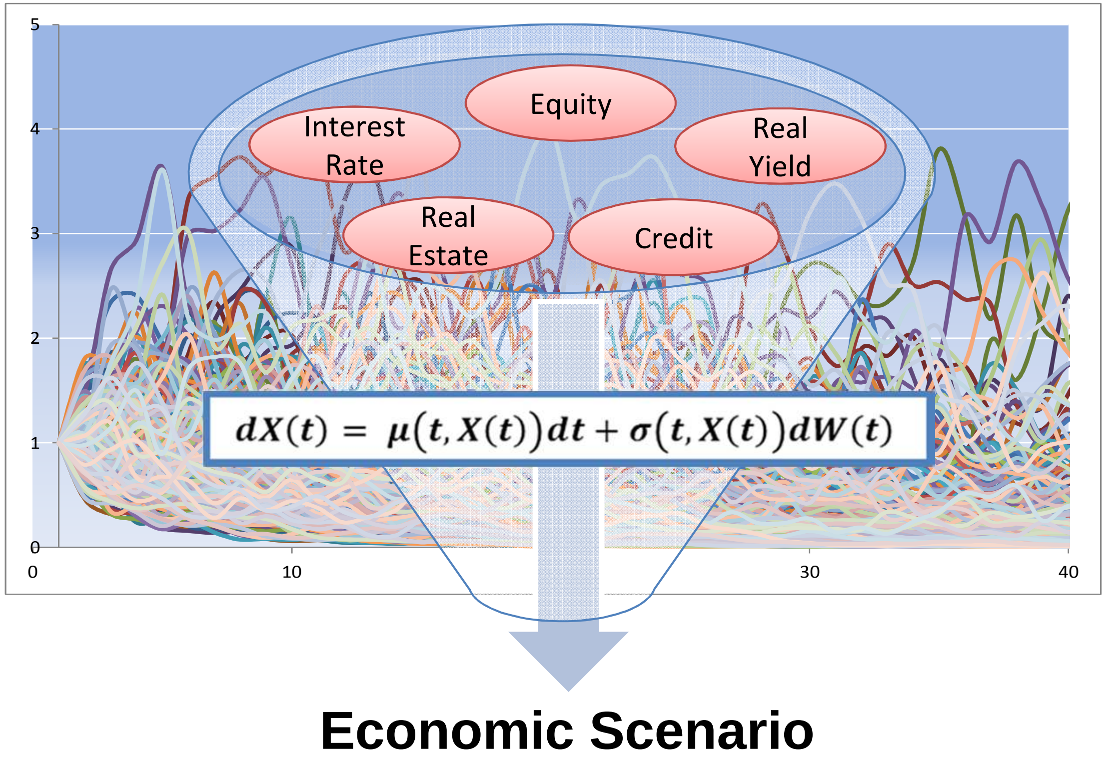
Economic Scenario Generators

Real world

- reflect the expected future evolution of the economy by the insurance company (reflect the real world, hence the name)
- include risk premium
- calibration of volatilities is usually based on analysis of historical data

Market consistent

- reproduce market prices
- risk neutral, i.e. they do not include risk premium
- calibration of volatilities is usually based on implied market data
- arbitrage free



Economic Scenario Generators – Interest rate models

The interest rate model is a central part of the ESG, as the price of most of the financial instruments are related to interest rates.
A large number of models have been developed in the few decades:

Short rate: based on instantaneous short rate

- **Equilibrium** or endogenous term structure
  term structure of interest rate in an output
  Vasicek (1977), *Dothan* (1978), *Cox-Ingersoll-Ross* (1985)

- **No-arbitrage**
  match the term structure of interest rate
  Hull-White (1990) $\boxed{dr(t) = [\theta(t) - a(t)r(t)]dt + \sigma(t)dW(t)}$
  Black-Karasinski (1991) $\boxed{d\ln(r(t)) = [\theta(t) - a(t)\ln(r(t))]dt + \sigma(t)dW(t)}$

Instantaneous rate not observable in the market

Good pricing only for atm asset

Arbitrage free, are perfect for market consistent valuation

Easy to calibrate

- **Forward rate**: based on instantaneous forward rate
  instantaneous forward Heath-Jarrow-Morton (1992)

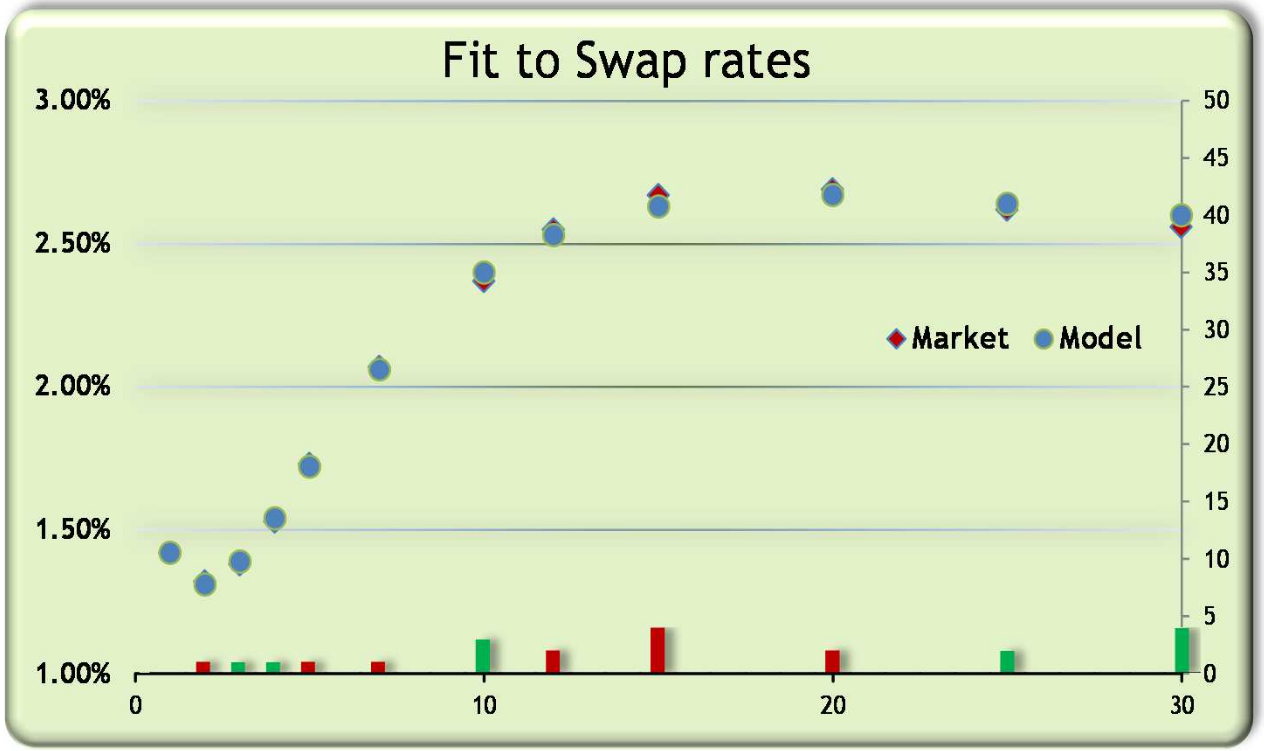
Hard to calibrate

- **LIBOR and swap market**: describe the evolution of rates directly observable in the market

Good pricing only for all assets

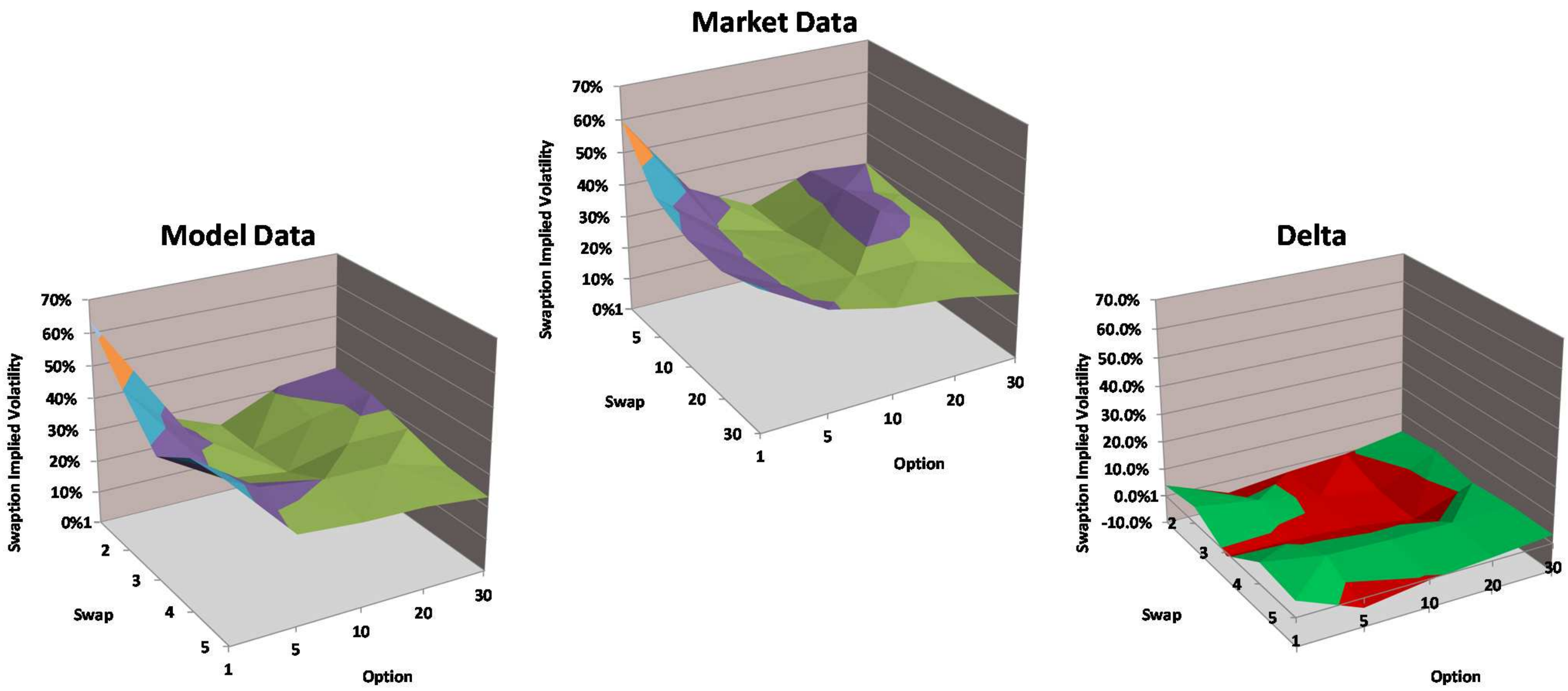
Economic Scenario Generators – Interest rate models

Considering interest rate models where the **market** yield curve is a direct input, it is possible to derive an excellent-fitting **model** yield curve (the **delta** are really unimportant).



Economic Scenario Generators – Interest rate models

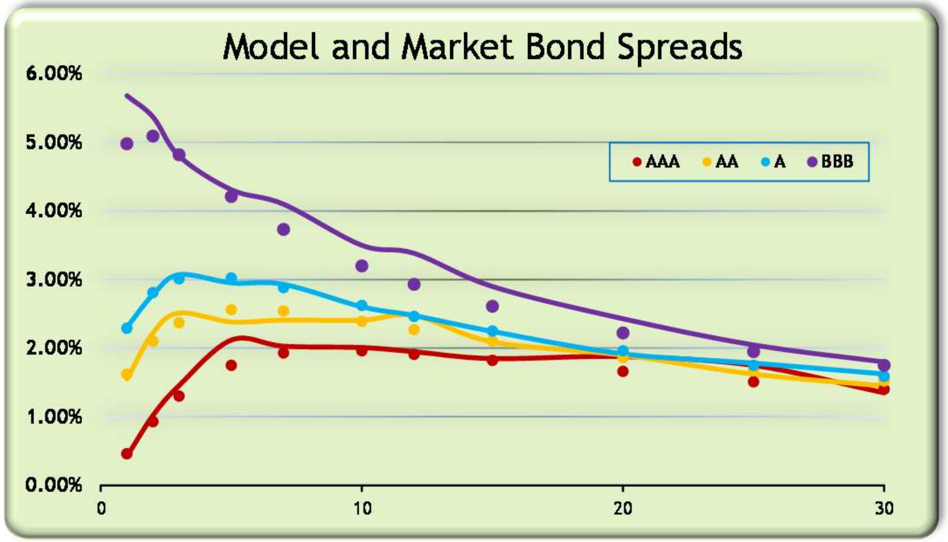
The calibration of the **volatility** of the term structure is based on swaption prices, since these instruments gives the holder the right, but not the obligation, to enter an interest rate swap at a given future date, the maturity date of the swaption



Economic Scenario Generators – Credit model Calibration

The most used Credit model is the Jarrow, Lando and Turnbull (1997) that is able to

- fit **market credit spread** for each rating class matching a single spread of a given rating and maturity
- provide a risk-neutral probability through **annual transition matrix** moving bonds to a different rating class (including default)



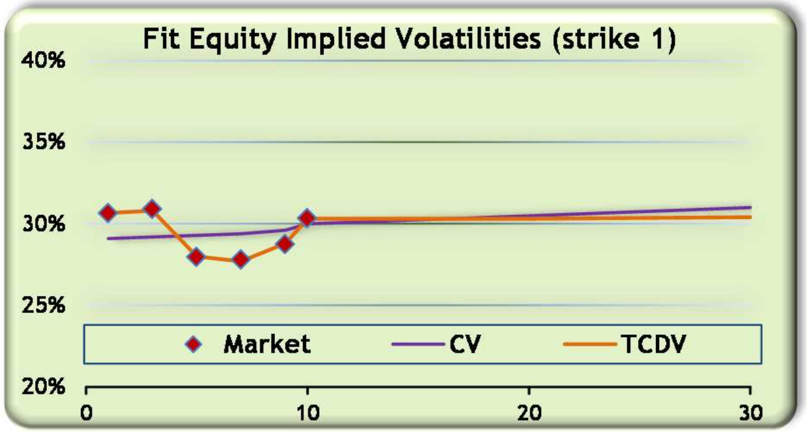
Rating at start of period	Rating at End of Period							
	AAA	AA	A	BBB	BB	B	CCC	D
AAA	90.0%	8.0%	1.0%	0.5%	0.3%	0.2%	0.0%	0.0%
AA	2.0%	86.0%	3.0%	2.5%	2.3%	2.2%	1.6%	0.4%
A	1.5%	2.0%	84.0%	5.0%	2.8%	2.4%	1.8%	0.5%
BBB	0.4%	1.8%	2.5%	81.0%	4.0%	3.2%	4.0%	3.1%
BB	0.3%	1.2%	1.3%	7.0%	78.0%	3.5%	4.5%	4.2%
B	0.2%	0.3%	0.5%	2.5%	4.0%	75.0%	5.0%	12.5%
CCC	0.1%	0.2%	0.4%	1.4%	2.0%	3.0%	71.0%	21.9%
D	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%

Economic Scenario Generators – Equity model Calibration

Equity models are calibrated to equity implied volatilities, that are generally traded with terms up to two years; long terms are available over-the-counter (OTC) from investment bank. The choice depends on the users' appetite for sophistication and liability profile

Constant volatility (CV)

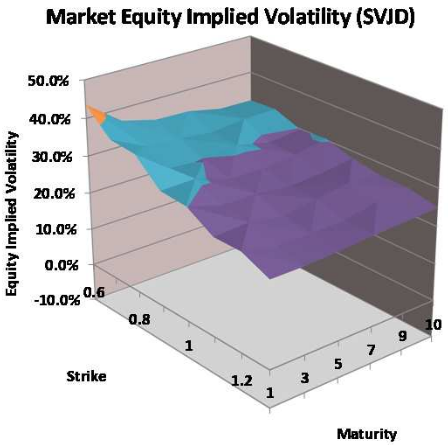
is the Black-Scholes log-normal model implied volatilities of options will be quite invariant with respect to option term and strike.

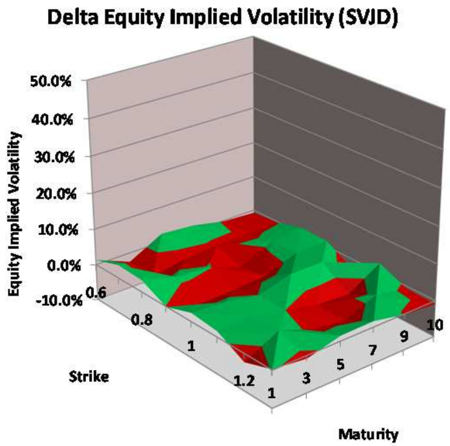


Time varying deterministic volatility (TVDV)

volatility vary by time according monotonic deterministic function

It captures the term structure of implied volatilities but are still invariant by strike





Stochastic volatility jump diffusion (SVJD)

captures the term structure and the volatility skew

Economic Scenario Generators – Reduce Sampling Error

The Monte Carlo technique is subject to statistical error ("sampling error"); to reduce the magnitude of sampling error it is possible to

- ❑ **Run more simulation**: the size of sampling error scales with the square root of the number of simulations. This mean that we would need to run 4 times the number of scenarios to halve the sampling error.
- ❑ **Variance reduction techniques**: "adjust" the simulations, or the cash flows produced by them, or the weights assigned to them in a way that ensures the resulting valuations are still "valid" but the sampling error is reduced.

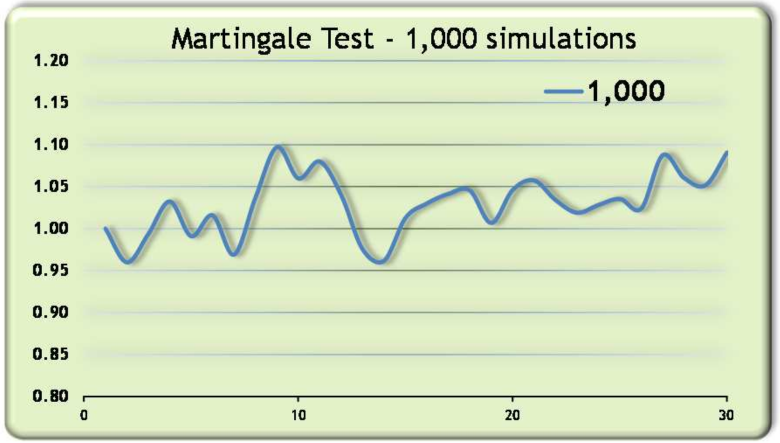
Martingale test is performed verifying that the discounted prices of the asset is the same as today's price

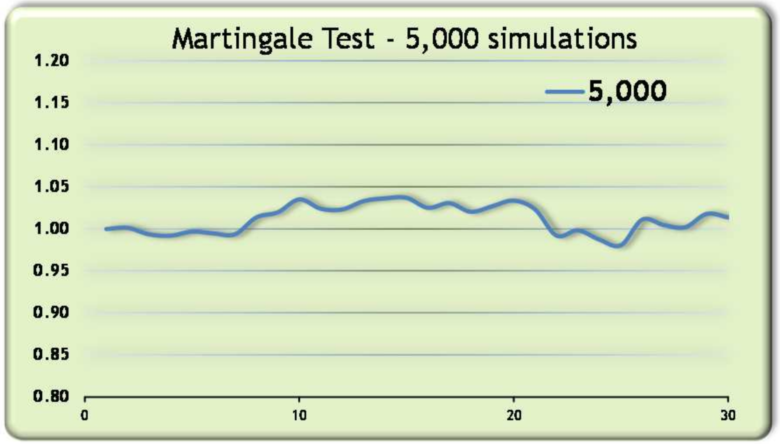
	Equity	Risk free	Deflator	PV Equity
0	1.00			
1	1.05	5%	95.24%	1.00
2	1.10	5%	90.70%	1.00
3	1.17	5%	86.38%	1.01
4	1.23	5%	82.27%	1.01
5	1.29	5%	78.35%	1.01
6	1.35	5%	74.62%	1.01
7	1.42	5%	71.07%	1.01
8	1.49	5%	67.68%	1.01
9	1.58	5%	64.46%	1.02
10	1.66	5%	61.39%	1.02

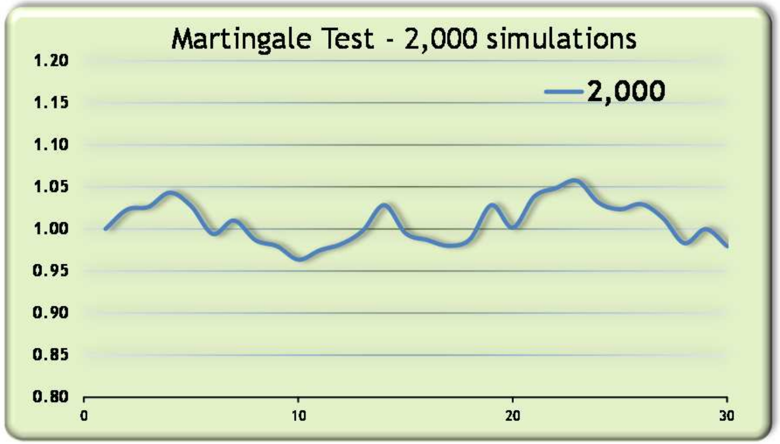
	Equity	Risk free	Deflator	PV Equity
0	1.00			
1	1.03	3%	97.09%	1.00
2	1.06	3%	94.26%	1.00
3	1.11	3%	91.51%	1.01
4	1.13	3%	88.85%	1.01
5	1.17	3%	86.26%	1.01
6	1.21	3%	83.75%	1.01
7	1.24	3%	81.31%	1.01
8	1.28	3%	78.94%	1.01
9	1.33	3%	76.64%	1.02
10	1.37	3%	74.41%	1.02

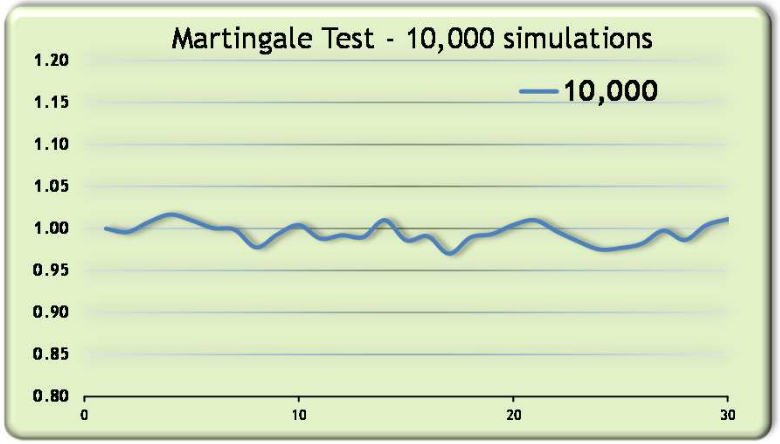
Economic Scenario Generators – How Many simulations?

Martingale test is so used to determine how many simulations are to be considered in the calibration of Economic Scenario.









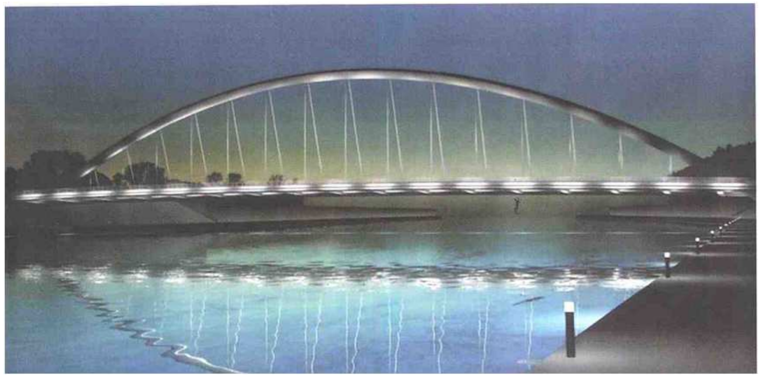
Valuation Framework “the story so far”

The “Market Consistency”

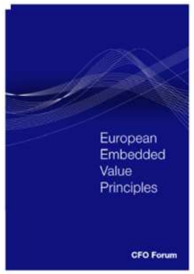
CEIOPS-SEC-52/10

The Solvency 2 directive prescribes that:

The calculation of technical provisions should be consistent with the valuation of assets and other liabilities, market consistent and in line with international developments in accounting and supervision.

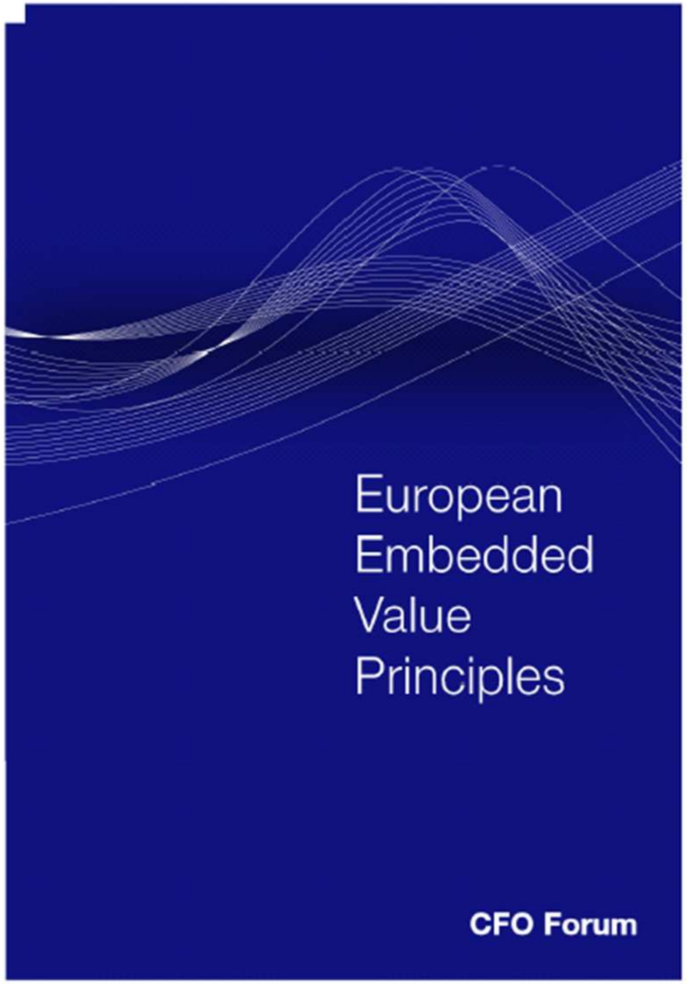


The CFO Forum in 2008 defines **market consistent** principles for the Embedded Vale Calculation



CFO Forum and MCEV Principles

- In May 2004, the CFO Forum published the **European Embedded Value Principles** and member companies agreed to adopt EEVP **from 2006** (with reference to 2005 financial year)
- EEV Principles consisted of 12 **Principles and** 65 related areas of **Guidance**
- Other 127 comments, collected in the **"Basis for Conclusions",** summarised the considerations in producing the Principles and Guidance
- In October 2005, **additional guidance on EEV disclosures** was published to improve consistency of disclosures and sensitivities



CFO Forum and MCEV Principles

European Embedded Value Principles

Principle 1	Introduction
Principle 2	Coverage
Principle 3	EV Definitions
Principle 4	Free Surplus
Principle 5	Required capital
Principle 6	Future shareholder cash flow from the in-force covered business
Principle 7	Financial options and guarantees
Principle 8	New Business and renewals
Principle 9	Assessment of appropriate projection assumptions
Principle 10	Economic assumptions
Principle 11	Participating business
Principle 12	Disclosure

Required use of appropriate approaches (*e.g. stochastic simulations*) to determine the impact of financial guarantees

CFO Forum and MCEV Principles

CFO Forum – June 2008: launch of MCEV Principles

Market Consistent Embedded Value Principles – June 2008 CFOFORUM

CFO Forum

Market Consistent Embedded Value Principles

June 2008

On the 4th June 2008, the CFO published the **Market Consistent Embedded Value Principles**

MCEV Principles:

- **replaced the EEV Principles** (i.e. standalone document, no t supplement to EEV)
- **at beginning compulsory from year-end 2009** for CFO Forum members (early adoption was possible)
- mandated **independent external review** of results as well as methodology and assumptions

CFO Forum and MCEV Principles

Market Consistent Embedded Value Principles

- **Principle 1** Introduction
- **Principle 2** Coverage
- **Principle 3** MCEV Definitions
- **Principle 4** Free Surplus
- **Principle 5** Required Capital
- **Principle 6** Value of in-force Covered Business
- **Principle 7** Financial Options and Guarantees
- **Principle 8** Frictional Costs of Required Capital
- **Principle 9** Cost of Residual Non Headgeable Risks
- **Principle 10** New Business and Renewals
- **Principle 11** Assessment of Appropriate Non Economic Projection Assumptions
- **Principle 12** Economic Assumptions
- **Principle 13** Investment Returns and Discount Rates
- **Principle 14** Reference Rates
- **Principle 15** Stochastic models
- **Principle 16** Participating business
- **Principle 17** Disclosure

CFO Forum and MCEV Principles

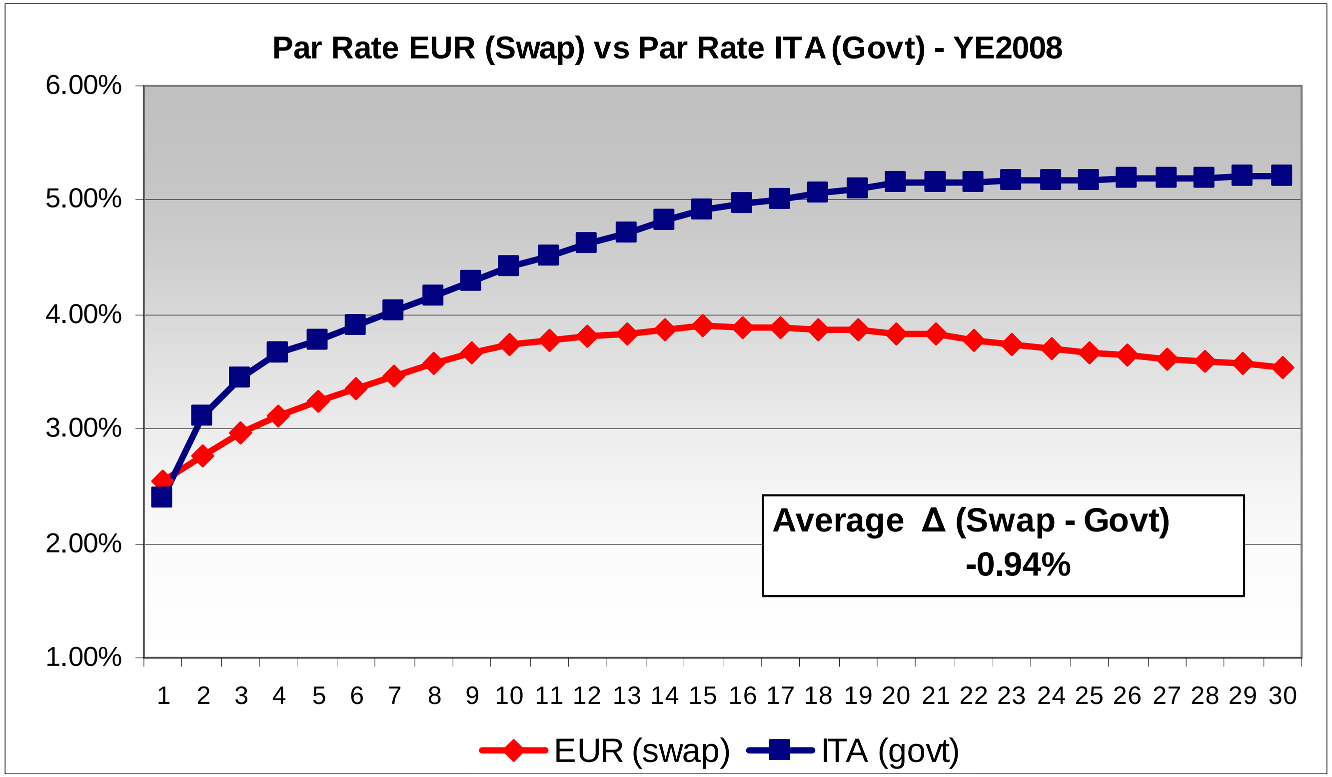
Main implications of the MCEV Principles:

- all projected cash flows should be valued **in line with the price of similar cash flows** that are traded in the capital markets [*Principle 3 & 7*]
- **use of swap rates as reference rates** (i.e. proxy for risk-free rate) [*Principle 14*]
- **no adjustment for liquidity premium** is allowed [*Principle 14*]
- volatility assumptions should be based on **implied volatilities** derived from the market **as at the valuation date** (rather than based on historic volatilities) [*Principle 15*]
- **required capital** should include amounts required **to meet internal objectives** (based on internal risk assessment or targeted credit rating) [*Principle 5*]
- explicit and separate **allowance for the cost of non hedgeable risks** [*Principle 9*]

The launch of **MCEV Principles** was initially welcomed by analysts and investor community and it was seen as a step in the right direction

Financial market situation at YE2008: a “dislocated” market

For Italy government bond rates higher than swap rates



CFO Forum - December 2008: tackling extreme financial

CFO Forum - EEV Principles - Microsoft Internet Explorer

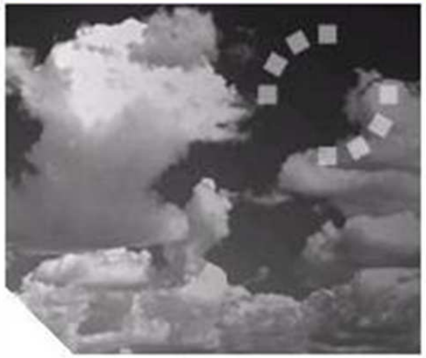
File Modifica Visualizza Preferiti Strumenti ?

Indietro Cerca Preferiti

Indirizzo http://www.cfoforum.nl/eev.html

CFOFORUM

HOME | MCEV/EEV PRINCIPLES | IFRS | CFO FORUM MEMBERSHIP | DISCLAIMER



Market Consistent Embedded Value (MCEV) Principles©

19 December 2008

In response to the current dislocated market conditions, the CFO Forum members are working collaboratively on the application of the Market Consistent Embedded Value (MCEV) Principles© to address the notion of market consistency in the current turmoil.

The CFO Forum remains committed to MCEV and the Principles published in June 2008. However, the MCEV Principles were designed during a period of relatively stable market conditions and their application could, in turbulent markets, lead to misleading results. The CFO Forum has therefore agreed to conduct a review of the impact of turbulent market conditions on the MCEV Principles, the result of which may lead to changes to the published MCEV Principles or the issuance of guidance.

The particular areas under review include implied volatilities, the cost of non-hedgeable risks, the use of swap rates as a proxy for risk-free rates and the effect of liquidity premia.

CFO Forum - May 2009: deferral of mandatory date

CFO FORUM

Amsterdam, 22 May 2009

PRESS RELEASE

The European Insurance CFO Forum (the CFO Forum) provic
in developing the Market Consistent Embedded Value (MCEV)

In December 2008, the CFO Forum announced that its member companies would be working to address the notion of market consistency within the MCEV Principles across the economic cycle and in particular its application in current dislocated markets.

The current financial crisis has revealed significant challenges for MCEV, such as adjustments for liquidity premia, which have ultimately harmed comparability. The CFO Forum has agreed to do further work to seek to improve the consistency in the adjustments made for liquidity premium and volatilities. This should also allow due consideration to be given to Solvency II developments where liquidity premium is an equally important issue. A further update on the work of the CFO Forum will be provided later this year.

In light of these developments, which may result in significant amendments to MCEV, we believe it is sensible to defer the mandatory MCEV reporting for all member firms until 2011.

CFO Forum statement

- further work needed
- mandatory date of MCEV Principles reporting deferred from 2009 to 2011

CFO Forum - October 2009: amendment of MCEV principles

In October 2009, the CFO Forum announced a change to its MCEV Principles to reflect the **inclusion of a liquidity premium**

Market Consistent Embedded Value Principles – June 2008

REFERENCE RATES

***Principle* 14: The reference rates used should, wherever possible, be the swap yield curve appropriate to the currency of the cash flows.**

G14.4 No adjustments should be made to the swap yield curve to allow for liquidity premiums or credit risk premiums.

Market Consistent Embedded Value Principles – October 2009

REFERENCE RATES

***Principle* 14: The *reference rate* is a proxy for a risk free rate appropriate to the currency, term and liquidity of the liability cash flows.**

- **Where the liabilities are *liquid* the *reference rate* should, wherever possible, be the swap yield curve appropriate to the currency of the cash flows.**
- **Where the liabilities are not *liquid* the reference rate should be the swap yield curve with the inclusion of a liquidity premium, where appropriate.**

G14.1 In evaluating the appropriateness of the inclusion of a liquidity premium (where liabilities are not liquid) consideration may be given to regulatory restrictions, internal constraints or investment policies which may limit the ability of a company to access the liquidity premium.

Latest developments – YE2011 Tackling the sovereign debt crisis

CFO FORUM

Munich, 9 December 2011

PRESS RELEASE

The European Insurance CFO Forum (the 'CFO Forum') responds to current market conditions

In response to current sovereign debt market conditions and complementary to the transition guidance published in September 2011, waiting for the finalisation of Solvency II, the CFO Forum members are working collaboratively on the application of the Market Consistent Embedded Value (MCEV) Principles© to ensure that companies have access to the best possible guidance on the subject and that the application is appropriate to the current market conditions and to the needs of the users of financial statements.

Including an allowance for the current sovereign debt market conditions as a component of the reference rate in embedded value reporting or disclosing a sensitivity as supplementary information of reported embedded value to such parameters where it is deemed appropriate would represent an initial step towards the expected convergence of MCEV with the developing European regulatory regime (Solvency II) on the matter.

Latest developments – Setting the Risk Free Rates

The risk-free rate term structure is one of the **most critical areas** of Solvency2 framework, for the **Fair Value of Liabilities** and **Available Capital**.

The European Commission has defined in the QIS5 TS the risk free rate as
«SWAP – 10 bps + ILLIQUIDITY PREMIUM * %bucket»
BUT
The recent volatility in the financial market requests a «**predictable counter-cyclical mechanism**» to reduce the volatility without producing other undesirable effects.

Without a predictable counter-cyclical mechanism, insurers will be faced with uncertainty in managing risk which may lead to improper risk management (forced sale of assets and inappropriate ALM).

Lots of proposal are under discussion. The following are the most relevant open issues:

- the **basic risk-free interest rate** term structure (including credit spread)
- a **counter-cyclical premium** (only where market is dislocated)
- a **matching adjustment** (only for specific products)
- an **extrapolation model** (including UFR and convergence speed).

In the Trialogue should be agreed an exhaustive package for LTG. An Impact Assessment should be performed during next months

Counter Cyclical Premium: when and how

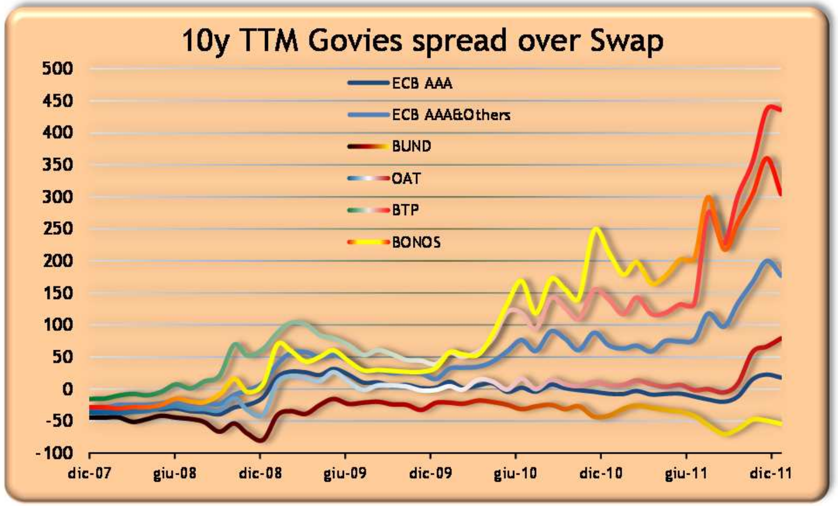
The CCP should include

- ✓ **an illiquidity premium (IP)**
- ✓ **a government spread premium (GSP)**

Periods of distress will be independently identified by EITHER of these two triggers (Corporate bond spread OR Sovereign bond spread).

When the CCP triggers are activeted, the risk free rate can be:

$$\text{Risk Free} = \text{SWAP} - \text{credit adjustment} + \alpha * \text{IP} + \beta * \text{GSP}$$



GSP = *f* (AAA&Other, swap, AA,default)

Counter Cyclical Premium: when and how

There are three primary methods currently used by practitioners to estimate the illiquidity premium in financial markets:

CDS Negative-basis method

The method compares the spread on a corporate bond with the spread of a Credit Default Swap for the same issuing entity, same maturity, same seniority and same currency.

Covered Bond method

The method involves choosing a pair of assets which, besides illiquidity, are assumed to offer equivalent cash flows and equivalent credit risk. The primary example is an index of covered bonds versus swaps.

Structural method

The method involves the use of option pricing techniques to calculate a theoretical credit spread which compensates only for credit (default and spread) risk. The difference between the theoretical spread and the actual market spread is typically taken to be illiquidity premium.

Derivation of the illiquidity premium

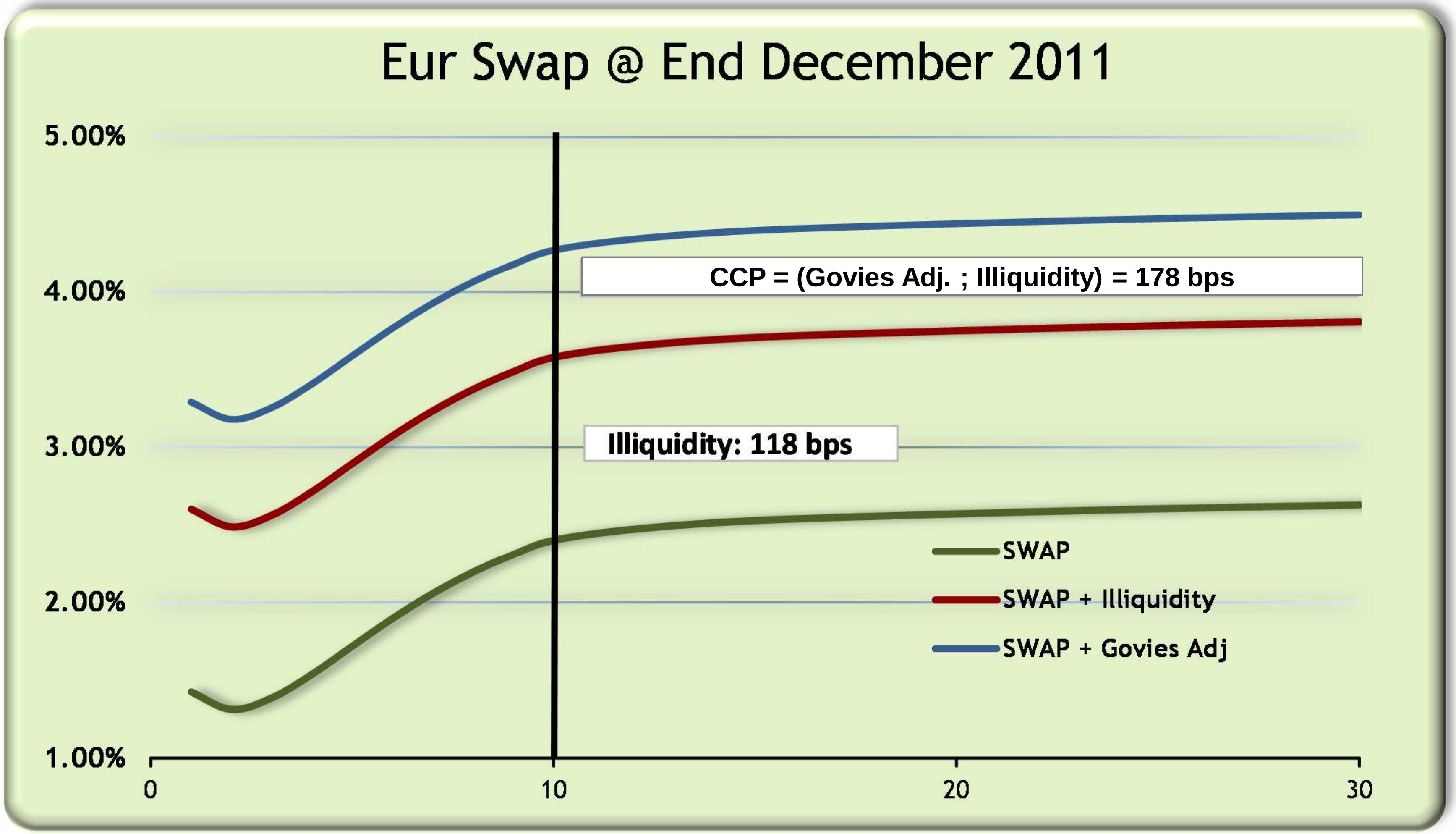
By making use of estimates derived from a number of different methods together EIOPA creates an overall estimate.

To do this a “proxy” method based on a simple transformation of the observed credit spread is proposed:

The corporate bond spread is so considered to be comprised of three components:

- an allowance for the cost of default
- a risk premium to compensate bond holders for bearing credit risk
- an illiquidity premium to compensate for the costs and associated uncertainty of trading illiquid bonds

A practical example



A simplified example (1/2)

Illiquidity Premium: what impact if asset allocation is 100% Government Bond ?
The result depends on the rationale underlying spread widening

Index	Market Condition	Asset	Liabilities	Own Fund	Note
6	Official YE2011	1.419	1.374	44	RF = swap rate + IP (118bps)
7	Spread + 100	1.419	1.289	130	RF = swap rate + IP (118bps) +100bps
8	Spread + 100	1.305	1.374	-69	RF = swap rate + IP (118bps)

Illiquidity premium

Govies Spread

CCP – Govies Spread Adjustment: what impact if asset allocation is 100% Basket of Government Bond?
The result depends on the rationale underlying spread widening

Index	Market Condition	Asset	Liabilities	Own Fund	Note
9	Official YE2011	1.419	1.275	144	RF = swap rate + GSP (180bps)
10	Spread + 100	1.394	1.252	142	RF = swap rate + GSP (180bps) + 21bps
11	Spread + 100	1.305	1.177	128	RF = swap rate + GSP (180bps) + 100 bps

BTP Spread Only

Basket Spread

A simplified example (2/2)

CCP – Govies Spread Adjustment: what impact if asset allocation is 100% BTP ?
The result depends on the rationale underlying spread widening

Index	Market Condition	Asset	Liabilities	Own Fund	Note
12	Official YE2011	1.419	1.275	144	RF = swap rate + GSP (180bps)
13	Spread + 100	1.305	1.252	53	RF = swap rate + GSP (180bps) + 21bps
14	Spread + 100	898	1.177	-279	RF = swap rate + GSP (180bps) + 100 bps

BTP spread

Basket Spread with 459 bps BTP

CCP – Govies Spread Adjustment: what impact if asset allocation is 100% BUND ?
The result depends on the rationale underlying spread widening

Index	Market Condition	Asset	Liabilities	Own Fund	Note
15	Official YE2011	1.419	1.275	144	RF = swap rate + GSP (180bps)
16	Spread + 100	1.419	1.252	167	RF = swap rate + GSP (180bps) + 21bps
17	Spread + 100	1.419	1.177	242	RF = swap rate + GSP (180bps) + 100 bps

BTP spread

Basket Spread with 459 bps BTP

Why a matching adjustment applied to a broader range of business?

- Solvency2 should capture the real risks for insurers: proposed SII regime makes insurance business more volatile than it really is.

- The inclusion of a MA removes the inclusion of risk to which the insurer is not exposed

- A Europe-wide application of a MA will promote stable long term investment and will support national governments and real economy through investment in sovereign bonds and long-term economic growth projects.

- MA has been introduced in Omnibus II for a limited number of products only.

- European Insurance industry asks the application of MA to a broader range of insurance business since:
    - Level playing field for all participants across Europe.
    - Avoids making own funds appear more volatile than they actually are.

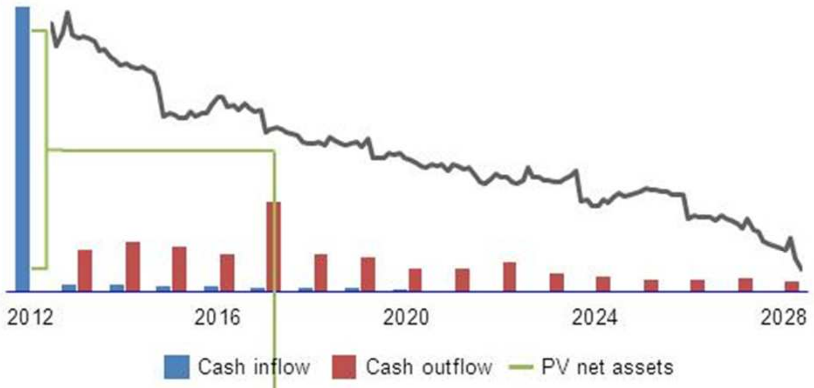
Insurers can demonstrate that they mitigate spread risks (typically investing in assets held to maturity) and are generally not exposed to forced sale of the corresponding assets. This substantially eliminates the exposure of insurers to market movements.

THE MATCHING ADJUSMENT PROPOSAL CAPTURES AND ARTICULATES IN PRINCIPLES THE UNDERLYING ECONOMICS DESCRIBED ABOVE

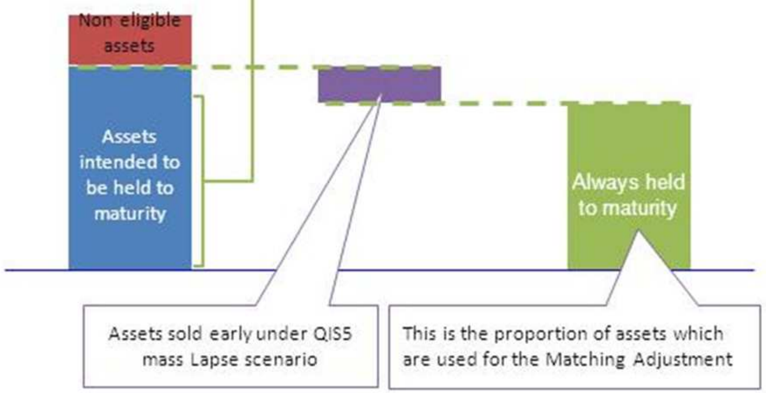
Example: Italian Product (profit sharing via Segregated Fund)

Currently excluded because assets and liabilities are not fully matched and underwriting risks other than expense and longevity risk exist

Illustration of product mechanics



Investment breakdown



Why should the Matching Adjustment apply?

1) The guarantee is fixed, whereas the profit share is based on book value asset returns and a predefined fund rule; surrenders are strongly discouraged via explicit penalties and guaranteed benefit reductions
2) Fixed income assets, with a high percentage of local sovereign bonds, are purchased to back the net cash flows
3) In the interest of sound ALM risk management, the insurer will hold these assets to maturity, avoiding volatility in fund returns for its policyholders
4) The simulation of a stress causing a forced sale shows that a portion of the assets designated as held to maturity would not have to be sold, as obligations could be met with ineligible assets

Implication for the product without MA

- Without the matching adjustment, this product would
  - Have unnecessary recognition of spread risk on the assets held to maturity
  - Be volatile on the balance sheet
  - Require higher capital and higher pricing
  - Could or would be withdrawn
  - Be incompatible with local sovereign bonds as a matching asset, reducing the appetite to hold these bonds.

Implications for the Italian Insurance industry

- Products exist with different technical characteristics (e.g. endowment, whole life, deferred annuity) but with similar design, management and need for a matching adjustment as described above.

Impacted products represent an estimated 73% of the Italian life insurance industry

Extrapolation – Smith Wilson Approach

Most extrapolation methods start from the price function, and assume that the price function is known for a fixed number of J maturities.

Smith and Wilson proposed the following pricing function:

$$P(\tau) = e^{-UFR*\tau} + \sum_{i=1}^{J} \vartheta_i * W(\tau, u_i)$$

With the symmetric Wilson functions $W(\tau, u_i)$ defined as:

$$W(\tau, u_i) = e^{-UFR*(\tau+u_i)} * \{\alpha * min(\tau, u_i) - 0.5 * e^{\alpha*max(\tau,u_i)} * (e^{\alpha*min(\tau,u_i)} - e^{-\alpha*min(\tau,u_i)})\}$$

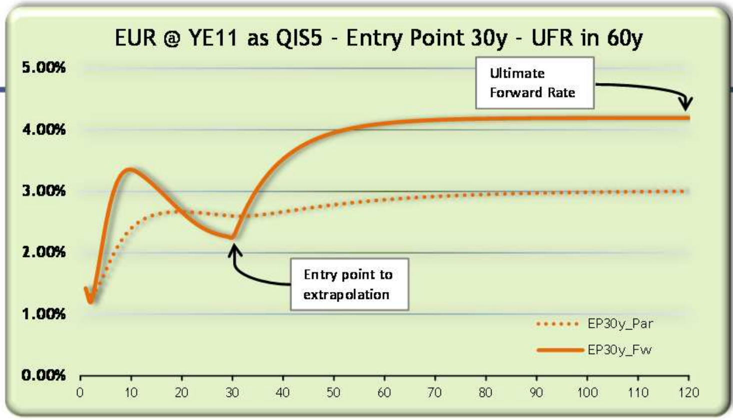
where:

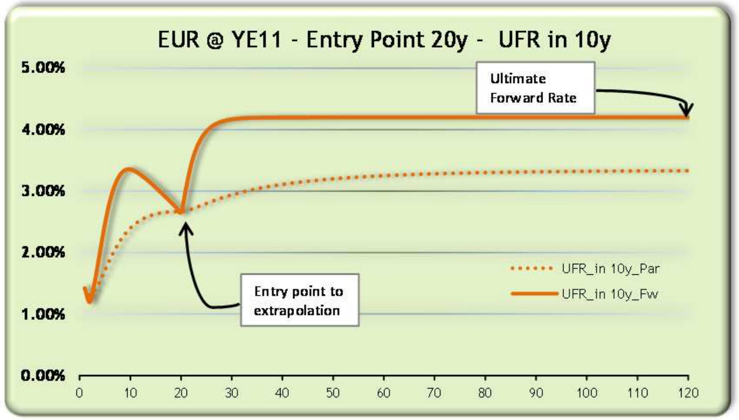
J is the number of zero coupon bonds with known price function (entry point to extrapolation)
u_i is the maturities of the zero coupon bonds with known prices
τ is term to maturity in the price function
UFR is the Ultimate Forward Rate (long term equillibrium rate)
α is mean reversion, a measure for the speed of convergence to the UFR
ϑ_i are parameters to fit the actual yield curve

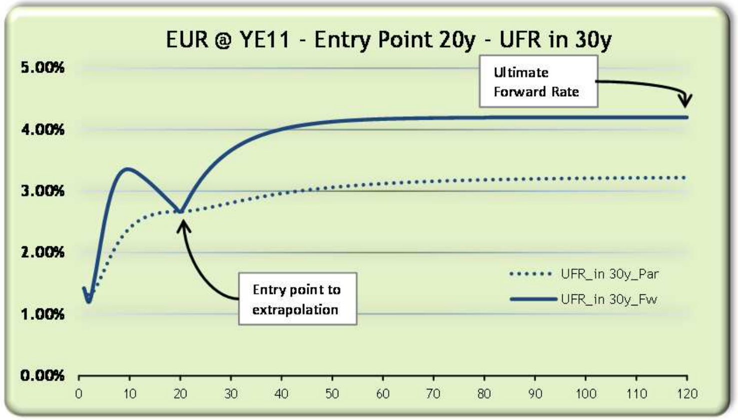
Extrapolation – From QIS5 to new industry proposal

Actually are under discussion some parameters of the Smith Wilson model to be used for the calibration of the risk-free interest rate term structures:

J from 30y to 20y - -α from 60y to 10y/40y







What does "best estimate operative assumptions" mean?

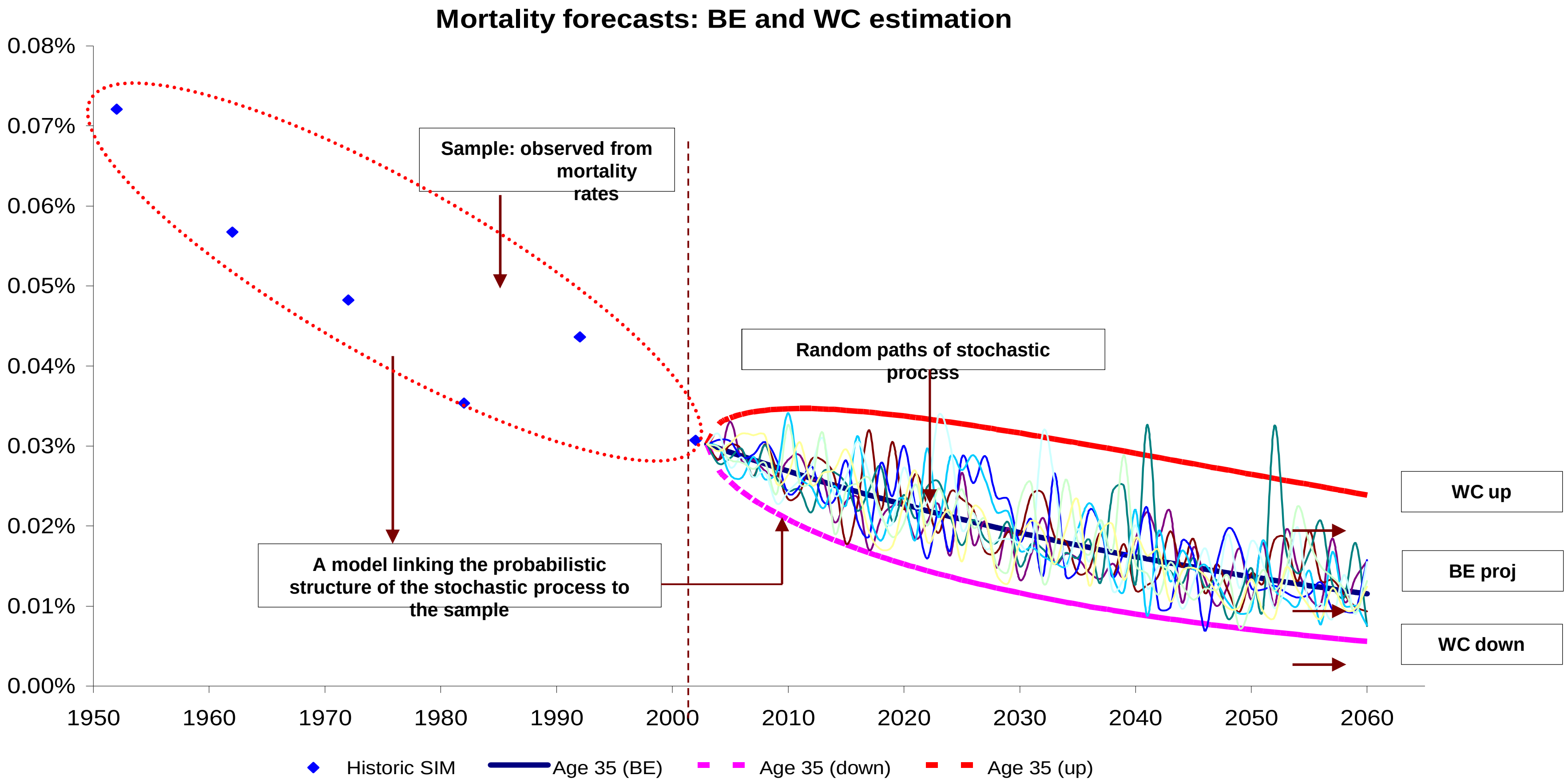
Open issues

- Mortality and longevity: selection factor or/and future trend?
- Lapse: are the historical observations useful to infer the future?
- Lapse: what type of link between market and surrenders?
- Expense: is the S2 going concern?
- Expense: what type of inflation?

Mortality assumptions – Lee Carter model

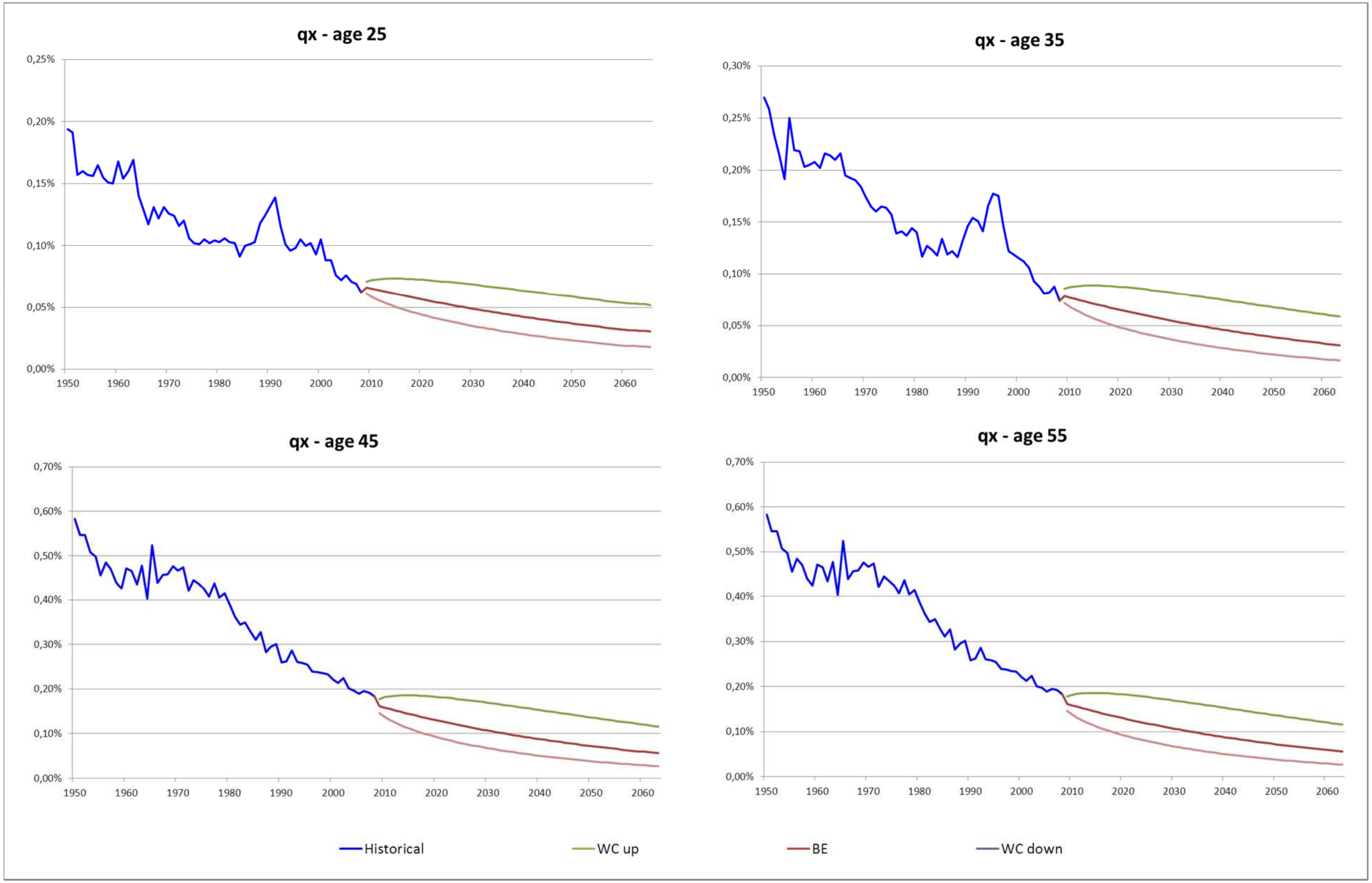
Lee Carter approach to mortality forecast takes into account a stochastic projection model both to Best Estimate and Worst Case valuation

- Observed mortality rates are random variables representing past mortality
- Forecasted mortality rates are estimates of random variables representing future mortality



Mortality assumptions – Lee Carter model Example (Italy)

Historical and projected mortality rates – q(x,t)



Mortality assumptions – Selection factor

The mortality in the various underwriting classes and product groups can be expected to differ from projected mortality rates

$$q_{x,t}(h) = q_{x,t}^{\mathrm{Pr}oj} * S(h)$$

Major selection factor causes:

- Age and sex
- Smoker status
- Socioeconomic status
- Method and quality of underwriting
- Sales channel
- Types of product

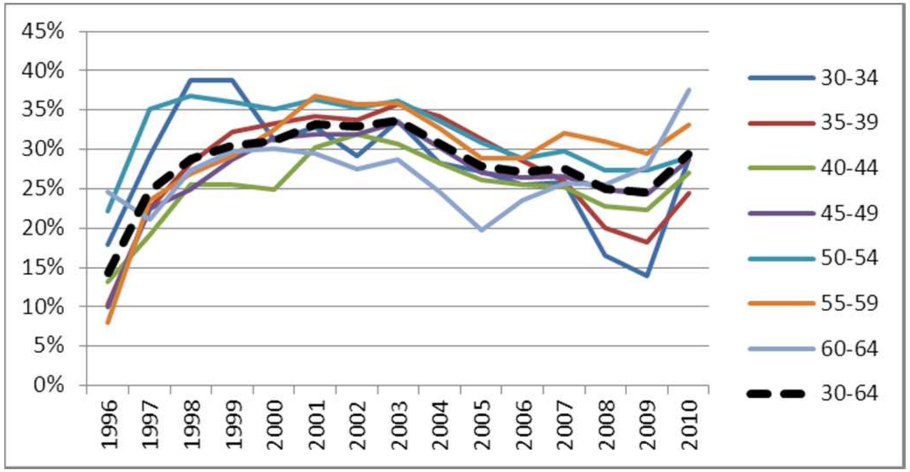
$$\hat{s}(h) = \frac{\sum_i Death_i^A(h)}{\sum_i Death_i^E(h)}$$

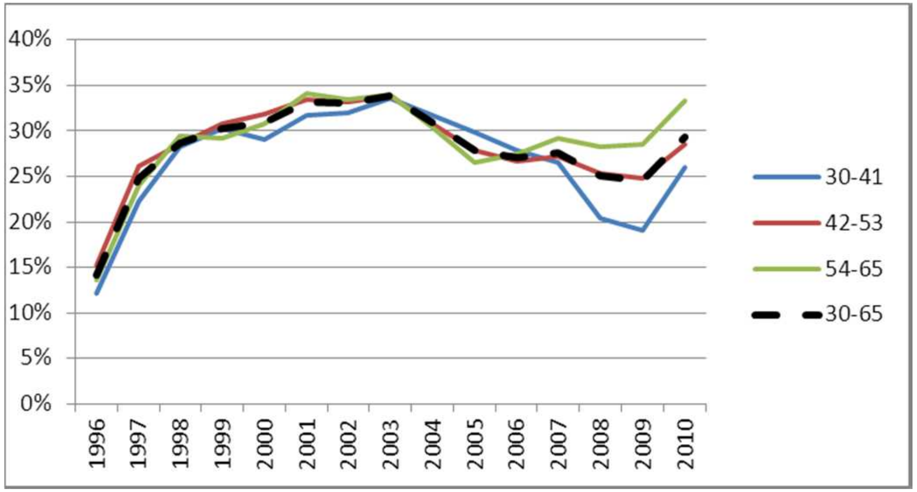
$$Death_i^E(h) = q_{x,t}^{\mathrm{Pr}oj} * Exposures_i(h)$$

Mortality assumptions – Selection factor

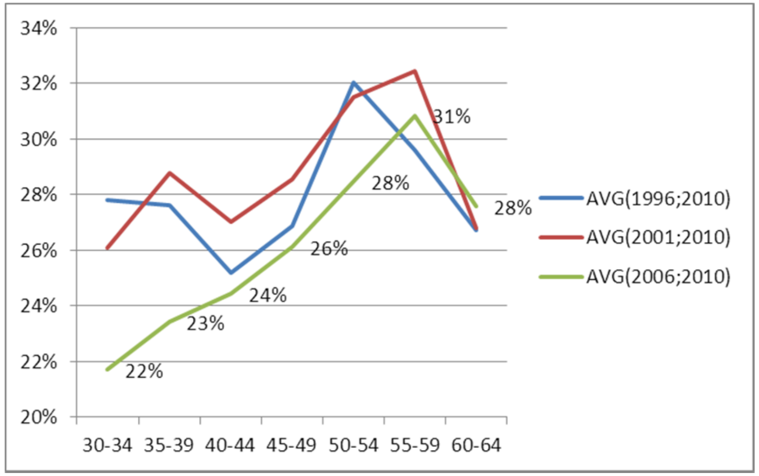
Application to real portfolio

Selection factors from 1996 to 2010 grouped in bukets of ages



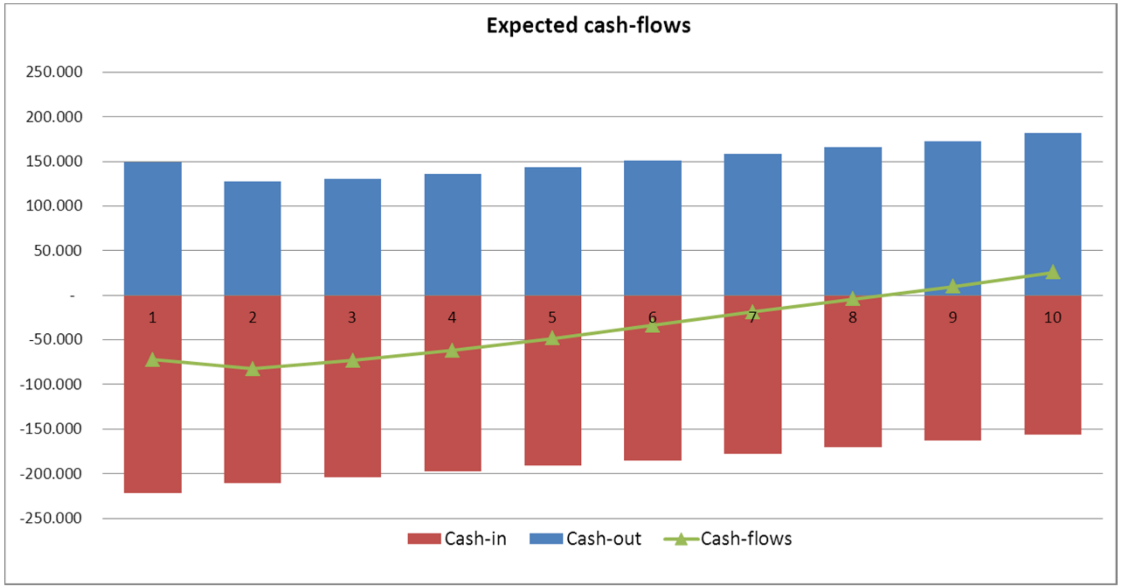


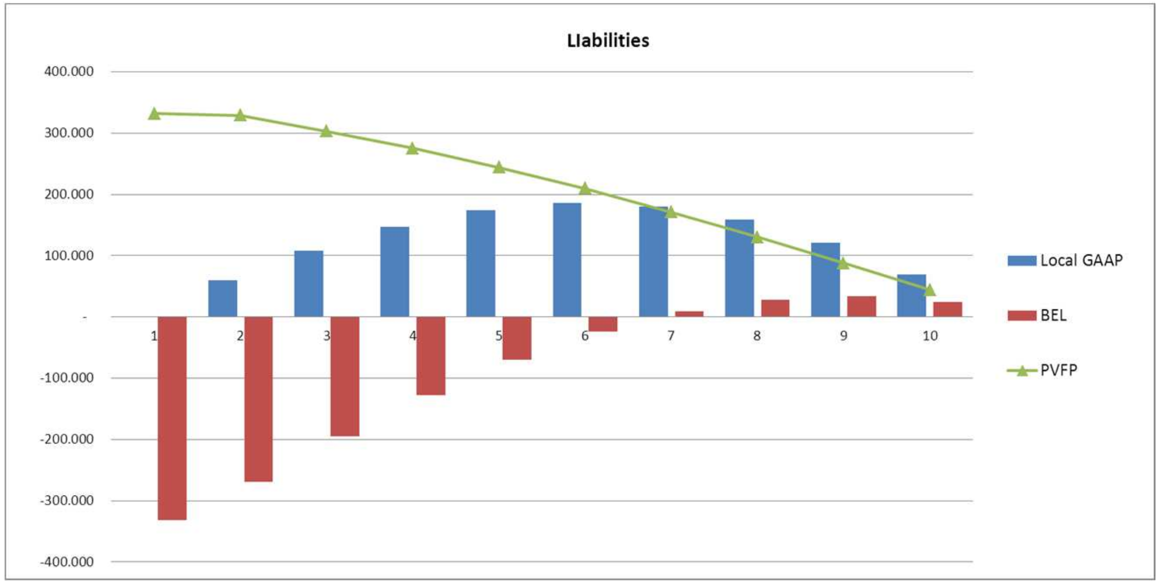
Average selection factors for different age bukets considering different periods



Mortality assumptions – Local GAAP vs. Best Estimate

Term Life contract	
Age	40
Term	10
I order mortality table	SIM 2003
II order mortality table	80% SIM 2003
Technical interest	3%
Premium loading	10%
n. of contracts	1,000
Premium	213
Sum in case of death	100,000





Impact of mortality improvement assumptions

Annual Premium - Individual Term Life portfolio

(23,200 policies)

	EBS YE2011	Mortality Improvement	Δ%
Local GAAP reserves	32.377.899,40	32.377.899,40	
Best Estimate			
BEL	- 28.841.557,47	- 36.340.271,13	-26%
Worst Case at 99.5%	**10% mortality stress**	**Lee Carter stress**	
BEL	- 24.864.107,31	- 27.560.064,14	-11%
RAC - Mortality trend	**3.977.450,16**	**8.780.206,99**	**121%**
	20% mortality stress		
BEL	- 20.895.855,89		
SCR - Mortality trend	7.945.701,58		

One Model Point of AP Individual Term Life portfolio

(7 policies – male – issue year 2007 duration 15 years I order mortality table SIM 1981)

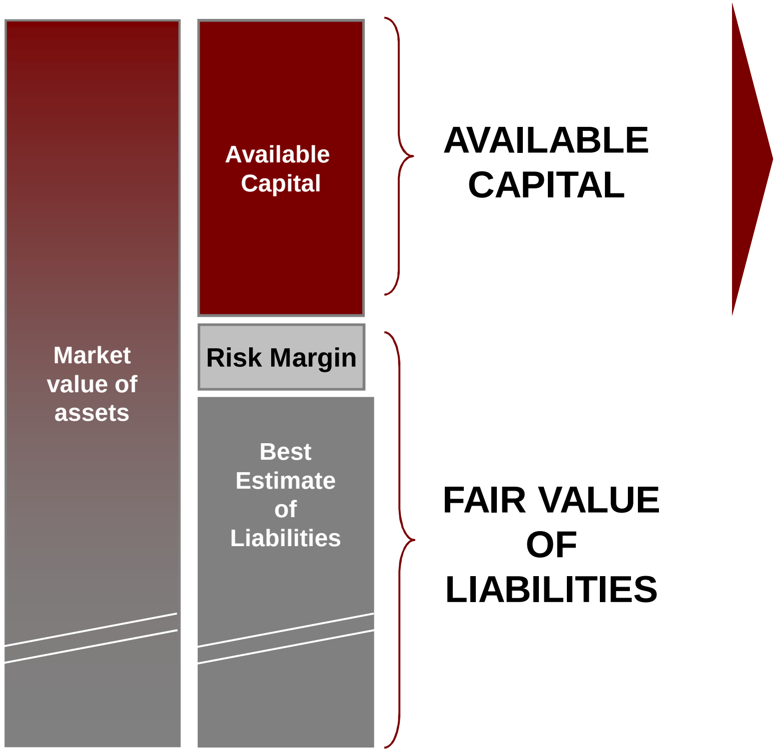
	EBS YE2011 valuation (1)	Mortality Improvement	Δ%
Local GAAP reserves	5.849,29	5.849,29	
Best Estimate			
BEL	- 8.824,29	- 10.493,31	-19%
Worst Case at 99.5%	**10% mortality stress**	**Lee Carter stress**	
BEL	- 8.292,53	- 9.396,68	-13%
RAC - Mortality trend	**531,76**	**1.096,64**	**106%**
	20% mortality stress		
BEL	- 7.761,25		
SCR - Mortality trend	**1.063,04**		

Solvency II Framework

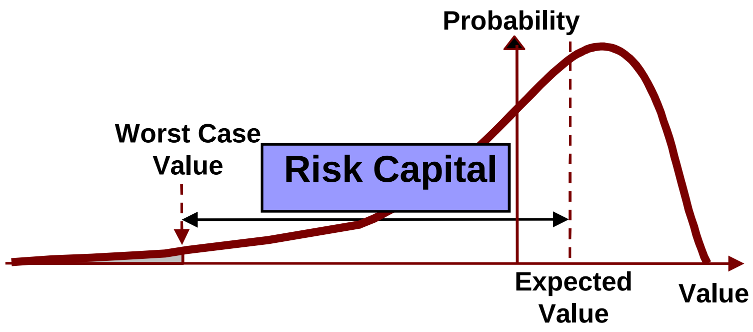
Methodology: Risk Capital

Risk Capital under Economic Balance Sheet	Risk Capital is the capital necessary to absorb the maximum loss of Available Capital, identified according t**o a 1-year value** at risk approach, at a specified confidence level consistent with **the risk appetite**: at **99.5% (BBB) for Solvency II** purposes.

Total Balance Sheet Approach

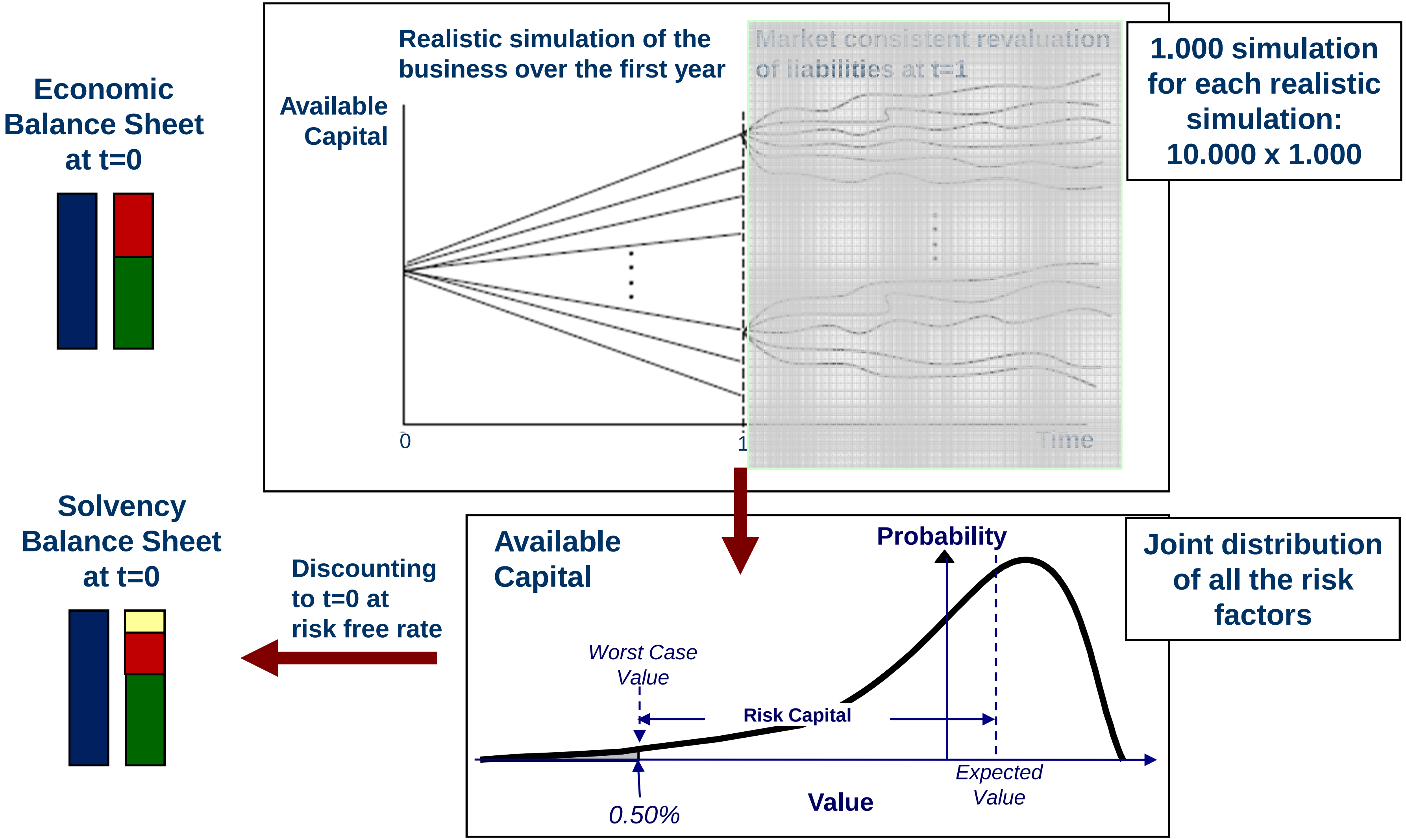


Distribution of Available Capital



- **Risk Capital** is equal to the **difference between Available Capital (expected value) and Available Capital (worst case value) after the "worst-case scenario"** (1-year value at risk approach, at a confidence level consistent with the risk appetite)
- The mentioned **"worst-case scenario"** is referring to the joint occurrence of negative outcomes of the different risks

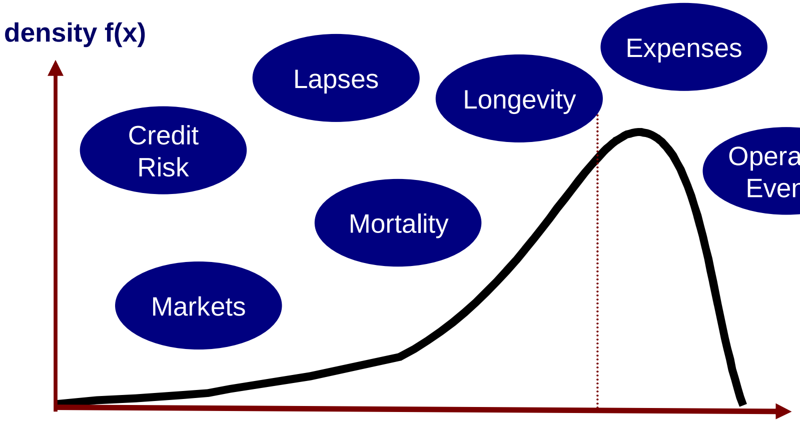
Methodology for Risk Capital: Theoretical approach



Methodology for Risk capital: Modular Approach (1/3)

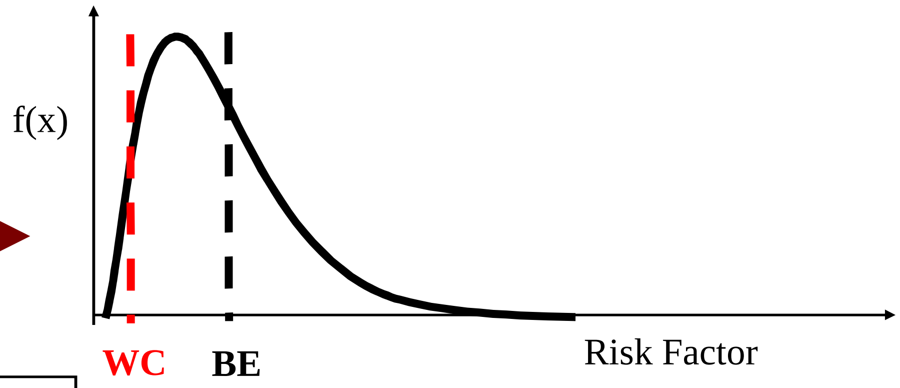
alternative solution: Modular approach

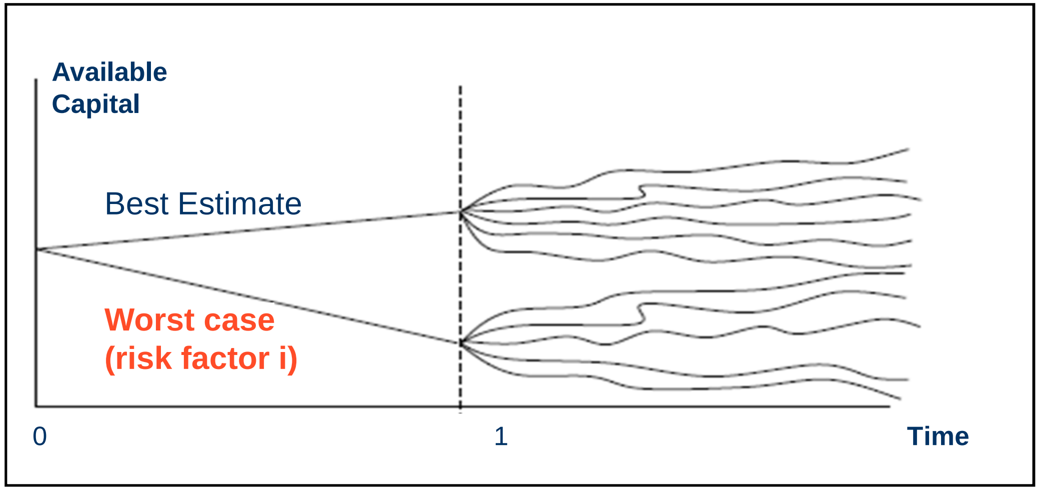
Identification of Risk Factors that affects the AC distribution

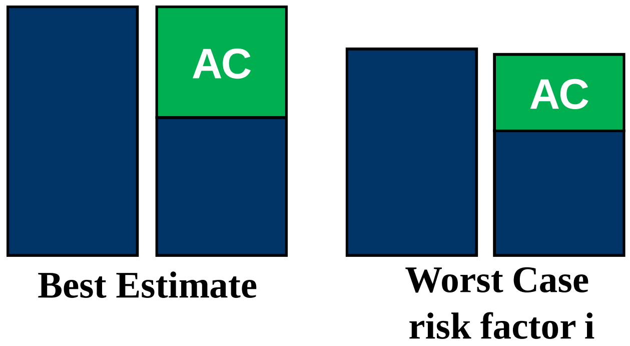


Focus on the single risk factors:

for each of them the stress level corresponding to desired confidence level is determined

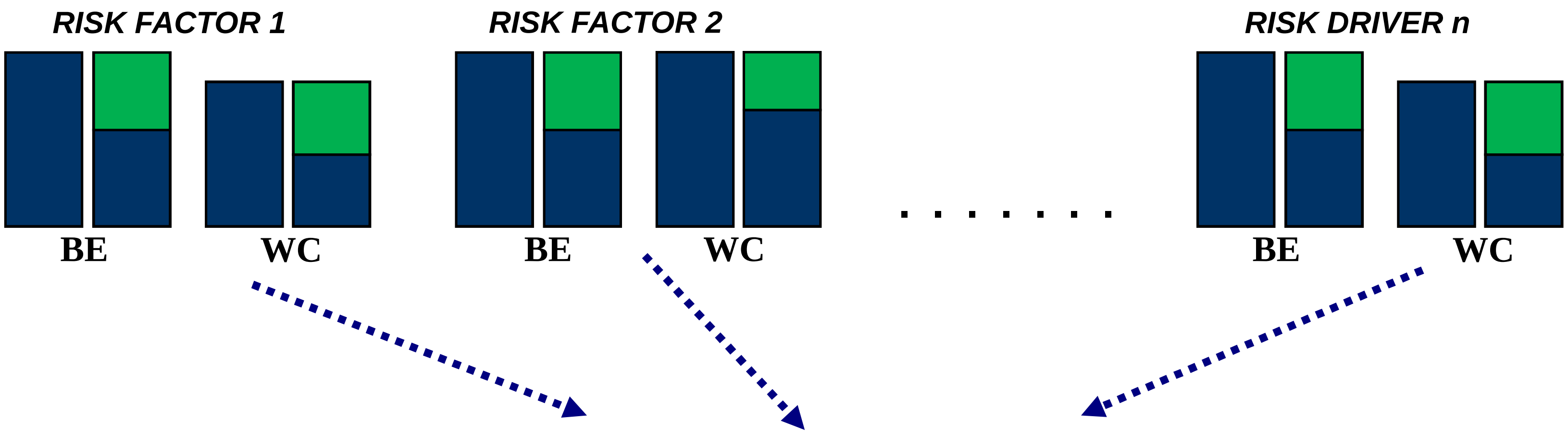






SCR = AC (BE) – AC(WCi)

Methodology for Risk capital: Modular Approach (2/3)



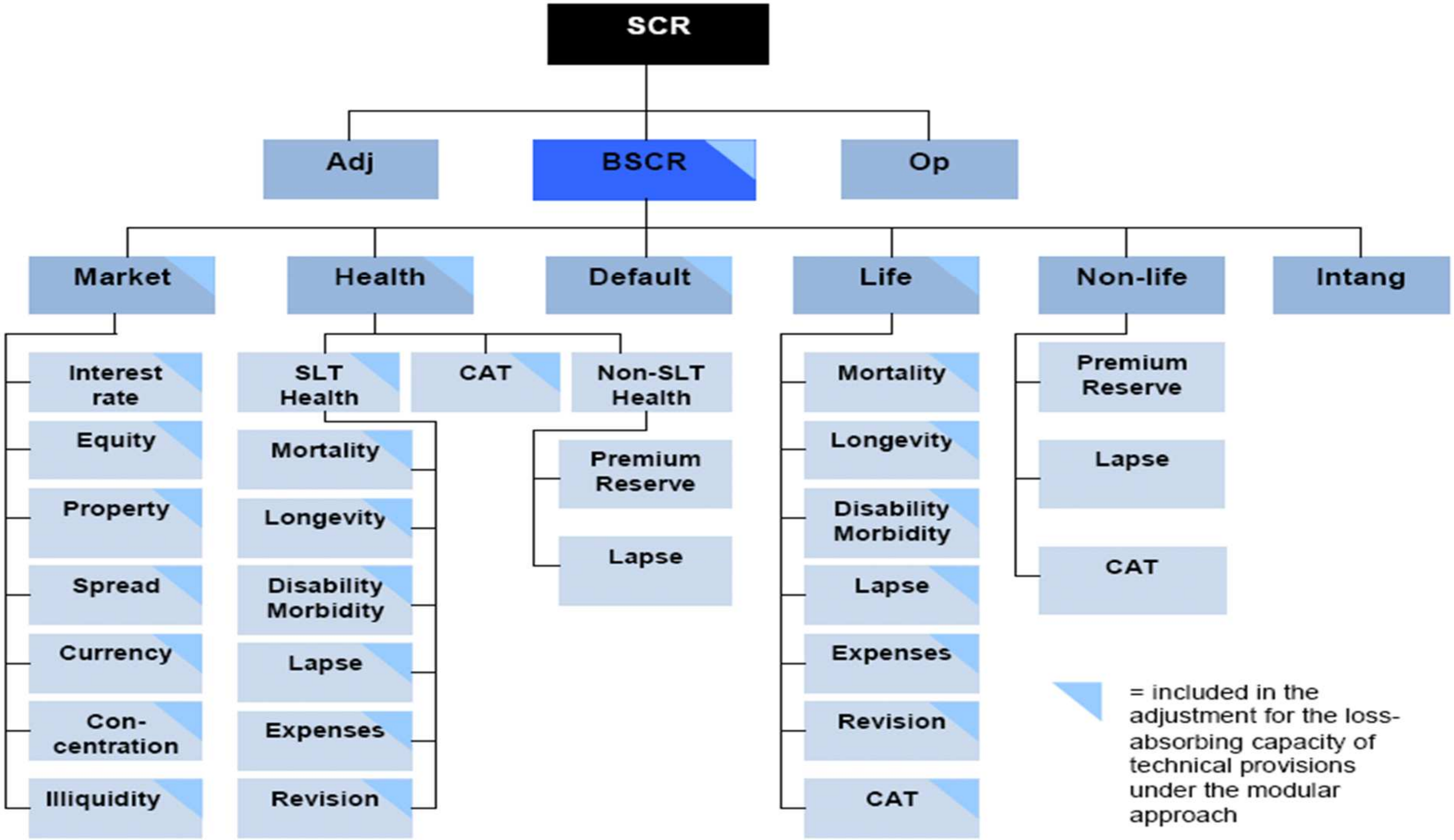
The stress impacts for all the risk drivers are finally aggregated using a correlation matrix <u>in stress conditions</u>

	RC_1	**RC_2**	**RC_3**	**…….**	**RC_n**
RC_1	1				
RC_2	$CorrRC_{2;1}$	1			
RC_3	$CorrRC_{3;1}$	$CorrRC_{3;2}$	1		
…….	…….	…….	…….	1	
RC_n	$CorrRC_{n;1}$	$CorrRC_{n;2}$	$CorrRC_{n;3}$	…….	1

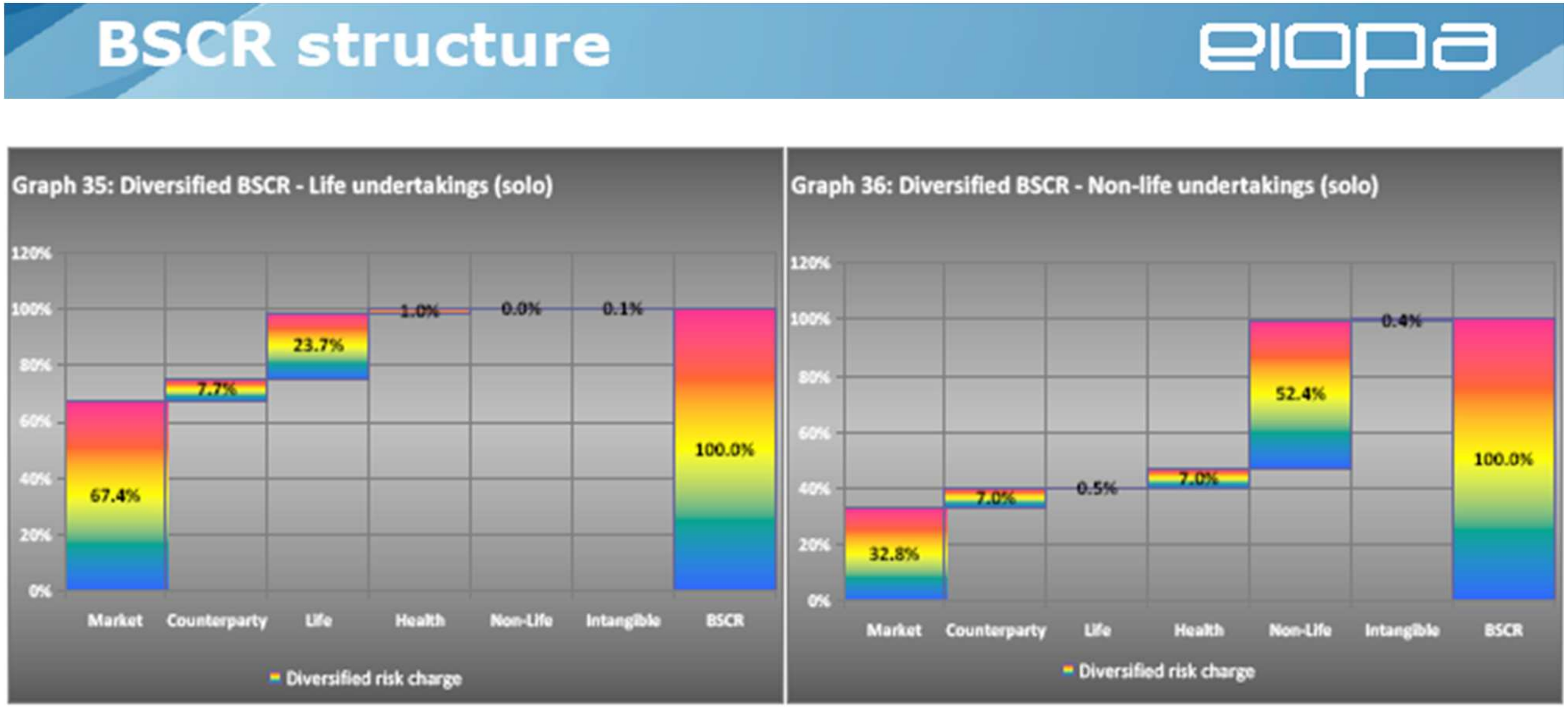
$$RC = \sqrt{\sum_{rxc} CorrRC^{rxc} \bullet RC_r \bullet RC_c}$$

Methodology for Risk capital: Modular Approach (3/3)

Solvency II Framework: risk overview



QIS5 – Final Results



Methodology: Risk Capital

Is the Standard Formula the unique way to evaluate SCR for Solvency2 purpose?

→ Solvency II framework allows Companies to adopt an <u>Internal Model</u> or a <u>Partial Internal Model</u>.

BUT

<u>Internal Model</u> (IM) and <u>Partial Internal Model</u> (PIM) must be approved!

To obtain the approval, Companies are required to demonstrate that their IM / PIM verifies some Tests and Standards explicitly reported in the Solvency II Directive.

Methodology: Risk Capital

Use Test	**The Internal Model must be widely used in and plays an important role in the Company's system of governance**
Statistical Quality Standard	**Data quality – Adequate, applicable and relevant actuarial and statistical tecniques – PDF based on current and credible information and realistic assumptions – Coverage of all material risks – Inclusion of mitigation tecniques and diversification effects**
Calibration Standard	**The Internal Model must provide policyholder and beneficiaries with the same level of protection equivalent to the Standard Formula della formula standard (i.e. VaR 99,5%)**
Profit and Loss Attribution	**The Internal Model must identify the sources of profits and losses and must explain those sources in respect of categorisation of internal model risks and the Company's risk profile**
Validation Standard	**A regular model validation cycle must be put in place that includes monitoring the performance of the Internal Model, reviewing the on-going appropriateness of its specification and testing its results against experience**
Documentation Standard	**Company must document the design and operational details of the Internal Model, guaranteeing compliance with Directive articles 120-124, with focus on theory, assumptions, mathematical and empirical basis and circumstances for not working**
External Model and Data	**All the above mentioned requirements must be considered also regarding the use of external model and data obtained from a 3rd party**

Other Risk Based Capital Models

Different approaches can be implemented to evaluate Risk based Capital

- VaR or Tail VaR*: Solvency 2 vs Swiss Solvency Test
- One year or multi-year?
- Modular approach ?
- Probability distribution forecast? Using which type of model?
- Including or not loss absorbency capability of liability ?
- Internal model or standard formula?

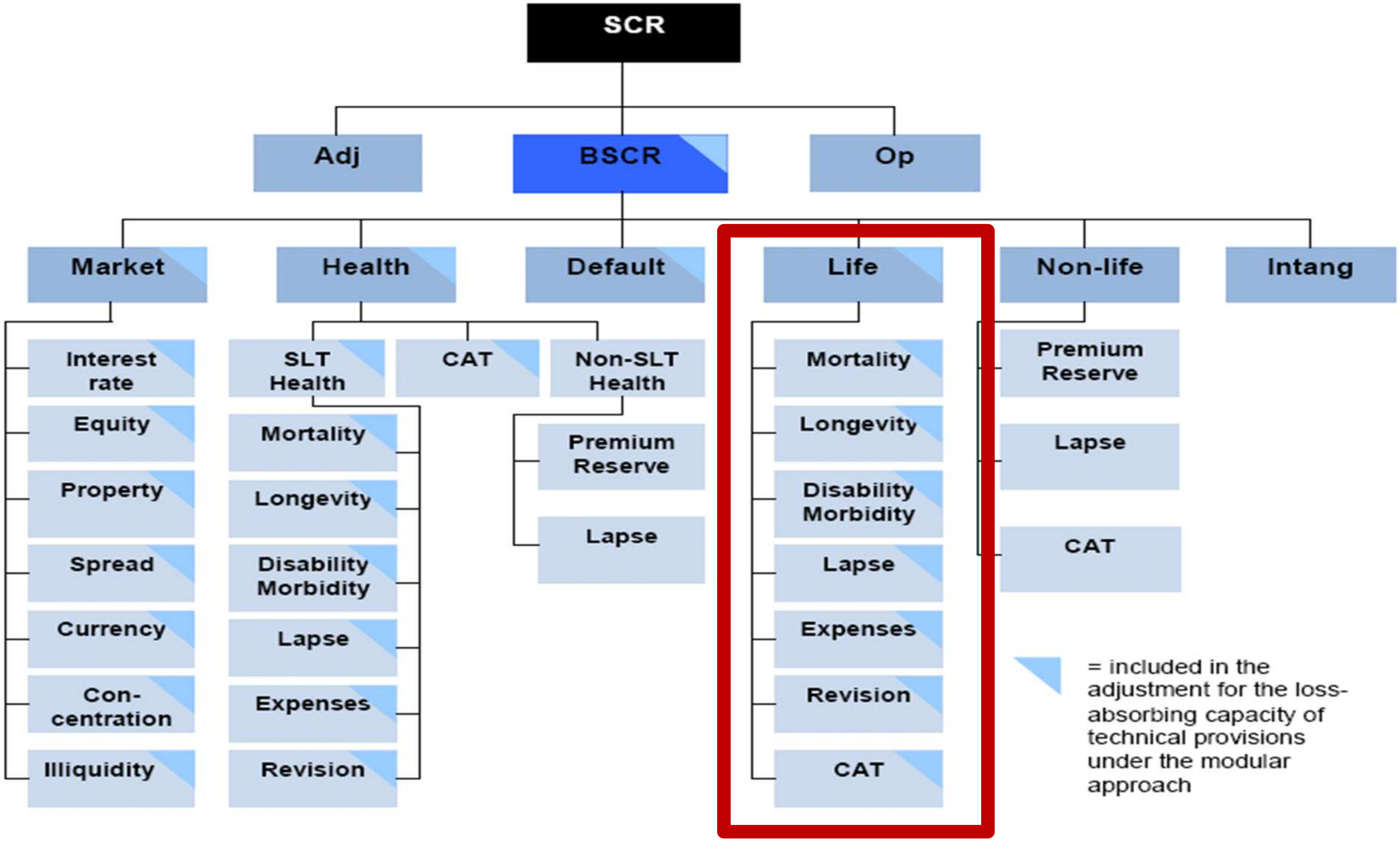
***Value at Risk (VaR)**: massima perdita attesa, in uno specifico orizzonte temporale e ad un predefinito livello di confidenza.

TailVaR: media delle perdite che eccedono, in uno specifico orizzonte temporale un predefinito livello di confidenza.

Riassumendo, considerando 10.000 perdite simulate, il VaR sarà uguale alla 50-esima maggiore perdita mentre il TAilVAR sarà la media delle 50 perdite maggiori.

Methodology for Risk capital: Underwriting Risk

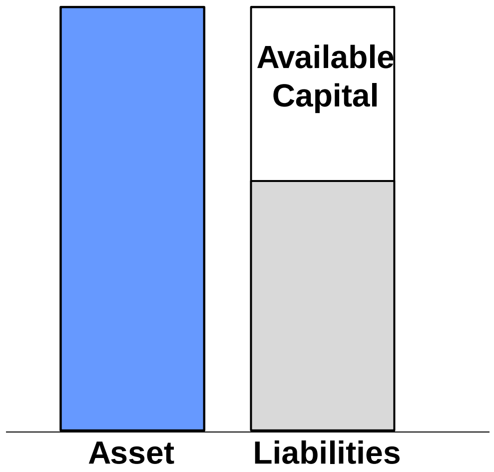
Solvency II Framework: Underwriting Risk



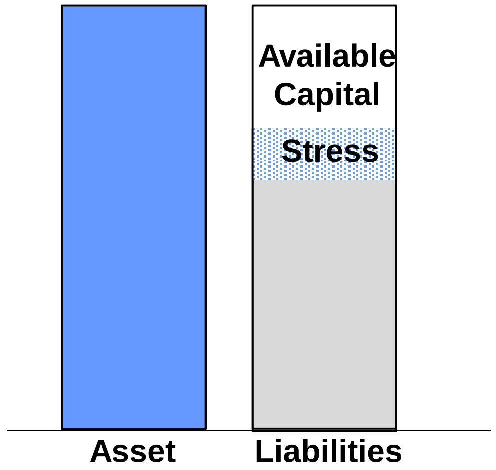
Underwriting Risk

Valuation Framework for Underwriting Risks

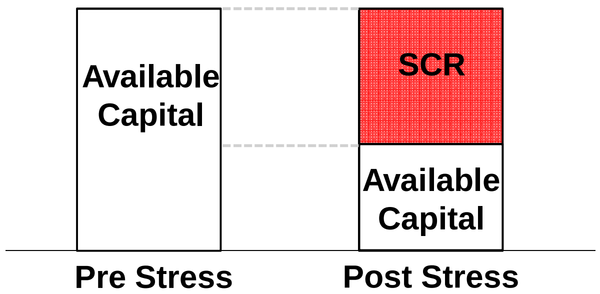
Available Capital: Pre Stress



Available Capital: Post Stress



Risk Capital: Δ Available Capital

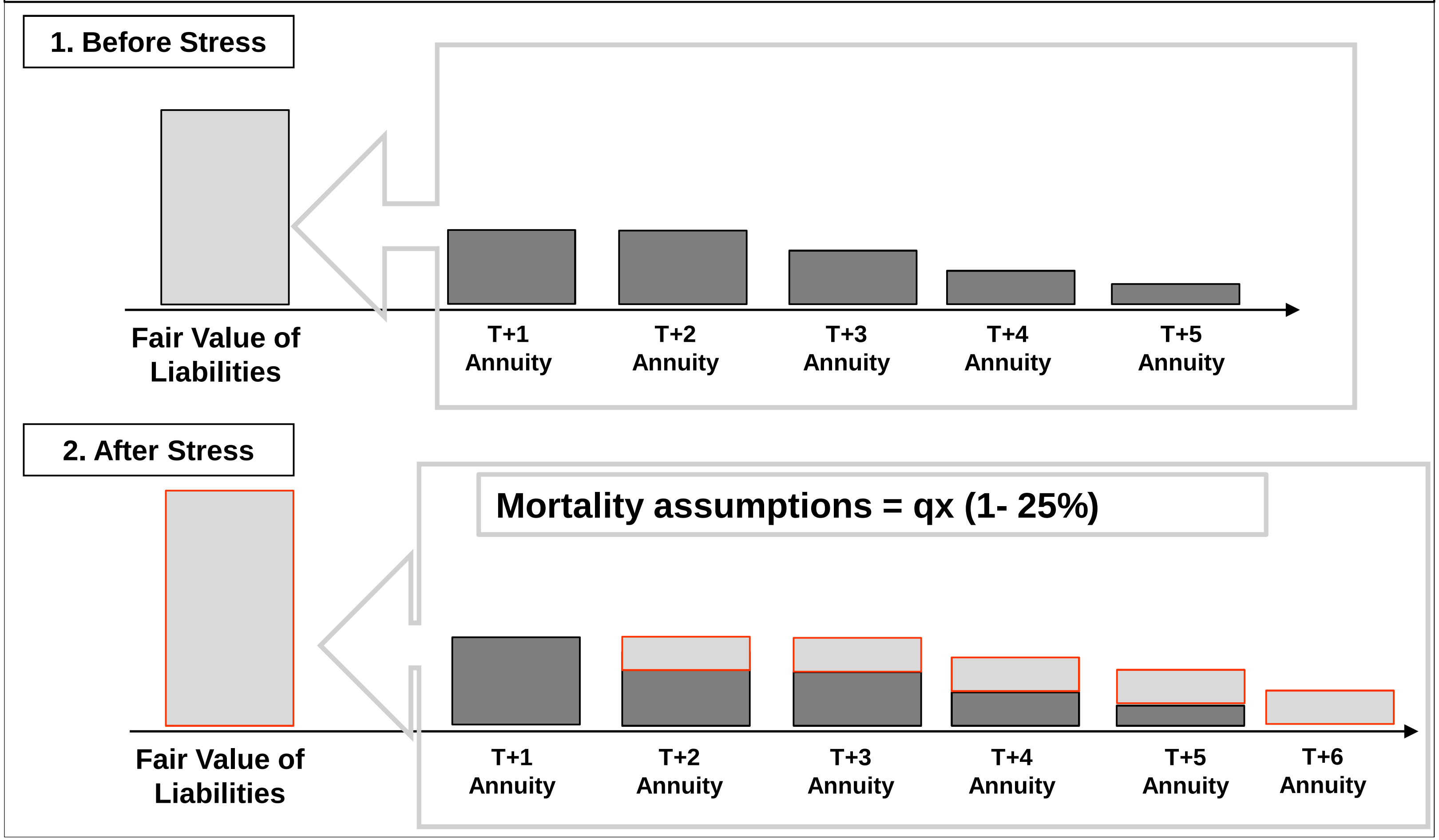


- **Calculation of Market Value of the Assets and Fair Value of the Liabilities in the Central Scenario with Best Estimate Assumptions**
- **Definition of the stressed underwriting stressed financial assumptions**
- **Calculation of the Best Estiamate of the Liabilities in the stressed scenario**
- **Calculation of the SCR as the difference between the Available capital in the central and in the stressed scenario**

Underwriting Risk

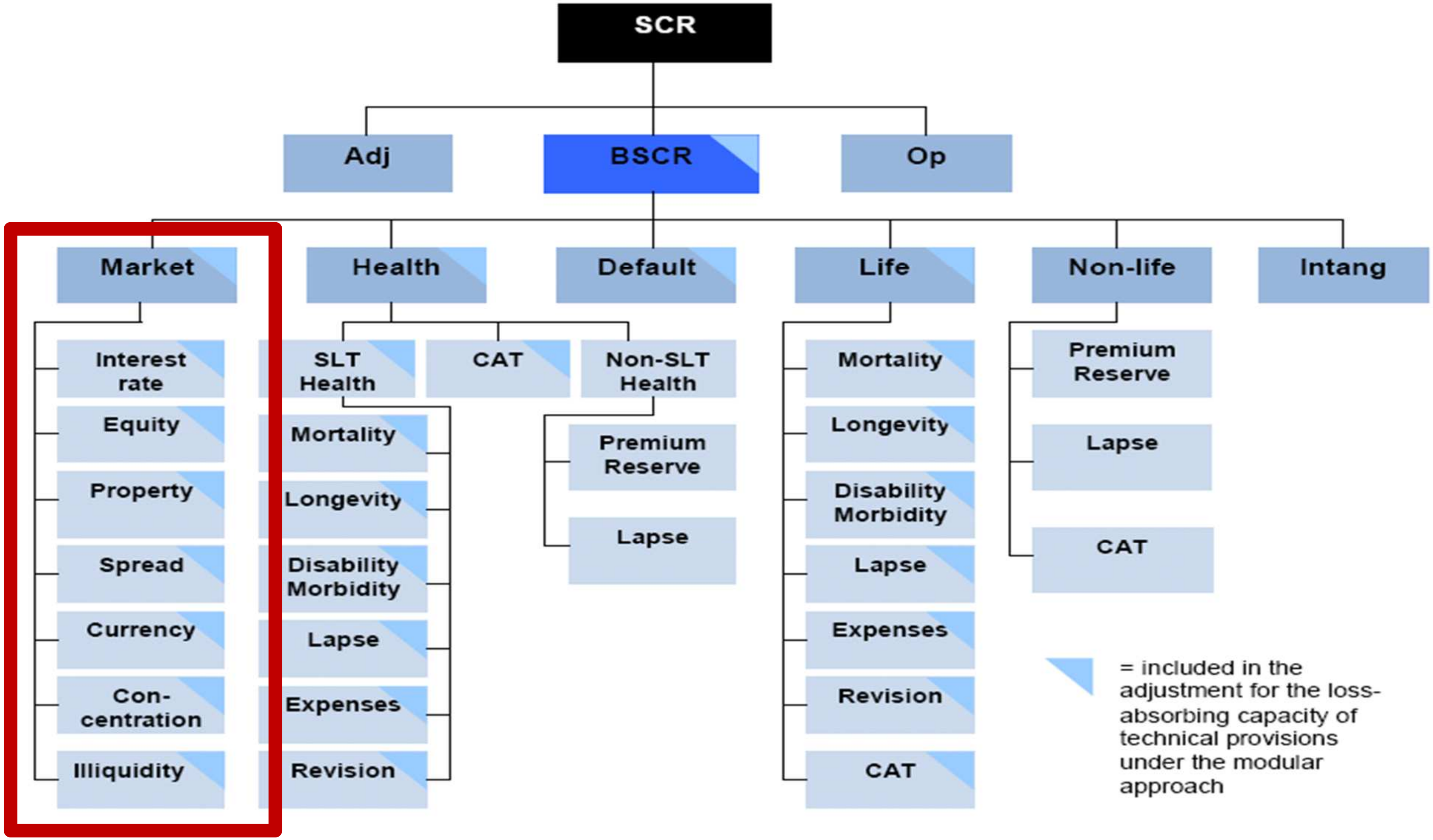
LONGEVITY RISK – annuity contracts

Change of Mortality Assumptions



Methodology for Risk capital: Market Risk

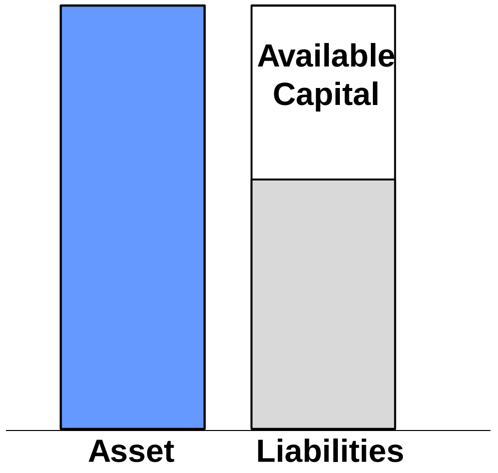
Solvency II Framework: Underwriting Risk



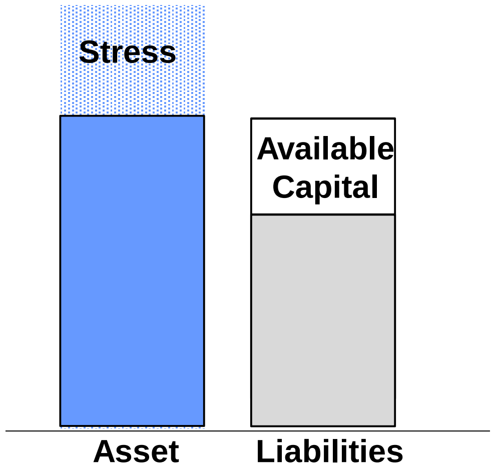
Methodology for Risk capital: Market Risk

Valuation Framework for Market and Credit Risks

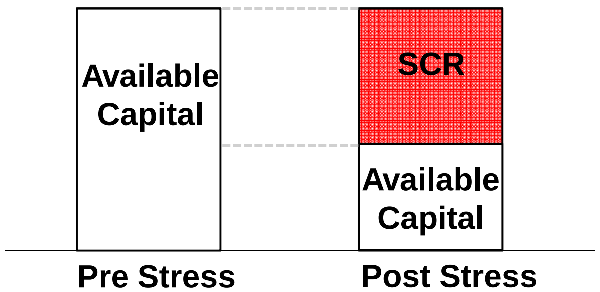
Available Capital: Pre Stress



Available Capital: Post Stress



Risk Capital: Δ Available Capital

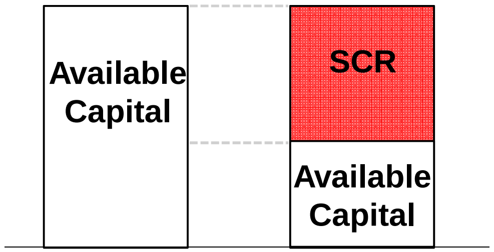


- **Calculation of Market Value of the Assets and Fair Value of the Liabilities in the Central Scenario with Best Estimate Assumptions**
- **Definition of the stressed financial stressed financial assumptions**
- **Calculation of the Market value of the assets and the Best Estimate of the Liabilities in the stressed scenario**
- **Calculation of the SCR as the difference between the Available capital in the central and in the stressed scenario**

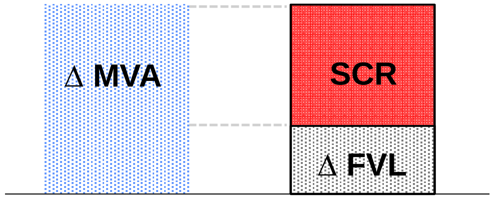
Methodology for Risk capital: Market Risk

Alternative definition of SCR: change in assets – change in liabilities

SCR = Δ AC

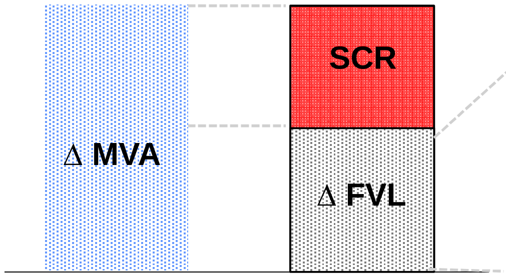


SCR = Δ MVA - Δ FVL



- The SCR formula can be rewritten as the difference between the change in market value of the assets and the change in market value of the liabilities (pre and post stress)

LAC “basic” interpretation and LAC index



SCR may be lower than ΔMVA, as the loss on the assets can be partially “absorbed” by a reduction of the Liabilities

$$\text{LAC index} = \frac{\Delta \text{ Fair value of Liabilities}}{\Delta \text{ Market value of Assets}}$$

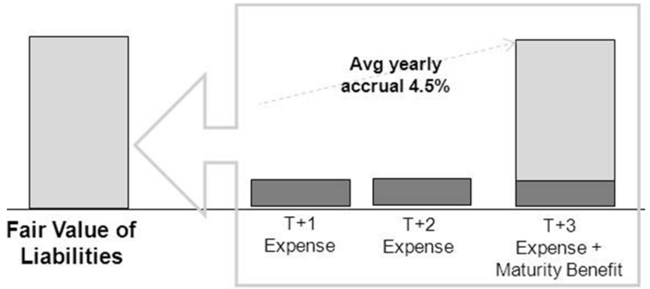
- This is the main interpretation of the absorbency capacity and it is applicable for Equity, Credit, Property and Currency risks.

Methodology for Risk capital: Market Risk

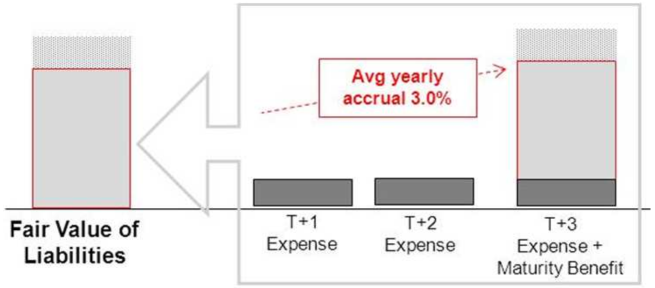
Equity Risk: Immediate loss in market value of the assets

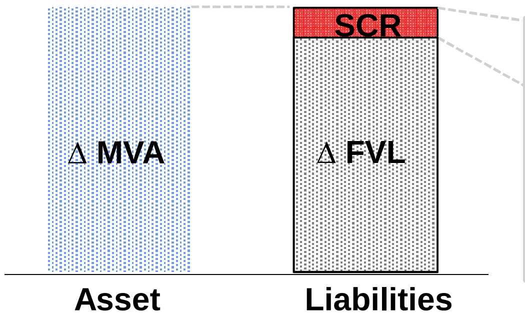
1.Unit Linked Contract

1. Before Stress



2. After Stress



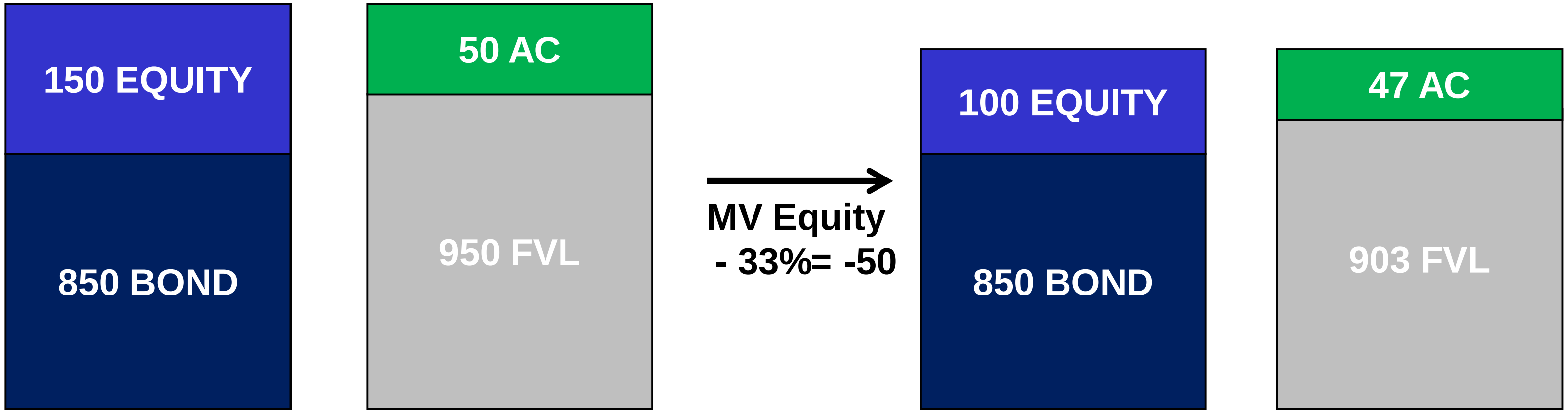


The benefits are constantly linked to the return on the assets. The absorption is almost «complete».

LAC index = 90% - 95%

Methodology for Risk capital: Market Risk

Unit Linked Portfolio w/o Guarantee



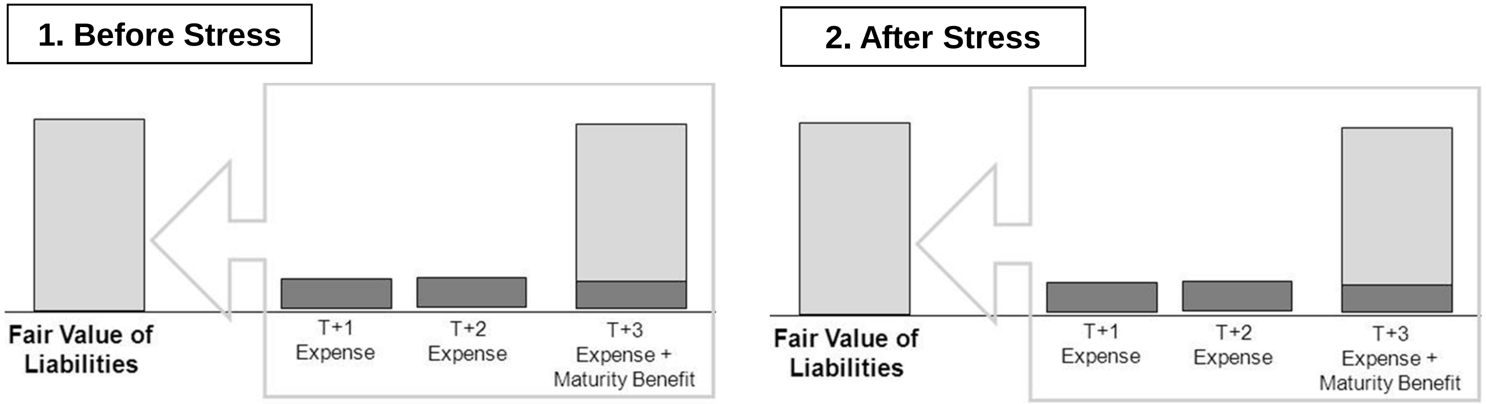
Change in Market Value = 50
Change in Liabilities = 47
SCR = AC – AC^{equity} = 50 – 47 = 3
Liability absorption = change in liabilities / change in assets = 47/50 = 95%

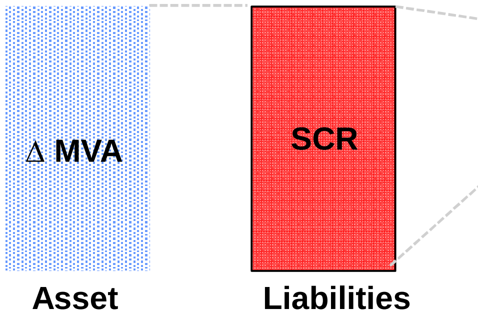
- In a unit linked contract the market risk is in charge of the insured;
- the asset stress produced only a “proportional reduction” of the expected profits (total MVAssets = -8% -> AC -8%)

Methodology for Risk capital: Market Risk

Equity Risk: Immediate loss in market value of the assets

2.Contract Without Profit Sharing

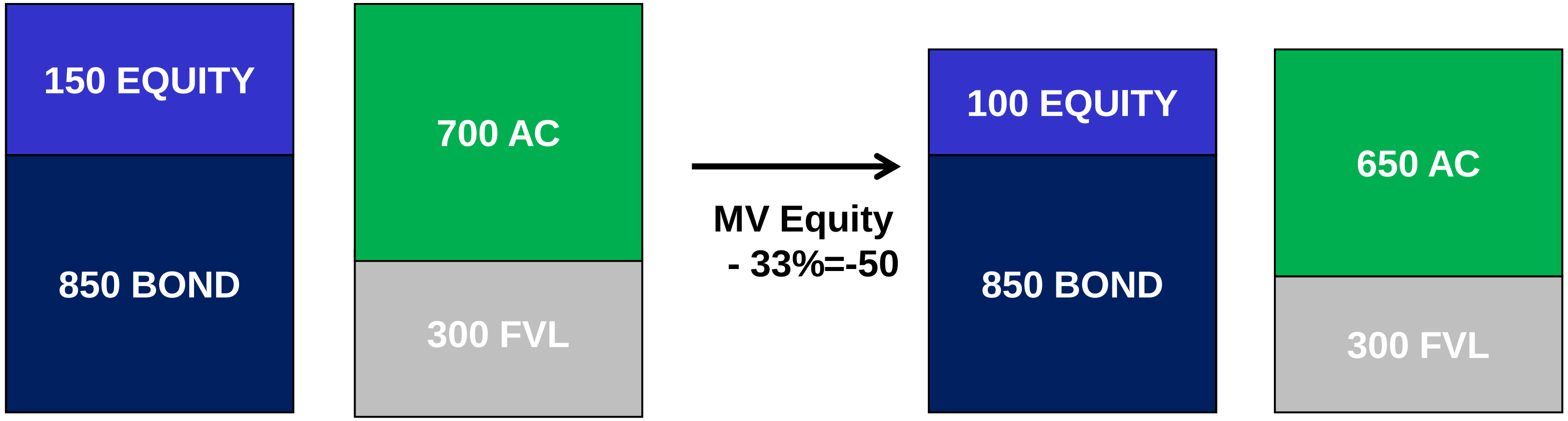




No liability absorption.
The SCR is equal to the loss in market value of the assets.
LAC index = 0%

Methodology for Risk capital: Market Risk

Term Assurance



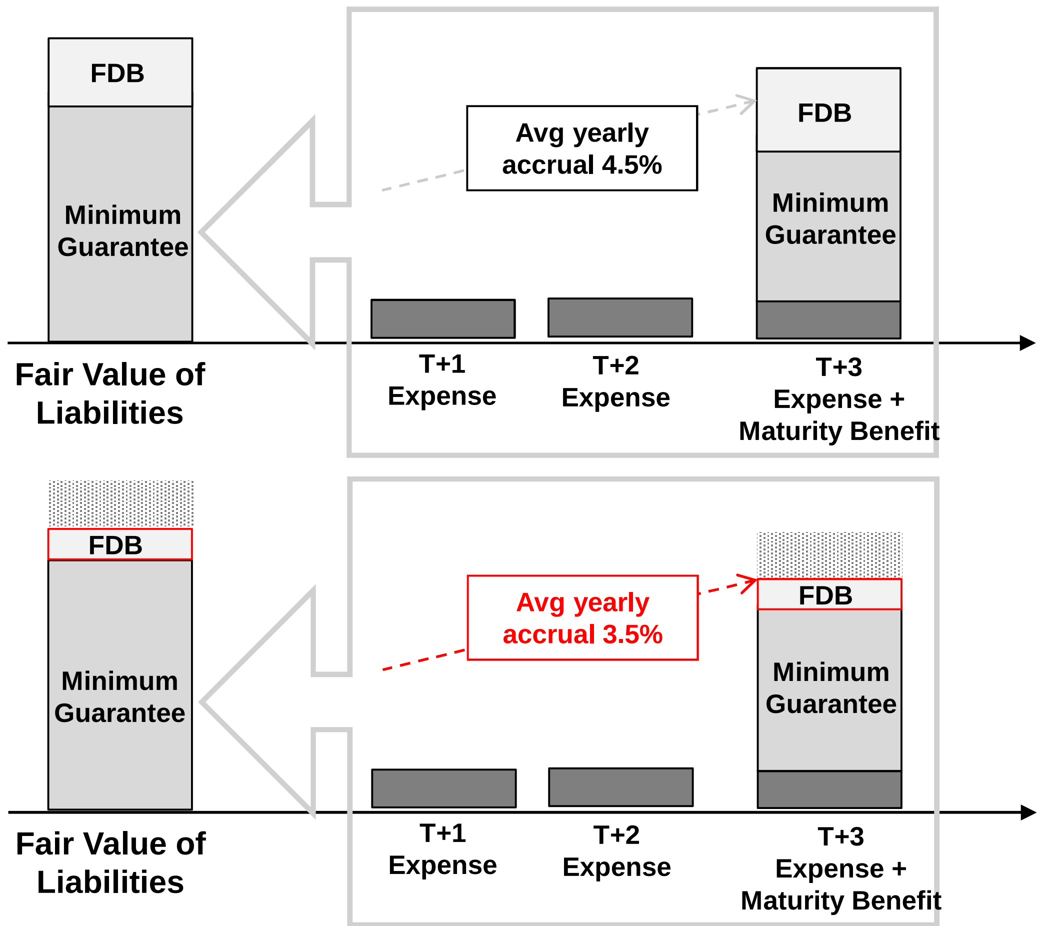
Change in Market Value = 50
Change in Liabilities= 0
SCR = AC – AC^{equity} = 50
Liability absorption = change in liabilities / change in assets = 0/50 = 0%

- In a term the market risk is in charge of the insurer
- the asset stress doesn't affect the liabilities, therefore all the stress produces a PVFP reduction

Methodology for Risk capital: Market Risk

Equity Risk: Immediate loss in market value of the assets

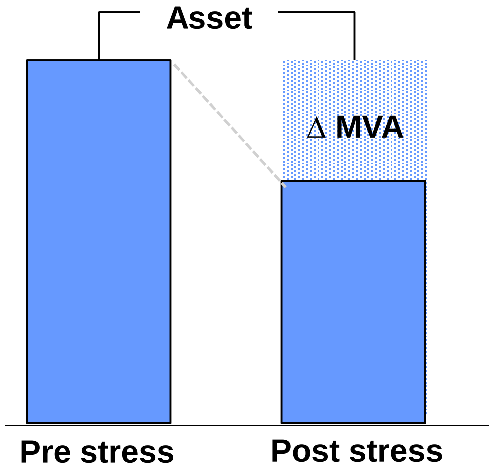
3.Traditional Saving contract minimum guarantee and profit sharing

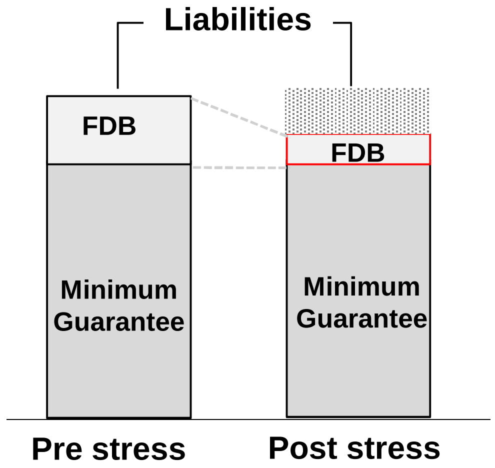


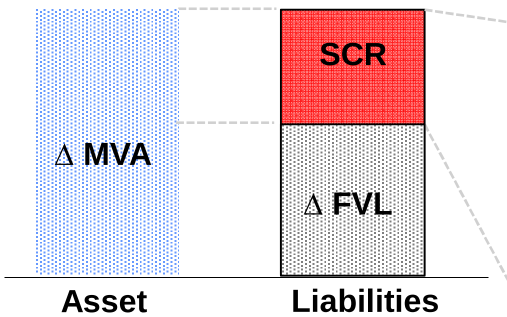
Methodology for Risk capital: Market Risk

Equity Risk: Immediate loss in market value of the assets

3.Traditional Saving contract minimum guarantee and profit sharing





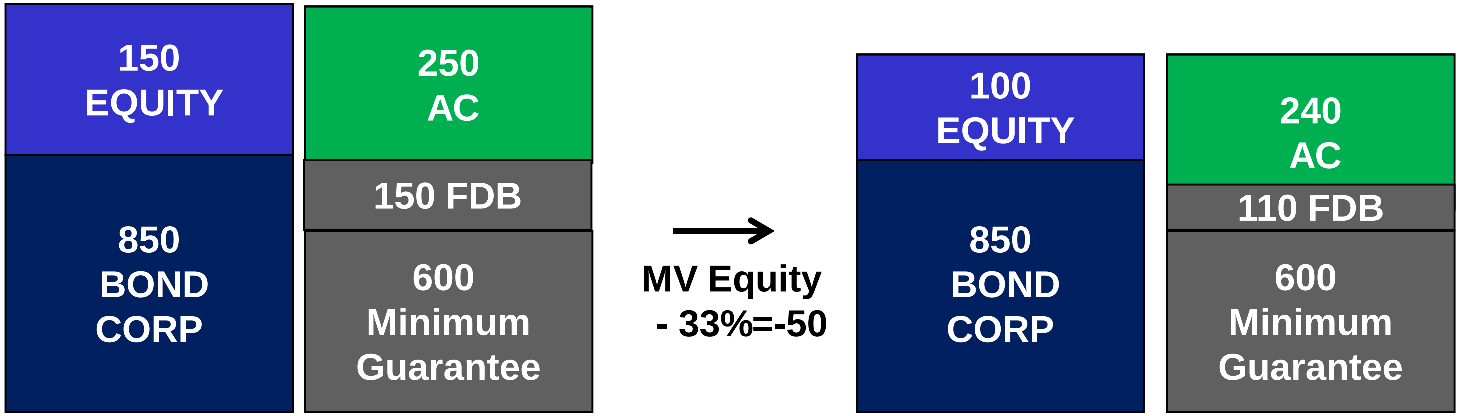


The benefits are linked to the return on the assets. The only absorbing liability is the FDB.

0% ≤ LAC index < 100%

Methodology for Risk capital: Market Risk

Case C: Product with guarantee and Profit Sharing (80%)



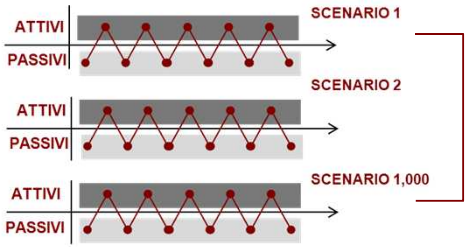
Change in Market value of Assets = 150*33% = 50
Change in FVL = 750 – 710 = 40
Change in AC = 250 – 240 = 10
Liability absorption = 10/ 40 = 80%
The loss is shared: 20% SH, 80% PH

- In a product with profit sharing, both proifts and losses are shared; the % of sharing is a function of the portfolio structure and the level of the stress
- In general we can notice an **absence of linearity** among the loss sharing partecipation and the increase of the stress level

Methodology for Risk capital: Market Risk

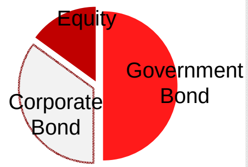
Equity Risk - The calculation process requires :

1. the calculation of the market value of the assets and the fair value of the technical provisions at valuation date:



Fair Value Technical Provisions: 750

Asset Allocation

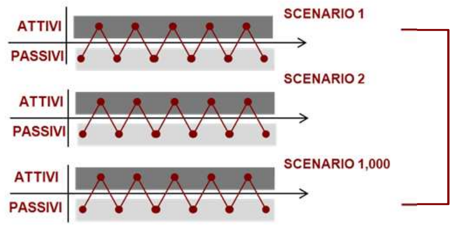


Market Value

Government Bonds:	450
Corporate Bonds:	400
Equities:	150

2. Calculation of the 99,5% stress on the asset side is calculated : i.e. the loss of 50 (150*33%).

3. re-valuation of the value of the technical provisions in the 1,000 scenarios where the initial assets have a lower value (-50).
The revaluation of benefits can be decreased according to the profit sharing rules.



Fair Value of Tech. Provisions: 710

4. The capital requirement is not equal to **50 euro** (as in non life segment) but **10 euro** (50-40), by ceding part of the loss (80%) to the policyholders, through the absorption provided by the profit sharing rules.

The liabilities absorption capability, depends on the expected returns and on the level of the guarantees.

Equity risk capital charge:

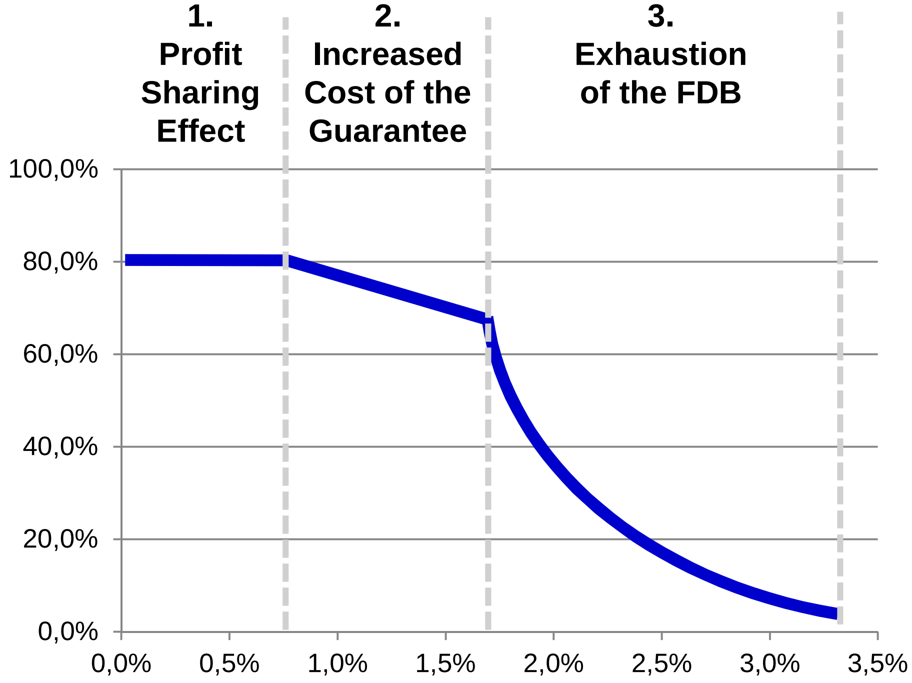
Loss on assets:	50
Capital requirement before absorption:	50
Tech. Provision decrease:	-40
Net capital requirement:	10

Loss Absorbency Capacity – Equity Risk

Equity Risk: the LAC asymmetry

LAC vs change in expected returns

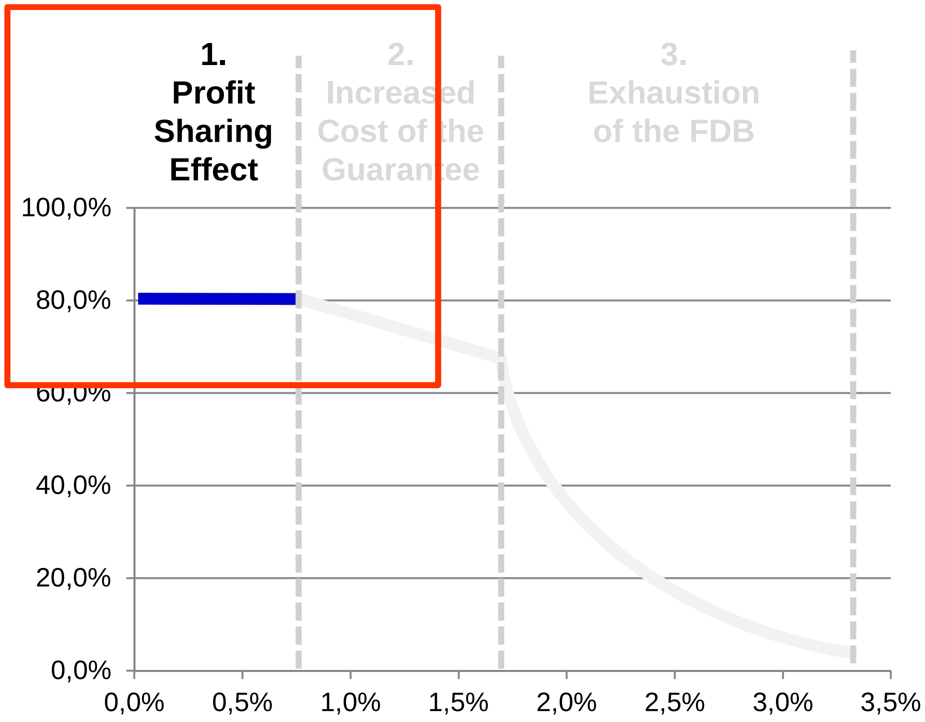
Sources of LAC asymmetry:



Loss Absorbency Capacity – Equity Risk

Equity Risk: the LAC asymmetry

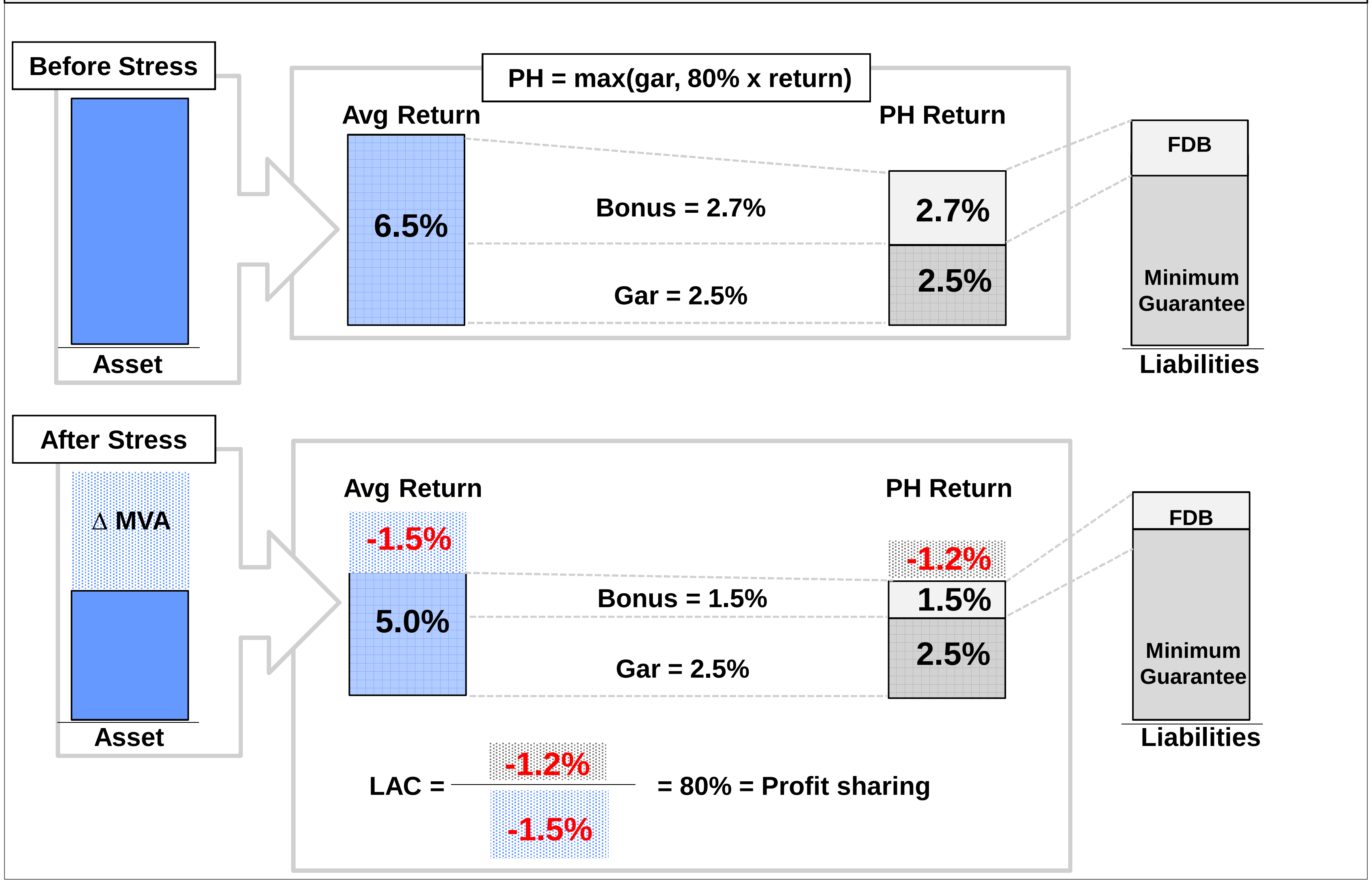
LAC vs change in expected returns



- Required Capital: calculations process and examples

Loss Absorbency Capacity – Equity Risk

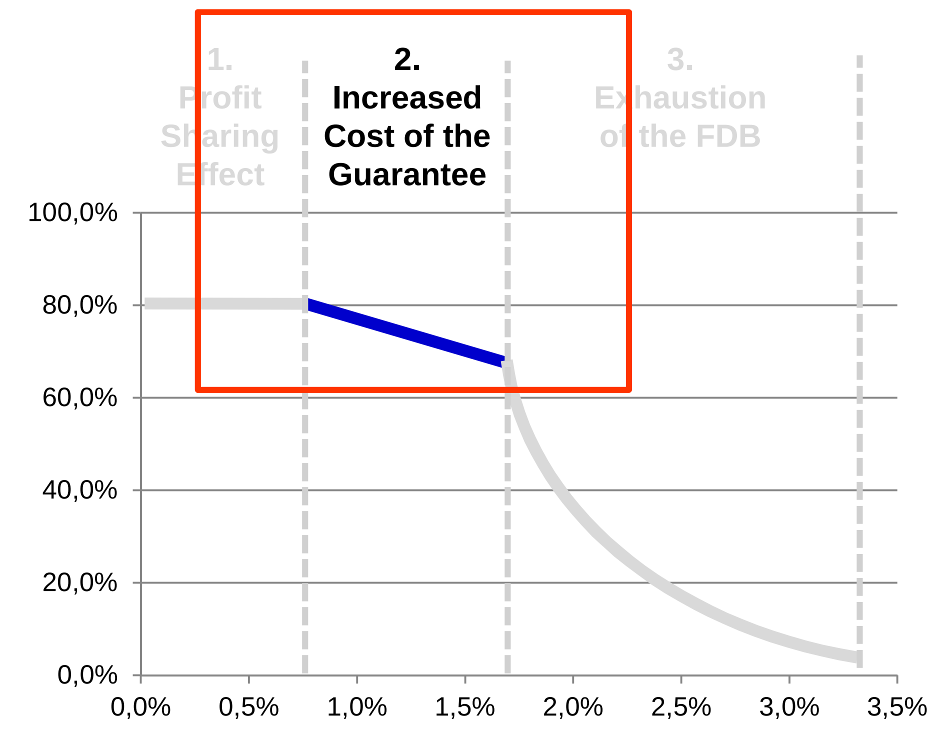
1. Profit Sharing «mitigating» effect



Loss Absorbency Capacity – Equity Risk

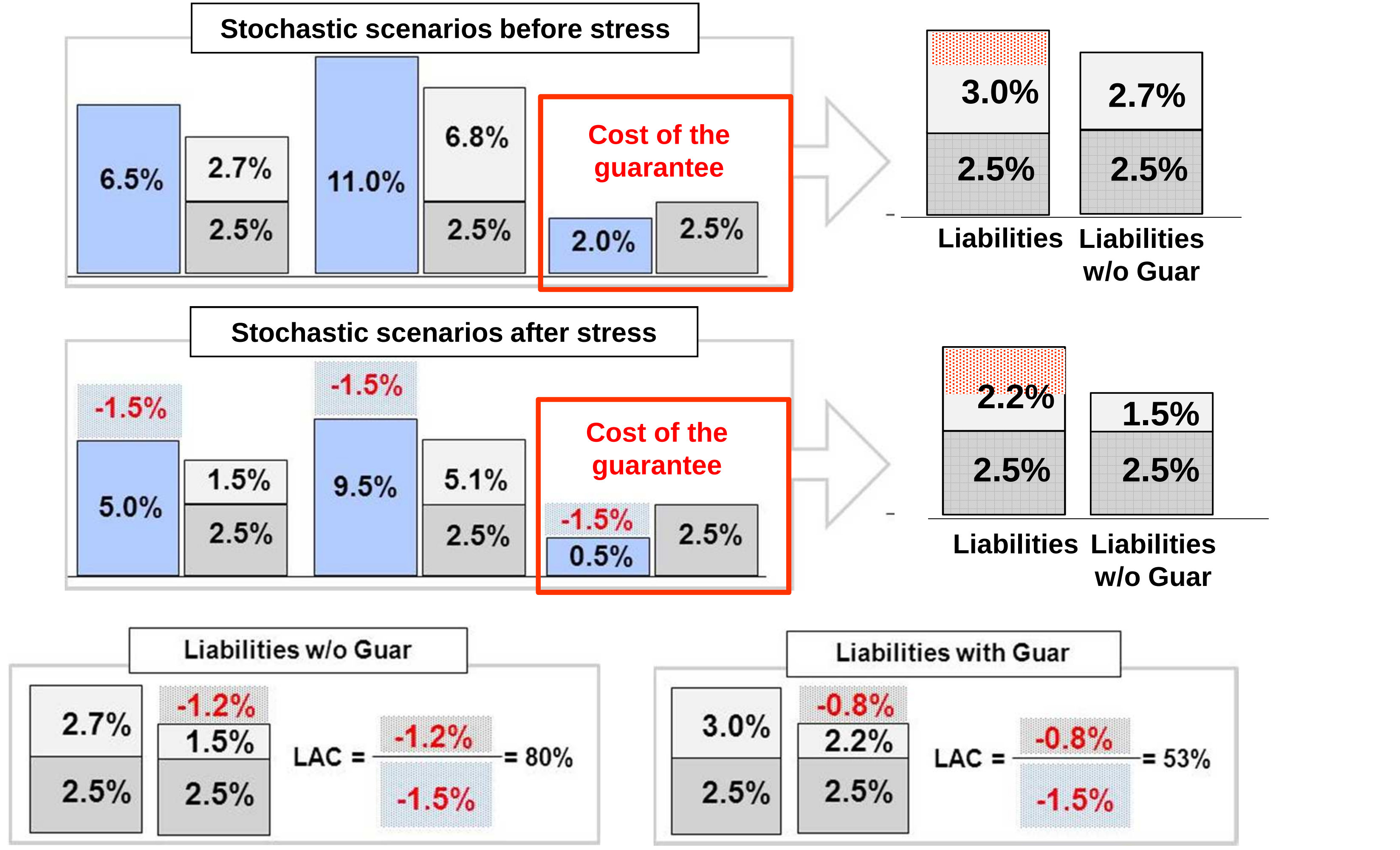
Equity Risk: the LAC asymmetry

LAC vs change in expected returns



Loss Absorbency Capacity – Equity Risk

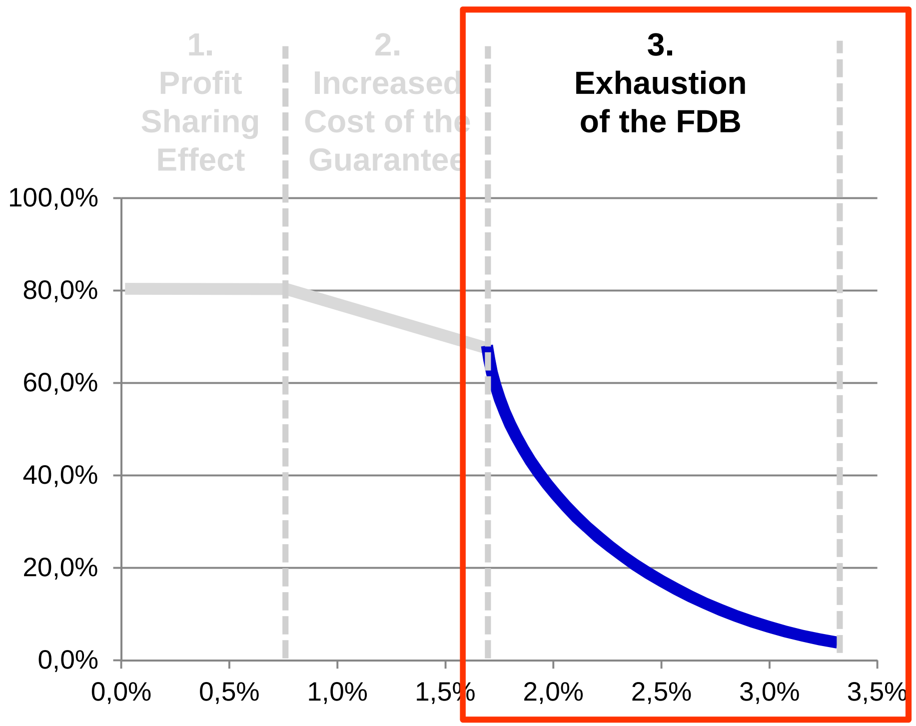
2. Increased cost of the Guarantee



Loss Absorbency Capacity – Equity Risk

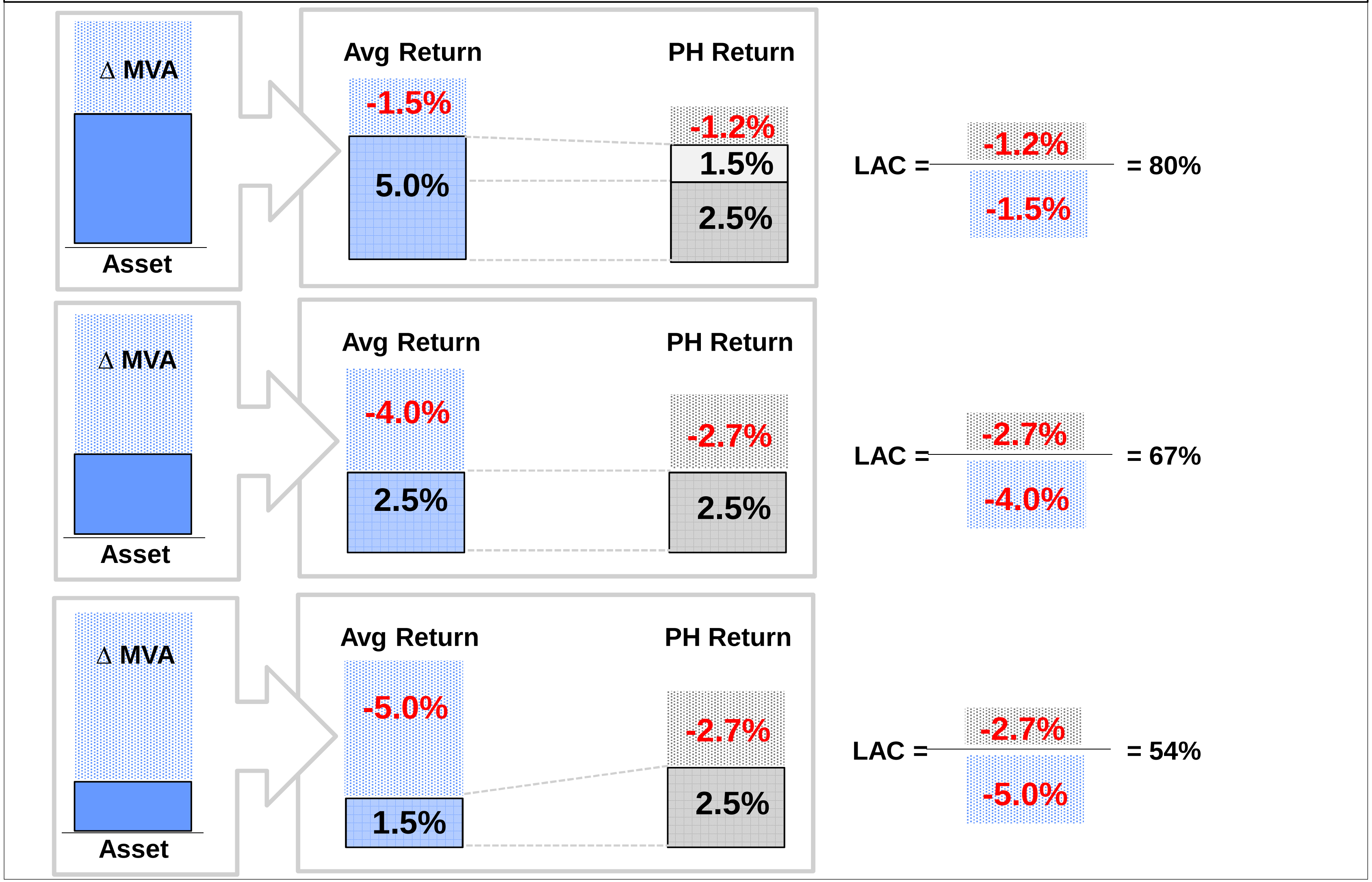
Equity Risk: the LAC asymmetry

LAC vs change in expected returns



Loss Absorbency Capacity – Equity Risk

3. Exhaustion of the FDB



Solvency II Framework

1. An Introduction to Solvency II
2. Solvency 2 Definitions: Available Capital and Capital Requirement
3. Best Estimate of Liabilities: calculation process and examples
4. Required Capital: calculation process and examples
5. Applying Solvency II models: Risk Drivers and Practical Examples
6. New Products and Capital Absorption: definitions and examples

Solvency 2 – Risk Optimization

Under Solvency II perspective, **risk optimization** can be performed both on assets and liabilities, considering also the **impact on Available Capital** and the **dynamic interaction between assets and liabilities**.

Asset management:

✓**Asset allocation** based on effective risks Company want to be exposed to

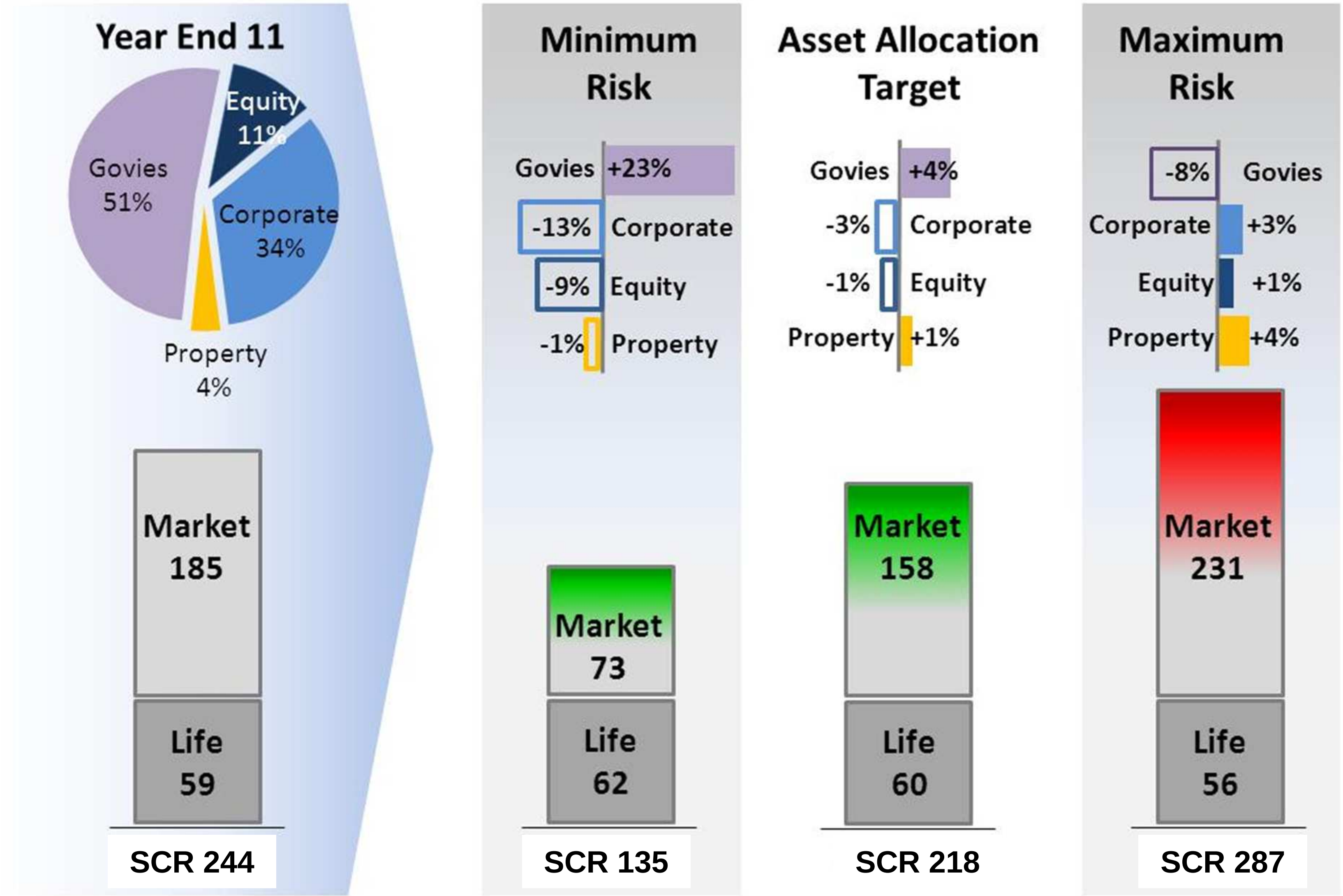
✓**Counterparty selection** for monitoring credit and concentration risks

Product design and definition:

✓Products generating **Available Capital**

✓Products allowing for **liability absorbency capacity**

ORSA & SAA: A Segregated Fund Example



Solvency II Framework

New Products and Value

New Business Value = present value, at issue date, of future industrial profits (after taxes and reinsurance) expected to emerge from all contracts issued during the last

Marginal

NBV = difference between portfolio value and value of old business

PROS
- It takes into consideration the cross subsidies among old business and new business
- Properly measures the value creation in the year caused by the new production

CONS
- It is complex
- It requires selection of assets backing old business; different selections may cause "artificial" NBV
- Due to one-off effects it is not appropriate to evaluate the Goodwill (NBV *multiple)

Stand Alone

NBV calculated in isolation *with its own assets, even if it insists on an open fund*

PROS
- New money investment rates are used and hence the NBV is valued in current market conditions environment
- Comparability: the same product produces the same value independenlty on the company that is selling it

CONS
- It does not capture the effects deriving from the fact that the business is sold within a going concern;
- It does not reflect the way the business is actually managed (e.g. a perfect AL matching may be assumed, even if not applied in reality).

Proportional

NBV is part of the existing business

PROS
- Simpler and understandable practical implementation
- The attribution of gains and losses from in force business to the new production reflects the way business is managed

CONS
- The attribution of gains and losses to new business may bring to their double counting

New Products: Profit ratios based on «volumes»

New Business Margin (NBM) = NBV / APE = New Business Value/Annual Premium Equivalent (Regular premium+single premium/10)

- It is a **multi-period** profitability indicator
- **Strength**: widely used and easy to understand
- **Weaknesses**: normalized assumption of 10 years of duration for single premiums

NBV/P.V. Premiums = New Business Value/Present Value of Future Premiums

- Expresses the profitability as a percentage of the products yearly turnover
- **Strength**: solves the problem of the normalization used in the NBM, representing the effective duration of the contract

NBV/P. V. Reserves = New Business Value/Present Value of Future Premiums

- Expresses the profitability as a percentage of assets under management of the company related to the product under analysis
- **Strength**: is a good measure of the annual profitability in terms of managed assets
- **Weakness**: meaningless for products where the mathematical reserve is a very small amount (e.g. Pure risk products)

New Products: Profit ratios based on «volumes»

Profitability ratios based on volumes: which indicator should we look at?

	Product 1	Product 2	Product 3
NBV/PVR	0,96%	0,66%	0,45%
NBV/PVP	4,03%	4,13%	3,68%
NBM	33,48%	44,62%	46,21%
APE	1.000	1.000	1.000
Term	10	15	20
Fee	0,85%	0,80%	0,70%

Assume

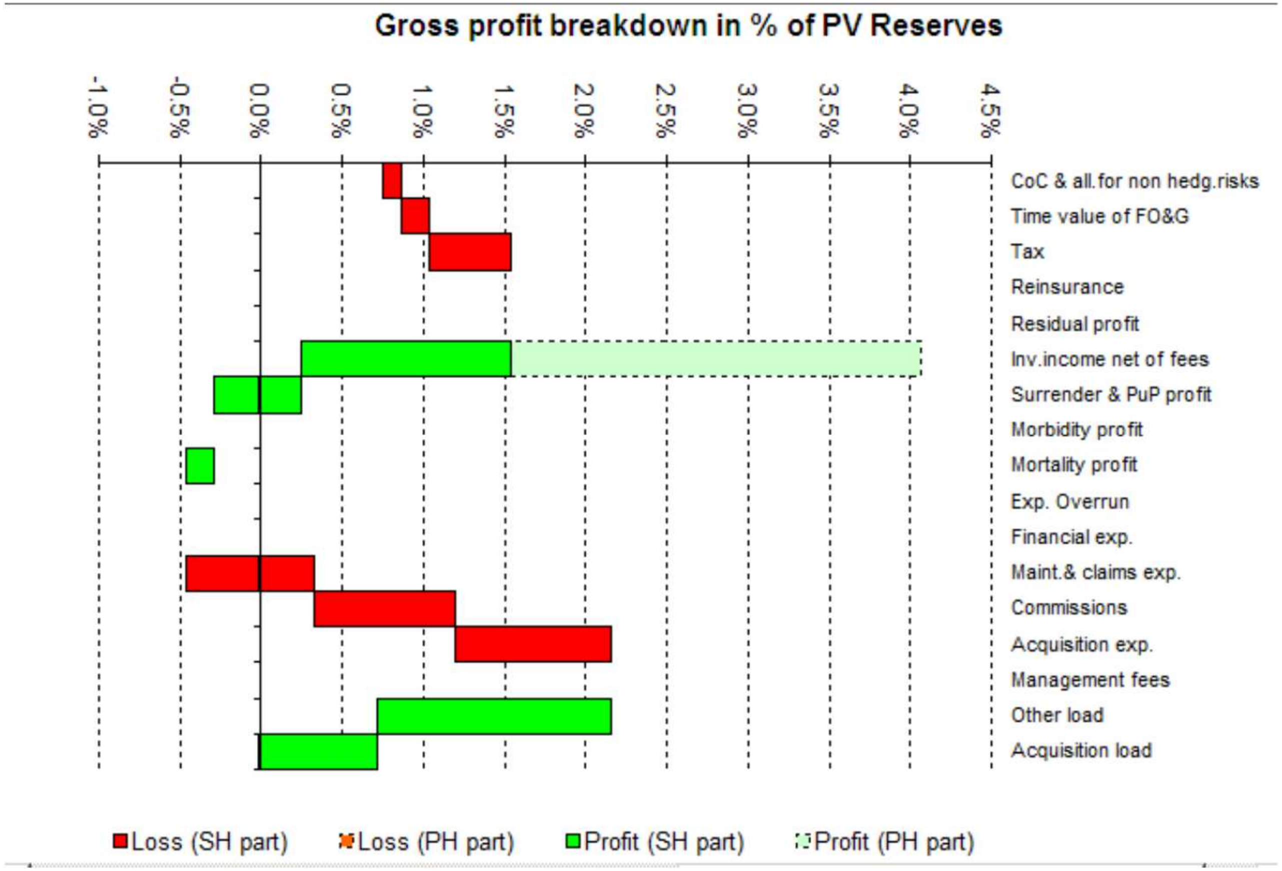
- Recurrent premium financial product;
- 2% Cliquet guarantee;
- 10% loading on premium;
- 5% of sum of premium commission;
- 0,2% of reserves of financial/management expenses;
- 3% risk capital
- 35% tax
- 3% yearly surrender rates
- death according to SIM 1992
- Investment returns among 2,5% and 3,5%

- **NBM**: the **less profitable is Product 1**
  - the denominator is the same for the 3 products (equal to 1000) and hence increasing the term brings to higher NBV that is reported to the same amount leading to a higher value of the ratio
  - the effect of the annual loss of the fee (0.15% between Products 1 and 3) is lower of the effect of gaining it for a longer time

- **NBV/PVP**: the **less profitable is Product 3**
  - the denominator varies i.e. increases with the term; in Product 3 the NBV (the same as in the NBM) is divided by a higher amount

- **NBV/PVR**: the **less profitable is Product 3** but the most profitable is Product 1
  - this indicator rewards the product with higher management fee

New Products: Profit Breakdown

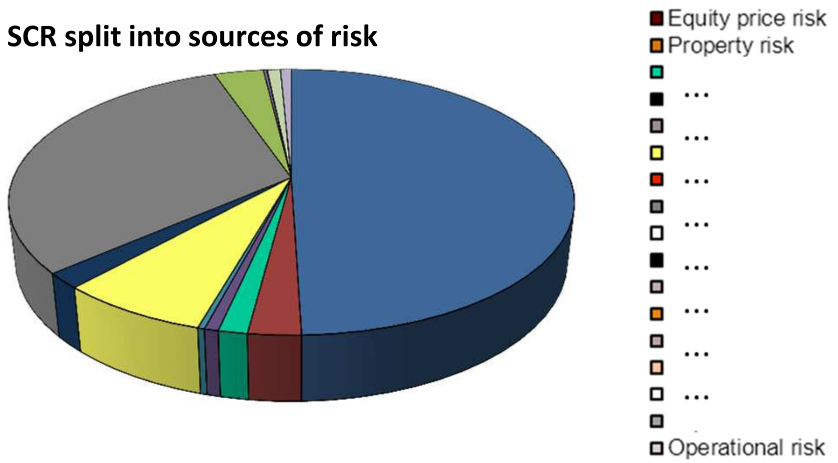


- Gives indication on the **equilibrium of the product among different sources of profits**:
  - What is the main source of profit of the product?
  - Is it highly exposed on the financial side?
  - Are the loadings sufficient to cover the expenses?

New Products: Capital Absorption

- In a Solvency II perspective, when a new product is launched, it shall be evaluated in terms of capital absorption and remuneration

- Estimate of the SCR at product level, possibly with simplified procedures that avoid fully stochastic calculations but too strong approximations (e.g. rescaling of the SCR calculated for the total new production or even worse that on the existing contracts) may be meaningless leading to totally misleading allocation of capital to the new product the company is going to launch



Solvency II is not only only quantitative time consuming and reporting but it is:

- an instrument to **improve the risk management in the ''real world''**
- a **better efficiency in the capital management**

New Products: a multiple dimensions view

V. FINAL REMARKS

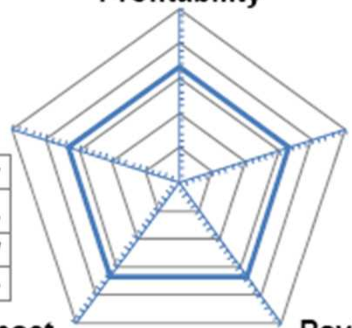
Generali on new life production

5

We evaluate new life products across 5 dimensions:

Profitability

Margins on APE	Italy	France	Germany
	28.5%	10.3%	17.7%
Total	CEE	RoE	RoW
21.7%	39.1%	23.3%	28.2%



Riskiness / Capital Absorption

Capital Strain(1) / NBP(2)	Italy	France	Germany
	2.3%	2.3%	2.2%
Total	CEE	RoE	RoW
2.5%	1.9%	2.1%	8.4%

Capital remuneration

IRR	Italy	France	Germany
	13.7%	10.5%	18.7%
Total	CEE	RoE	RoW
13.1%	15.1%	11.9%	15.0%

1st Year P&L impact

P&L Strain(3) / NBP(2)	Italy	France	Germany
	5.8%	1.6%	1.1%
Total	CEE	RoE	RoW
3.7%	23.3%	4.5%	5.7%

Payback period

Payback Period (years)	Italy	France	Germany
	7	8	6
Total	CEE	RoE	RoW
7	6	7	7

(1) Required capital due to new business production
(2) New business premiums
(3) P&L cost of investment in life new business

ORSA: New Product and Capital Absorption

Q: What does Free Surplus mean at product level?

A: Free Surplus = NBV - SCR

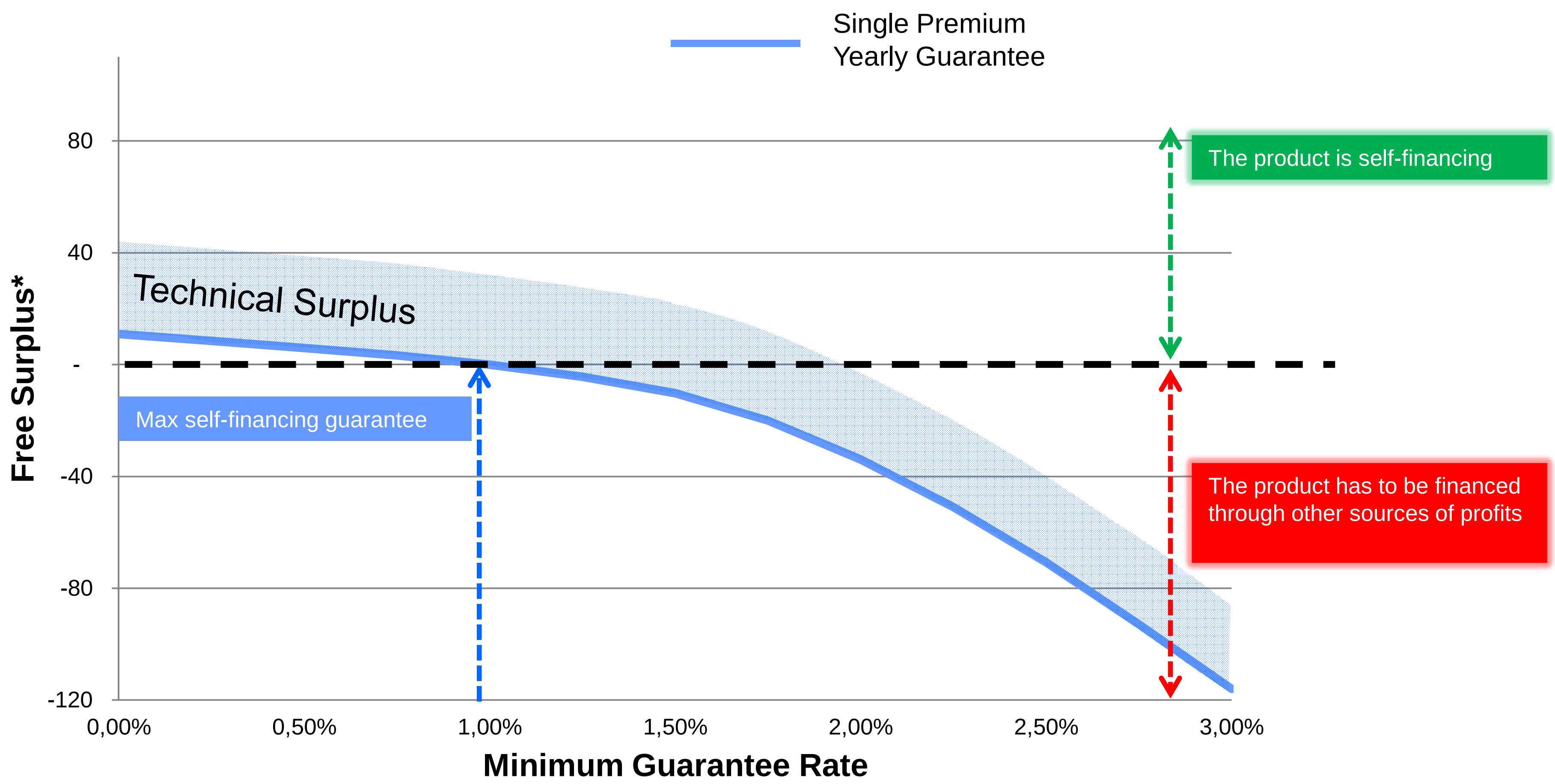
Q: When a new product is self financing?

A: When it does not require a capital injection:

- In Solvency 1: NEVER
- In Solvency 2: «could be» if the expected profits are considered as TIER 1 capital

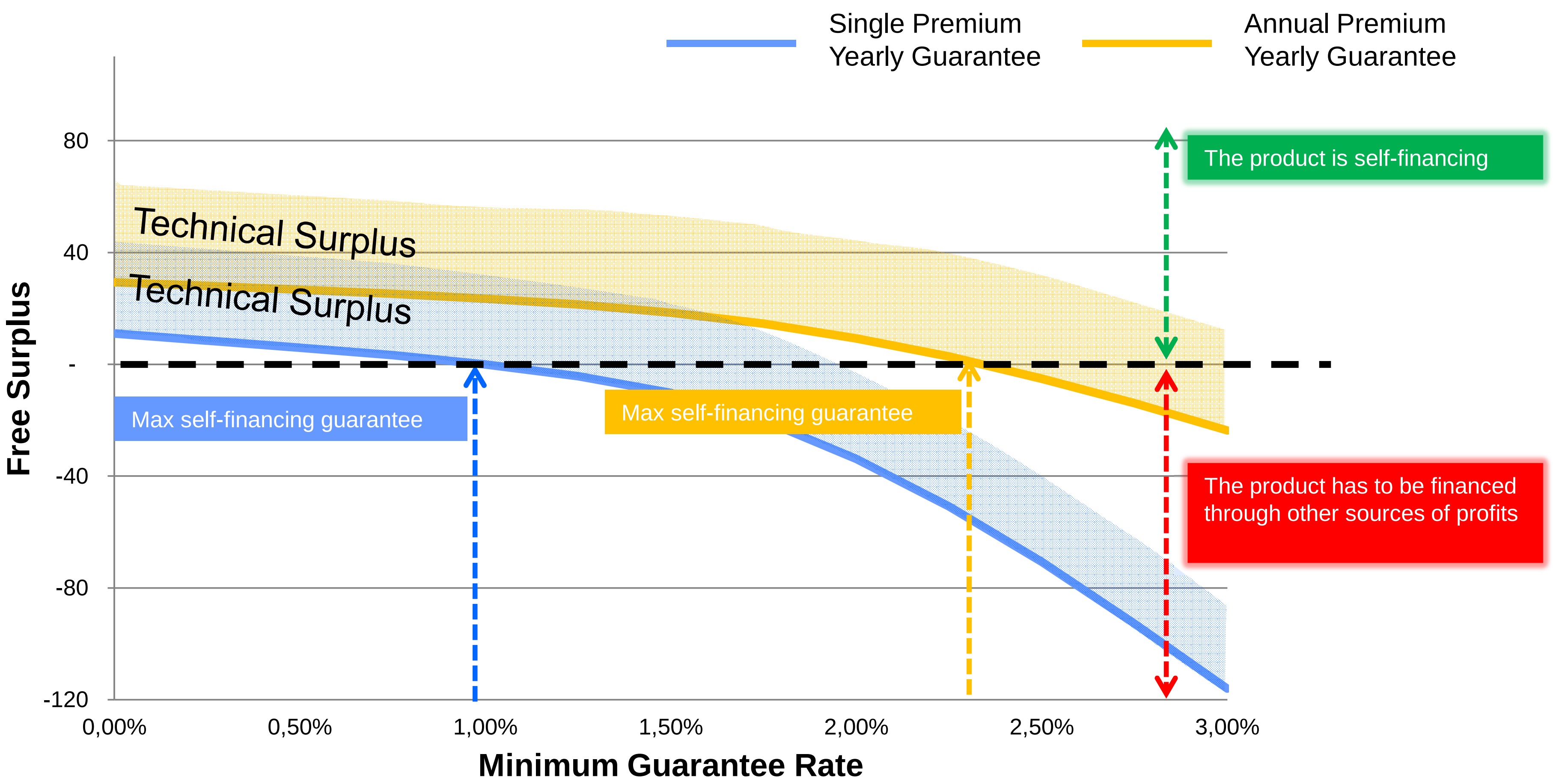
ORSA: New Product and Capital Absorption

90/10 with profit contract , 15 yrs contractual term: Single vs Annual Premium



ORSA: New Product and Capital Absorption

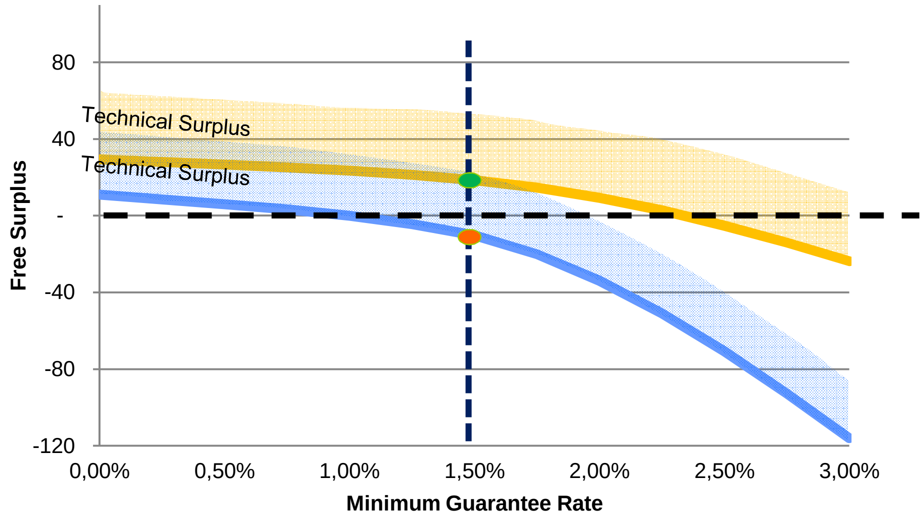
90/10 with profit contract , 15 yrs contractual term: Single vs Annual Premium



ORSA: New Product and Capital Absorption

Example: 1.5% guarantee

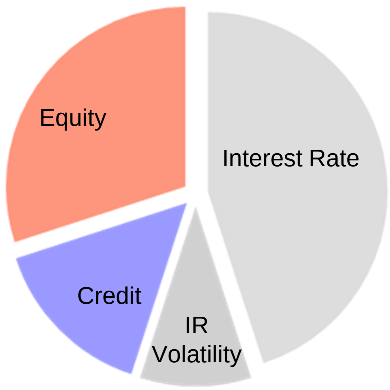
	Single Premium	Annual Premium
PVFP	41	36
SCR	52	18
FREE SURPLUS	-11	18



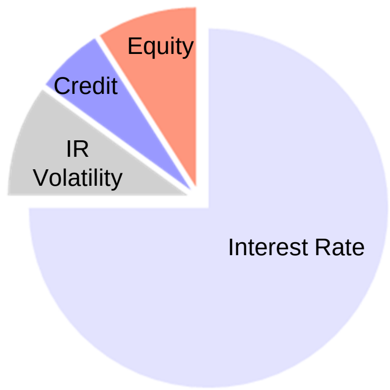
KEY POINTS

- ✓instantaneous shocks
- ✓permanent variation 1 y calibrated
- ✓instantaneous stress on asset exposures

SCR BREAKDOWN

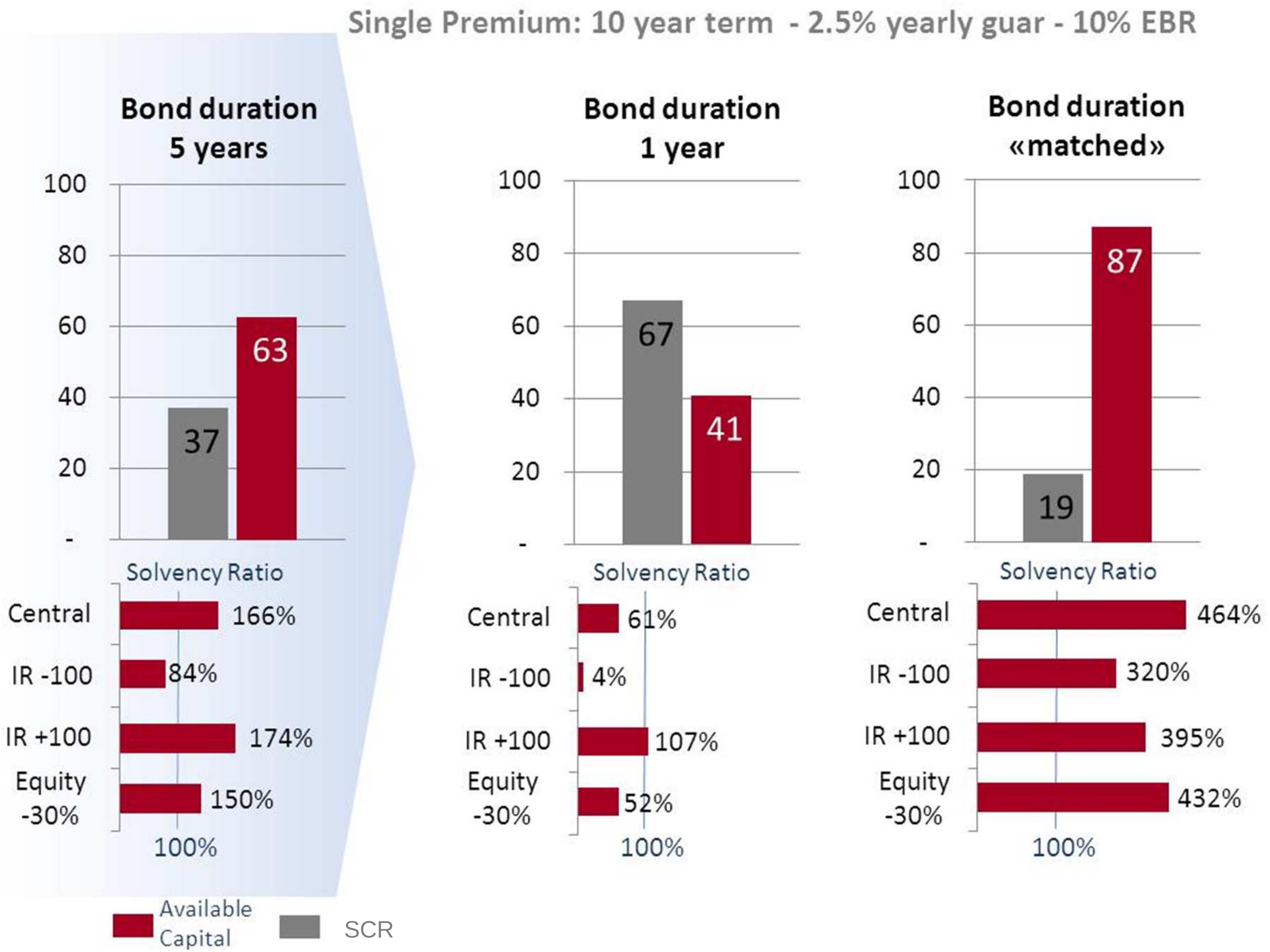


Single Premium



Annual Premium

New Product and SAA: Duration GAP



New Product and SAA: Investing in Equity